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WAR DEPARTMENT

MAINTENANCE MANUAL AND PARTS CATALOG

AGGREGATE DRYER MODEL 833

INCLUDING: HOT AND COLD ELEVATORS AND RECIPROCATING FEEDER

BARBER-GREENE COMPANY
AURORA, ILLINOIS
December 14, 1942

TM5 - 1004

WAR DEPARTMENT

TM5 - 1004, Maintenance Manual and Parts Catalog, Aggregate Dryer, Model 833, published by the Barber-Greene Company, is furnished for the information and guidance of all concerned.

(AG 062.11 (3/25/43) PC (C) June 10, 1941.)

G. C. Marshall
Chief of Staff

Official:
J. A. ULIO,
Major General,
The Adjutant General.

BARBER-GREENE

Model 833

(Dual Drum)

AGGREGATE DRYER

including

HOT ELEVATOR
COLD ELEVATOR
RECIPROCATING FEEDER

CONTENTS

War Department Purchase Orders
55645
56634
C-3502

This book applies to machines bearing the following serial numbers:

DRYER	COLD ELEVATOR	HOT ELEVATOR	RECIPROCATING FEEDER
833-4-21	833E-4-21	40648	833F-4-21
833-1-22	833E-1-22	40649	833F-1-22
833-2-22	833E-2-22	40650	833F-2-22
833-3-22	833E-3-22	40651	833F-3-22
833-4-22	833E-4-22	40652	833F-4-22
833-3-24	833E-3-24	40889	833F-3-24
833-4-24	833E-4-24	40890	833F-4-24
833-2-25	833E-2-25	40891	833F-2-25
833-3-25	833E-3-25	40892	833F-3-25
833-4-25	833E-4-25	40893	833F-4-25
833-5-25	833E-5-25	40894	833F-5-25
833-6-25	833E-6-25	40895	833F-6-25
833-7-25	833E-7-25	40896	833F-7-25
833-1-26	833E-1-26	40897	833F-1-26
833-2-26	833E-2-26	40898	833F-2-26
833-3-26	833E-3-26	40899	833F-3-26
833-4-26	833E-4-26	40900	833F-4-26
833-5-26	833E-5-26	40901	833F-5-26
833-6-26	833E-6-26	40902	833F-6-26
833-3-27	833E-3-27	40903	833F-3-27
833-4-27	833E-4-27	40904	833F-4-27
833-1-28	833E-1-28	40905	833F-1-28
833-2-28	833E-2-28	40906	833F-2-28
833-3-28	833E-3-28	40907	833F-3-28
833-4-28	833E-4-28	40908	833F-4-28

All Machines having serial numbers of later schedules.

The material in this book is restricted to the Barber-Greene Model 833 Aggregate Dryer, Hot and Cold Elevators, and Reciprocating Feeder, only and does not cover the other machines which are used in conjunction with these units nor the general operation of the entire plant in which these units are used.

Reference should be made to the following books

TM5-1002 ASPHALT MIXER Barber-Greene Model 848

TM5-1006 BUCKET LOADER Barber-Greene Model 82-A

TM5-1008 ASPHALT FINISHER Barber-Greene Model 879-A

TM5-1010 BELT CONVEYOR Barber-Greene Style "N"

TM5-1012 ASPHALT PUMP Littleford US-3C

TM5-1014 STEAM BOILER Cleaver-Brooks Model 3-Car
(Has Model Z Engine; applies to War Dept. Purchase Orders 55645 and 55634)

TM5-1046 STEAM BOILER Cleaver-Brooks Model 3-Car
(Same as TM5-1014 but has Model ZZ Engine; applies to War Dept. Purchase Order C-3438)

TM5-1016 ASPHALT PLANT ERECTION AND OPERATION

MATERIALS AND METHODS FOR MILITARY AIRPORT CONSTRUCTION
(Published by Barber-Greene Company)

Printed in U.S.A.
First Printing 4M-11-42-PP
Second Printing 2M-5-43.PP

OPERATOR'S MANUAL

CONTENTS

BARBER-GREENE COMPANY, Aurora, Illinois

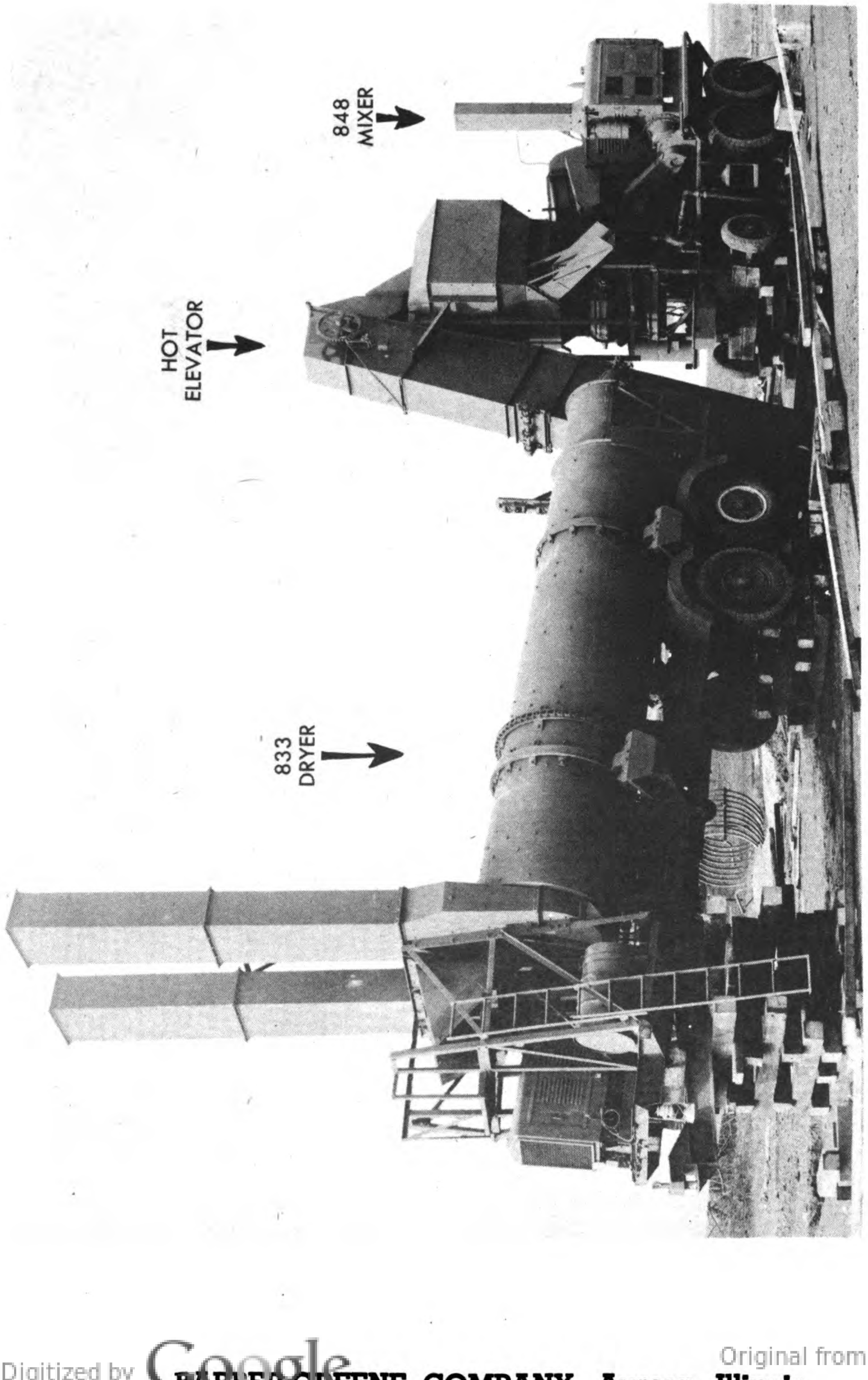


FIG. 1 - BARBER-GREENE MODEL 833 DRYER BEING SET UP WITH HOT ELEVATOR AND OTHER EQUIPMENT TO FORM CENTRAL PLANT.

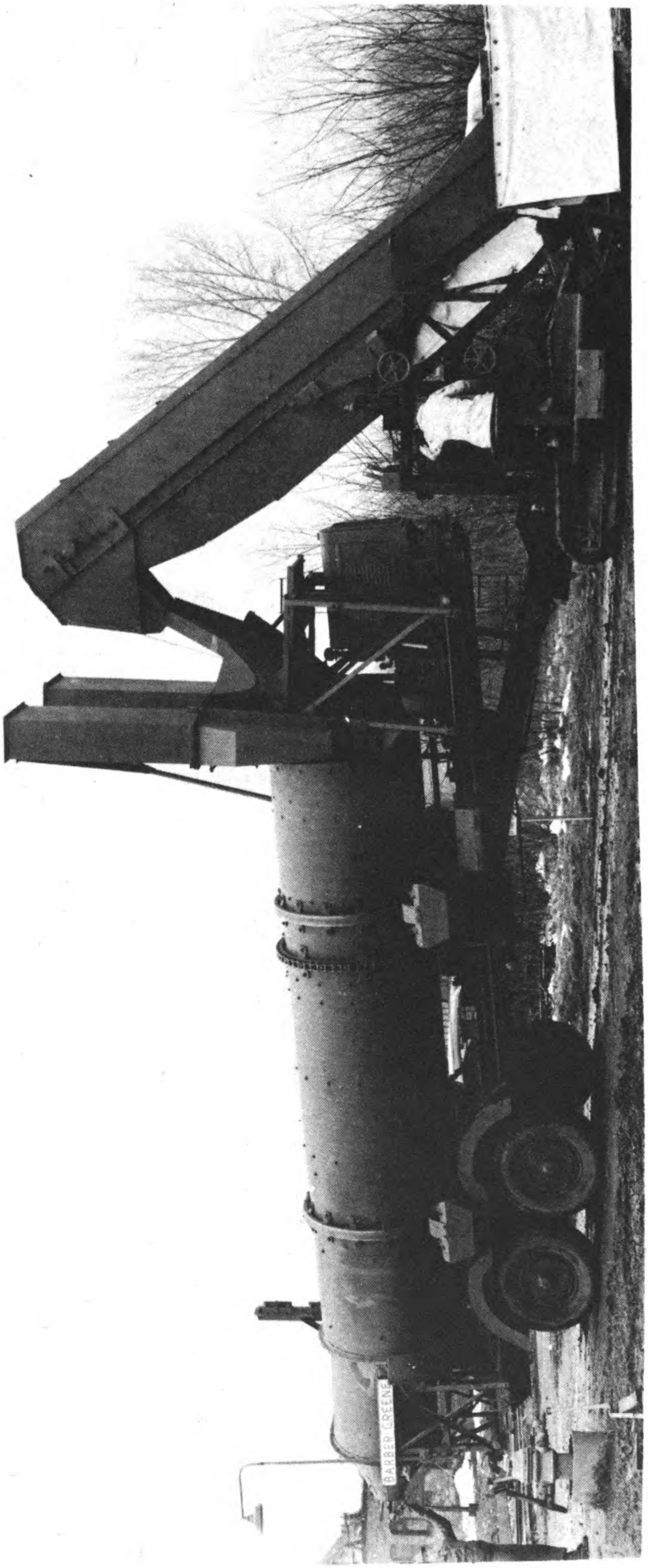


FIG. 1A - BARBER-GREENE MODEL 833 DRYER BEING TOWED BY BARBER-GREENE MODEL 82-A BUCKET LOADER FOR "TRAVEL DRYER" OPERATION.

General Information

Barber-Greene Model 833 Dual Drum Dryer

APPLICATION: This unit is designed to remove moisture from mineral aggregates for bituminous mixes in conjunction with the Model 848 Mixer on central plant operation or with the Model 82A Loader for travel drying operation.

CAPACITY: 60 to 120 tons per hour.

OVERALL DIMENSIONS:
Length - 36'-0"
Width - 10'-6"
Height - 14'-10" (Trailing)
- 11'1" (Shipping)

TYPE OF MOUNTING:
Wheel Base - 20'-0"
Axle Clearance - 11"
Tires - Single 10.00 x 20" 12 Ply - Front Axle
Tandem 12.00 x 20" 14 Ply - Rear Axle
Turning Radius - 24'-0" (Trailing)
Bearing Area - Front Axle - 122.4 sq. in.@ 70# pressure
- Rear Axle - 342.0 sq. in.@ 80# pressure

OPERATING WEIGHTS:
Front Axle - 13,300 lbs.
Rear Axle - 30,200 "
Total Empty - 38,500 "
Total Loaded- 43,500 "

SHIPPING DATA

Cubage - Not Boxed: Assembled with front axle - 5750 cu. ft.
" " " " - removed - 4200 cu. ft.

Boxed for Export: One crate - 4600 cu. ft.
Weight - 48,000 lbs. (approx.)

Rail Shipment: One machine per Flat Car.

Capacities and Consumption

Where Used	Description	Capacity	Fahrenheit Temperature	Grade	Nearest Army Equivalent	Consumption per 100 Operating Hours
Engine Crankcase	Motor Oil	6 qts.	Below 0° 0° to 32° 32° to 90° Over 90°	SAE-10 SAE-20 SAE-30 SAE-40	U.S. Army Spec. #2-104-A of corresponding viscosity.	25 qts.
Air Cleaner	Motor Oil	1 qt.	(same as for crankcase)			10 qts.
Speed Reducer	Transmission Lubricant	3 qts.	Below 0° 0° to 32° Over 32°	SAE-80 SAE-90 SAE-140	Federal VV-L-761 SAE-80 Federal VV-L-761 SAE-90 Federal VV-L-761 SAE-90 or SAE-80-140	3 qts.
Bevel Gear Box	"	3 qts.	(same as for speed reducer)			3 qts.
Main Drive Guard	"	15 qts.	(same as for speed reducer)			5 qts.
Machinery	High Pressure Grease		Below 0° 0° to 32° 32° to 200°	Stazon Marfak #0 Marfak #2	U.S. Army Spec. #2-106 " " " " " " " #2-107 & #2-108	40 lbs.
Machinery	High Temperature Grease		200° to 300° 300° to 375°	Marfak #3 Kalrex #2	U.S. Army Spec. #2-110 " " " "	30 lbs.
Engine Fuel	Gasoline	55 gal.				600 gallons
Burner	Fuel Oil	(No tank on dryer)		#4 Fuel Oil SU Viscosity 90-125 145,000 BTU per gal.	#2 Diesel Oil SU Viscosity approx. 35 120,000 to 135,000 BTU per gal.	
		(Burner consumes 1-1/2 to 3-1/2 gallons per ton of aggregate)				
Engine Radiator	Coolant	$5\frac{1}{2}$ gal.				
Battery	Distilled Water					

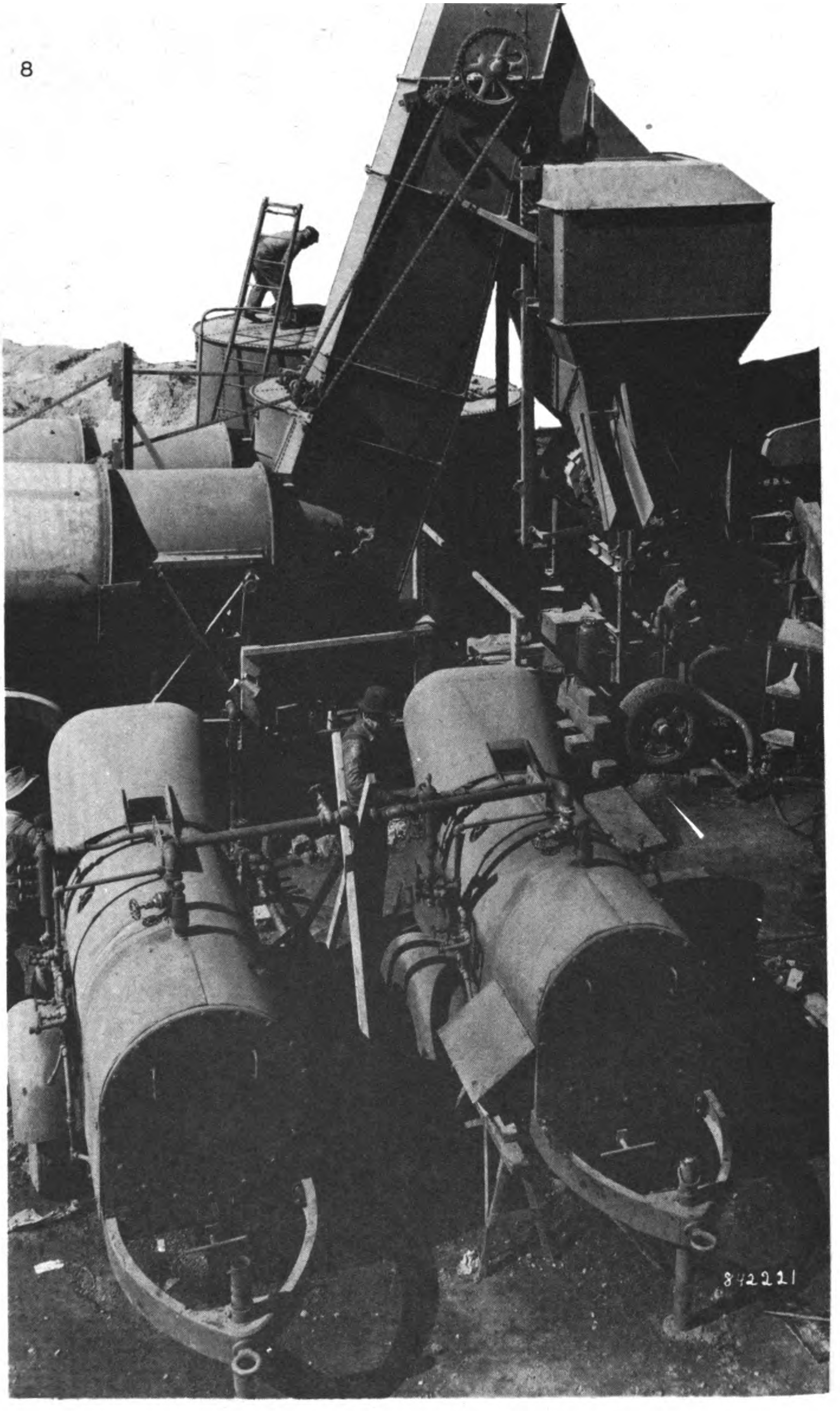


FIG. 2 - ENCLOSED ELEVATOR FOR ELEVATING DRIED AGGREGATE FROM DRYER TO MIXER.

Barber-Greene Hot Elevator

APPLICATION: This unit is a totally enclosed centrifugal discharge type bucket elevator designed to receive hot aggregates from the Model 833 Dryer and elevate them to the hopper on the Model 848 Mixer.

CAPACITY: 60 to 120 tons per hour.

OVERALL DIMENSIONS: Depth - 4'-6"
Width - 3'-3-3/8"
Length - 25'-6"

OPERATING WEIGHTS Total - 5220 lbs.

SHIPPING DATA

Cubage - Not Boxed: Assembled - 400 cu. ft.
Knocked down- 400 cu. ft. (10 packages)

Boxed for Export: One crate - 455 cu. ft.
Weight - 5400 lbs.

Rail Shipment - (Knocked down or Boxed for Export):
4 machines per Flat Car.
2 machines per Box Car.

Capacities and Consumption

Where Used	Description	Fahrenheit Temperature	Grade	Nearest Army Equivalent	Consump. per 100 Op. Hrs.
Machinery	High Temp. Grease	200° to 375°	Marfak #3	#3 Heavy Duty Wheel Bearing Grease	15 lbs.

Introduction

The Barber-Greene Model 833 Dual Drum Dryer is a drying medium for removing moisture from aggregate for bituminous construction and for heating the aggregates to suit the various bitumen requirements. The unit is highly portable and is mounted on pneumatic tires for transportation. Its high capacity is used to advantage in conjunction with the Barber-Greene continuous flow Pugmill Mixers. The dryer can be used as either a stationary dryer for central plant work or as a traveling dryer in conjunction with a Barber-Greene Bucket Loader.

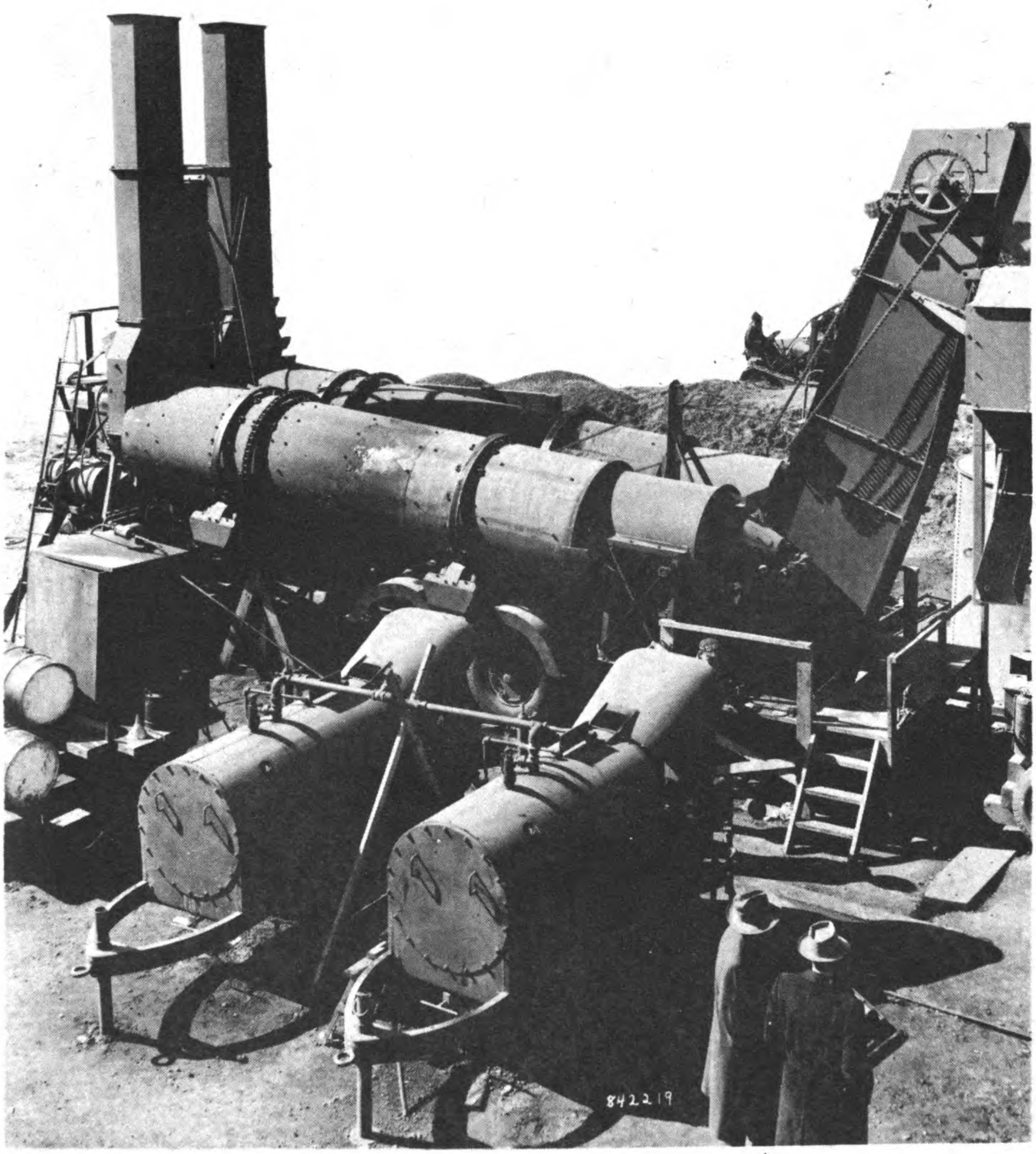


FIG. 3 - MODEL 833 DOUBLE DRUM DRYER USED IN CENTRAL PLANT APPLICATION.

Dryer Operating Principles

DESCRIPTION AND PRINCIPLE OF DRYER

The Dryer operates on the direct heat exchange principle between the heated products of combustion from a direct flame and the aggregates to be dryed and heated. The two rotating drums serve as a means for doing this in an economical and efficient way.

The flame is introduced at one end of the drums and the wet aggregates are fed in at the other end using the counter flow method. The drums are tipped at a suitable angle to feed the aggregates thru the drums as the aggregates are elevated and spilled by cupped flights in the rotating drums. The cupped flights are shaped and spaced to insure cascading across the entire cross section of the drum giving intimate contact with the hot gases. See Section "AA" Fig. 5.

Fuel oil is burned in a high pressure burner with steam injection and the hydrocarbons of this oil combine with free air to form principally carbon dioxide, carbon monoxide, nitrogen and superheated steam at a temperature of approximately around 4500° F. These hot products of combustion on passing thru the falling aggregates' impart some of their B.T.U.'s to these aggregates and convert any moisture present into superheated steam as well as raising the temperature of the aggregates. The drum itself assists in this heat transfer as it becomes a medium of heat exchange between the hot gases and the aggregates.

The gases at approximately atmospheric pressure that have to be handled at the stack include, the products of combustion, super-heated steam from the water evaporated from the aggregates, and super-heated steam from the steam used in the burner for atomizing purposes. There is also a slight amount of additional super-heated steam included which comes in with the air for combustion in the form of water vapor (humidity). The temperature of these gases at the stack vary from 400 to 600°.

Draft for the speedy handling of all these gases is assisted by the high pressure oil burner. The rapidly expanding products of combustion are directed into the dryer shell and are assisted by the velocity head imparted by the use of the injection steam. However, this propogating flame and hot expanding gases are confronted by a veil of falling aggregates which tends to slow down this process. This is further aggravated by the swelling of the volume of gases due to the moisture in the aggregates being converted into super-heated steam and in order to further assist the penetration of these gases thru the veil of falling aggregates, steam jets are provided in the dryer stack to give an induced draft.

FLOW OF AGGREGATES AND GASES THRU DRYER

The flow of aggregate thru the dryer starts at the reciprocating feeder (1) Fig. 5. The feeding mechanism of the feeder is kept filled with aggregate by means of a bull-dozer, clamshell, or some other type of available material handling equipment.

The amount of aggregate fed by the feeder is controlled by two adjustable gates (2). The feeder discharges the aggregate directly into the buckets (3) of the cold elevator (4). The cold elevator elevates the aggregate to the point of discharge, where the aggregate is split into approximately equal portions, each portion discharging into one of the two drums. The revolving action of the drums (5) with flights attached to the shell (see Section "AA") and the slope of the drums, cause the aggregate to be carried at a steady rate thru the drums. The aggregates are discharged at the burner end into a single concentrating chute.

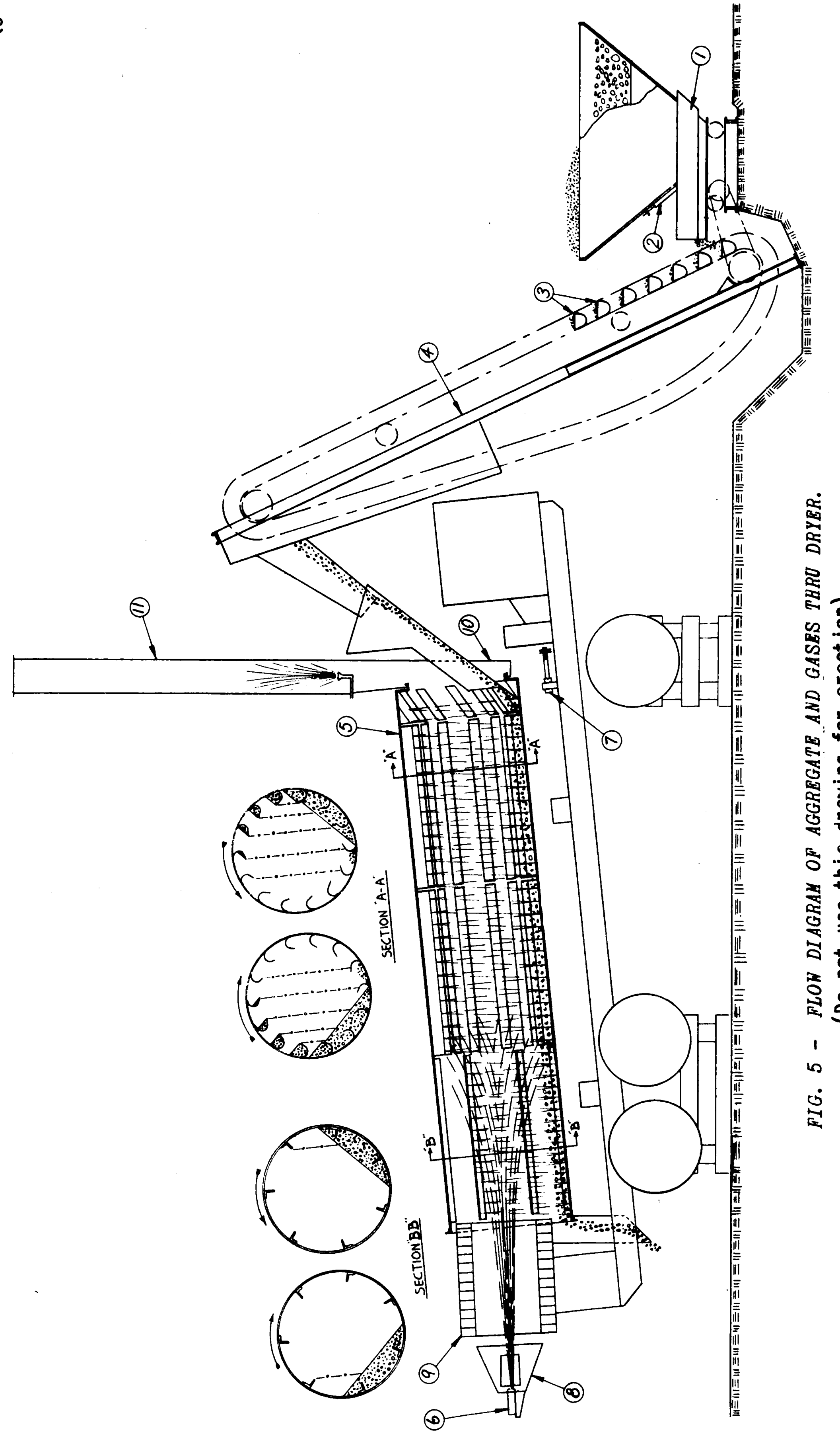


FIG. 5 - FLOW DIAGRAM OF AGGREGATE AND GASES THRU DRYER.
(Do not use this drawing for erection)

As the aggregates flow thru the drums, it comes in contact with the flame and hot gases from the burners (6) flowing in the opposite direction. Fuel oil for the burners is supplied under pressure from the positive displacement pump (7) mounted on the dryer. High pressure steam is used for atomization and the combustion cones (8) and combustion chambers (9) assist in the combustion cycle. The combustion gases and moisture vapor from the aggregates pass out thru the exhaust manifolds (10) and up thru the exhaust stacks (11).

DRYER CAPACITY

The rated capacity of the dryer is 60 to 120 tons per hour of dryed aggregates.

This wide range of capacity is due principally to the variable moisture content to be removed. If very little moisture is to be removed, then the capacity is usually limited only by the actual physical dimensions of the dryer and accessories. As the moisture content increases the capacity then becomes limited by the ability of the dryer to accommodate the increasing volume of gases from the products of combustion, the super-heated steam from the evaporated moisture, and the injection steam. This increasing volume of gases is restricted by a decreasing effective cross-sectional drum area because of the heavier veil of material being handled as the aggregate capacity increases.

See "Steam Supply System" and "Combustion System" for more detailed discussion as to how capacity is affected by these items.

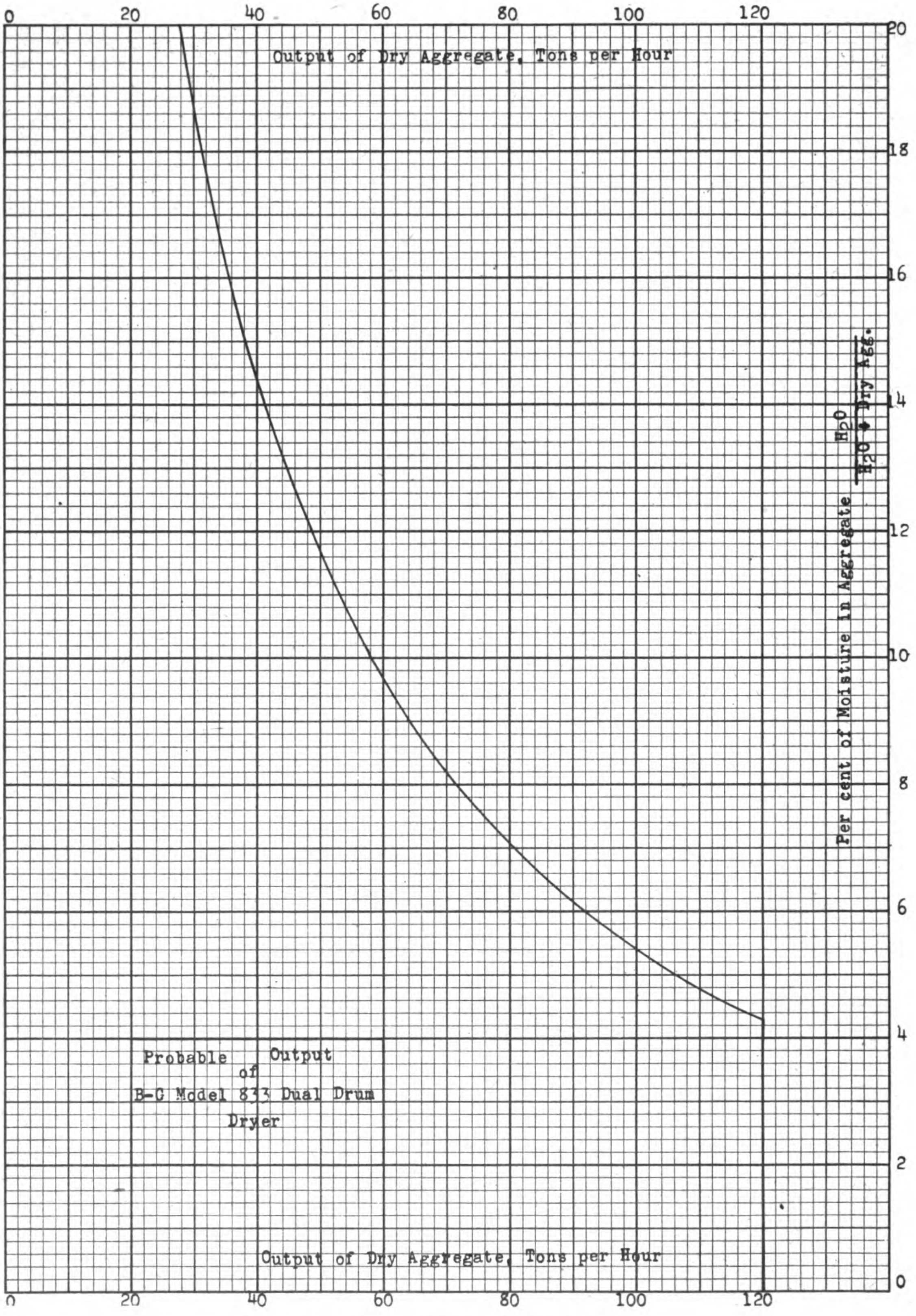
SELECTING DRYER SET UP CAPACITY AND PROBABLE FUEL OIL CONSUMPTION

Capacity

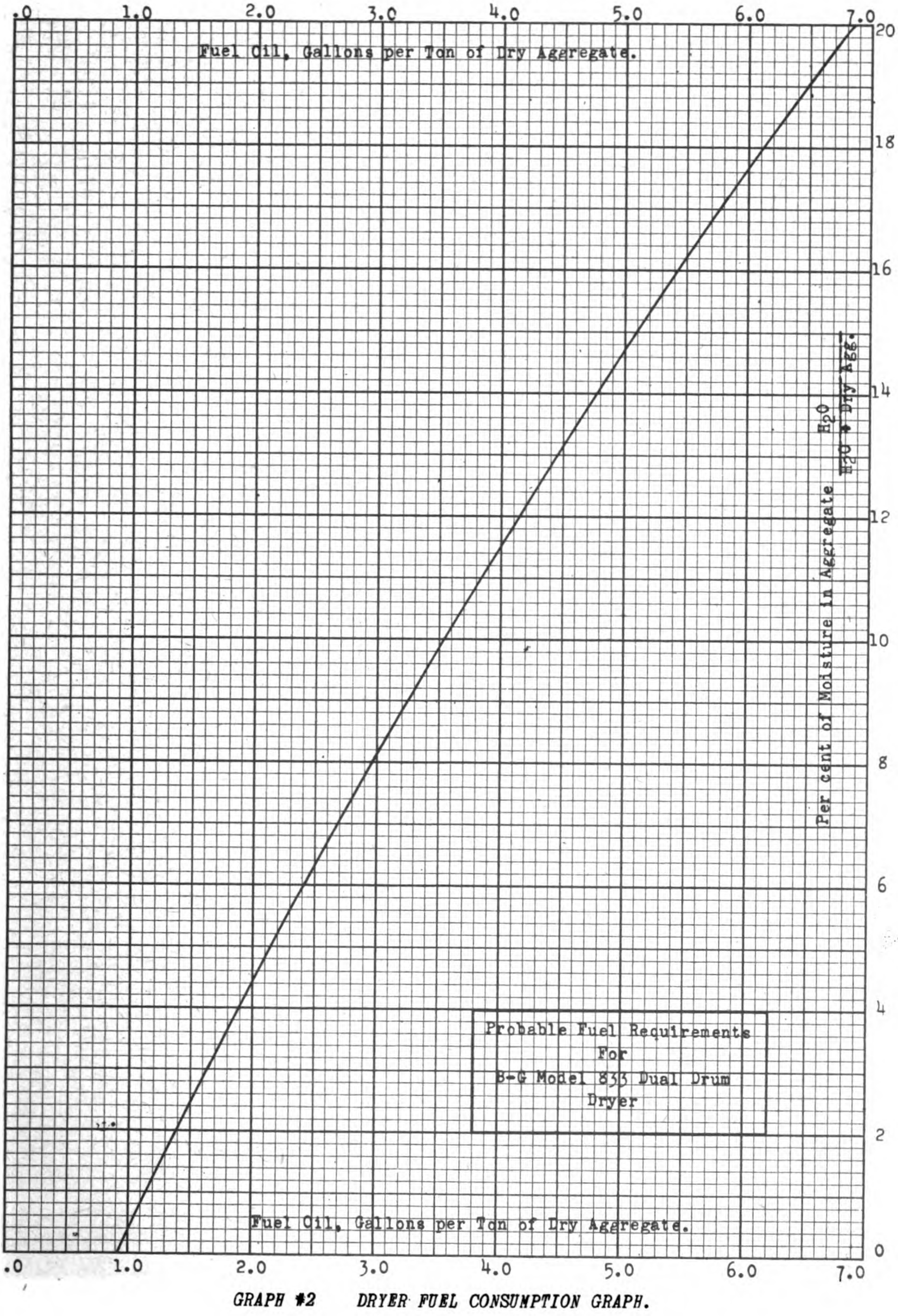
Graph #1 shows the dryer capacities that may be expected for various moisture contents. The vertical lines represent the tons of dried aggregate produced per hour. The horizontal lines represent the percentage of moisture content in the undried aggregate. To determine the probable dryer capacity for a given aggregate, use the following procedure: (1) Determine the percentage of moisture in the aggregate to be dried. (2) Starting at the lower right hand corner of Graph #1, proceed vertically upward until the number corresponding to the aggregate moisture percentage is found. (3) Then proceed horizontally to the left until the graph line is reached. (4) From that point on the graph line, proceed vertically downward to the base line and read the number of tons per hour shown. For example, an aggregate containing 5% moisture could be dried at the rate of 106 tons per hour, or, an aggregate containing 8.3% moisture could be dried at the rate of 67 tons per hour.

It must be remembered that the Capacity Graph was made up on the basis of many average operating conditions and the capacities actually obtained may be above or below the capacity shown on the graph. See "Assumptions Made in Capacity, Etc."

By consulting the graph, it will be seen that the dryer capacity, when drying an aggregate with 20% moisture, drops to 28 tons per hour. This, of course, is inconsistent with the above stated minimum capacity of 60 tons per hour. The reason for this is that very few aggregates can hold more than 10% of moisture even when saturated. Consequently, the minimum rated capacity of the dryer is based on aggregate containing approximately 10% of moisture.



GRAPH #1 DRYER CAPACITY GRAPH.



GRAPH #2   DRYER FUEL CONSUMPTION GRAPH.

Fuel Oil Consumption

The probable dryer fuel consumption can be obtained by consulting the fuel consumption Graph #2. This graph gives the number of gallons of fuel required to dry one ton of aggregate at various moisture contents.

To determine the probable fuel consumption per ton of aggregate, use the following procedure: (1) Determine the percentage of moisture in the aggregate to be dried. (2) Starting at the lower right hand corner of Graph #2, proceed vertically upward until the number corresponding to the moisture percentage is found. (3) Then proceed horizontally to the left until the graph line is reached. (4) From that point on the graph line, proceed vertically downward to the base line and read the number of gallons of fuel required. For example, an aggregate containing 6% moisture would require 2.4 gallons of fuel per every ton of aggregate dried.

The hourly fuel consumption can be obtained by: first finding the dryer capacity in tons per hour at the existing aggregate moisture content (see Dryer Capacity Graph #1), then multiply the fuel consumption per ton by the number of tons per hour.

Assumptions Made In Capacity & Fuel Consumption Curves

The following assumptions and average conditions were assumed in making up these curves for estimating and dryer set up purposes:

Wet Aggregate Temperature	-	60° F.
Dryed " "	-	300° F.
Exhaust Stack Gas "	-	500° F.
Fuel Oil Heat Value	-	135,000 B.T.U. per gallon
Burner Steam Consumption	-	6# per gal. fuel oil (high)
Air Temperature (Atmosphere)	-	60° F.
Wind Velocity	-	5 miles per hour

Physical capacity based on handling 18,000 cu. ft. per minute of gases leaving the drums.

The dry aggregate temperature can vary considerably without materially affecting either the fuel consumption or the dryer output. The large percentage of the total heat produced by the burners is needed to evaporate the moisture from the aggregate. Once the aggregate is dry a comparatively small percentage of additional heat is required to raise the heat of the aggregate. For example, a decrease of 25° in the dry aggregate temperature would increase the dryer capacity only 1 to 2.5 tons per hour, and would cause a decrease in fuel consumption of only 1/10 of a gallon per ton of aggregate dried.

The consumption of fuel oils with other than 135,000 B.T.U. content per gallon is inversely proportional to the B.T.U. content. In other words, the number of gallons of high B.T.U. content fuel required to dry a ton of aggregate is less than the number of gallons required using a low B.T.U. content.

Wind velocity has a very noticeable effect on the capacity and, for approximately every 5 mile an hour increase, the output will decrease about $3\frac{1}{2}$%.

Dryer Units

Reciprocating Feeder

In order for the dryer to produce aggregate at uniform temperatures and dryness, the aggregate must not only be fed in a steady, uniform flow, but if two sizes of aggregate are being dried at the same time, the amounts of each must be proportioned. These functions are performed by the reciprocating feeder (Fig. 6).

The reciprocating feeder is set near the charging end of the dryer and at right angles to the dryer. The aggregate fed by the feeder is discharged directly into the buckets of the "cold elevator," which discharges directly into the dryer drums.

The feeder proper consists principally of a small hopper section, divider plate, sliding plate, adjustable gates, seals and driving mechanism.

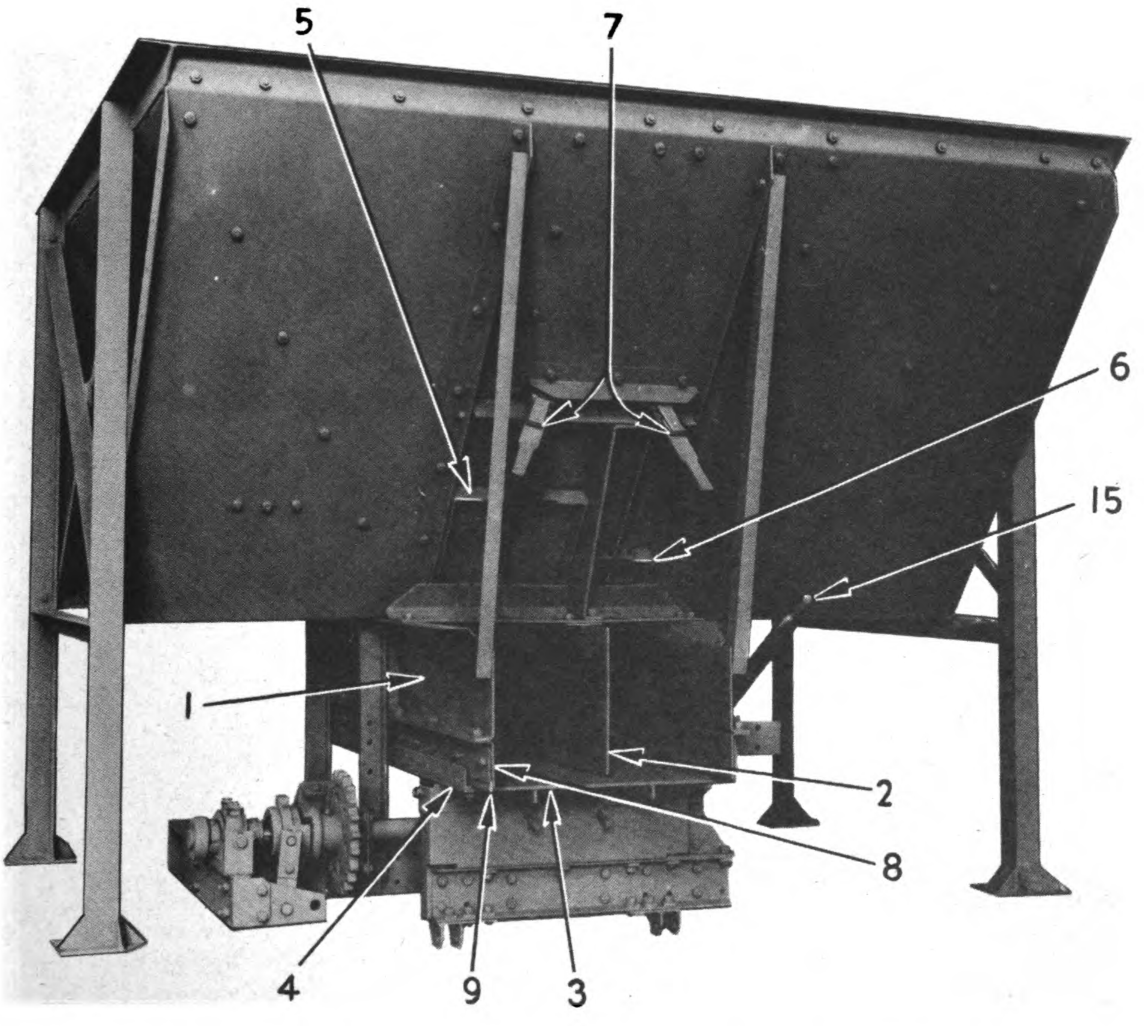


FIG. 6 - FRONT (DISCHARGE) END OF RECIPROCATING FEEDER AND HOPPER BASE.

HOPPER SECTION

The hopper section (1), Fig. 6 of the feeder proper has an insufficient surge capacity in itself to provide a uniform flow of aggregate under the gate for any length of time. Its primary function is to serve as a base for a large hopper extension or as a support for a bulkhead housing. In addition to these functions, it serves as a feeding chamber with more than ample capacity to provide sufficient aggregate for every stroke of the sliding plate, provided that a sufficient head of aggregate is maintained above the hopper section to replenish each void caused by a stroke of the sliding plate. The hopper section must be kept filled at all times to insure uniform feed of aggregate.

DIVIDER PLATES

Some types of mixes require that two sizes or types of aggregate be blended together so that the mix will conform to specifications. The hopper section of the reciprocating feeder is supplied with a divider plate (2) Fig. 6 for this purpose.

The divider plate divides the hopper into two sections, one 15" wide and the other 9" wide. This makes it possible to feed the size, comprising the greater part of the total, through the 15" side and the remainder through the 9" side. An individual gate for each side provides accurate control of the amounts of aggregate fed from each side.

The extension hopper, for mounting over the reciprocating feeder, also is provided with a divider plate, which when erected into position, serves as an extension or a continuation of the divider plate in the feeder. The hopper divider plate should be bolted into place regardless of the type of aggregate being fed as this plate adds structural strength to the hopper in addition to keeping two types or sizes of aggregate separated. When a single aggregate is being handled, the clam shell alternates, dumping the bucket first to one side, then to the other side while charging the hopper.

For applications involving the use of a bulk head instead of the hopper, a divider partition, built of planking is erected, extending from the existing feeder divider plate outward as far as necessary to keep the two stock piles of aggregate separated.

SLIDING PLATE

The sliding plate (3) Fig. 6, located directly beneath the hopper section, supplies the means by which the aggregate is fed from the hopper to the point of discharge. The plate is made of high carbon wear resisting steel. It is supported by four rollers, one at each corner of the plate. Angles (4), bolted to each side of the plate, assist in preventing leakage of aggregate along the sides of the hopper. These angles are bolted in place and can be easily replaced when worn.

When in operation, the plate slides back and forth on a 6" stroke. As the plate moves toward the point of discharge, it carries the quantity of aggregate with it. The void created by pulling aggregate from the hopper is immediately filled by reserve storage in the hopper. As the plate recedes, the aggregate that was supported by the outer end of the plate is let fall into the buckets of the "cold elevator".

ADJUSTABLE GATES

Two adjustable gates, one 15" (5) Fig. 6 and one 9" (6), located at the discharge end of the feeder, control the amount of aggregate fed from each side of the feeder. These gates are raised and lowered by means of long screws operated by ratchet levers (7). The size of gate opening is determined by measuring the distance, in inches, from the sliding plate to the bottom of each gate. If the feeder is used to feed a single aggregate, both gates are are set at the same opening. If two sizes of aggregate are fed thru the feeder, each gate is set at the opening that will give a proper feed for that size aggregate. (See Reciprocating Feeder Capacities, Table 1.)

HOPPER SEALS

Leakage of aggregate around the sides and the charging end of the feeder plate is prevented by seals around the base of the hopper section. The seals along each side consist of a wear resisting skirt angle (8) Fig. 6, and rubber belt flashing (9). The vertical leg of the angle is an extension of the hopper side and extends downward to within 1/8" of the sliding plate angle. The rubber belt flashing fits against the outside of the angle and extends downward, -- flush against the sliding plate angle. The flashing is held in position against the angle by a steel bar, running the full length of the flashing and is secured by bolts. The rubber flashing keeps all aggregate confined within the hopper section.

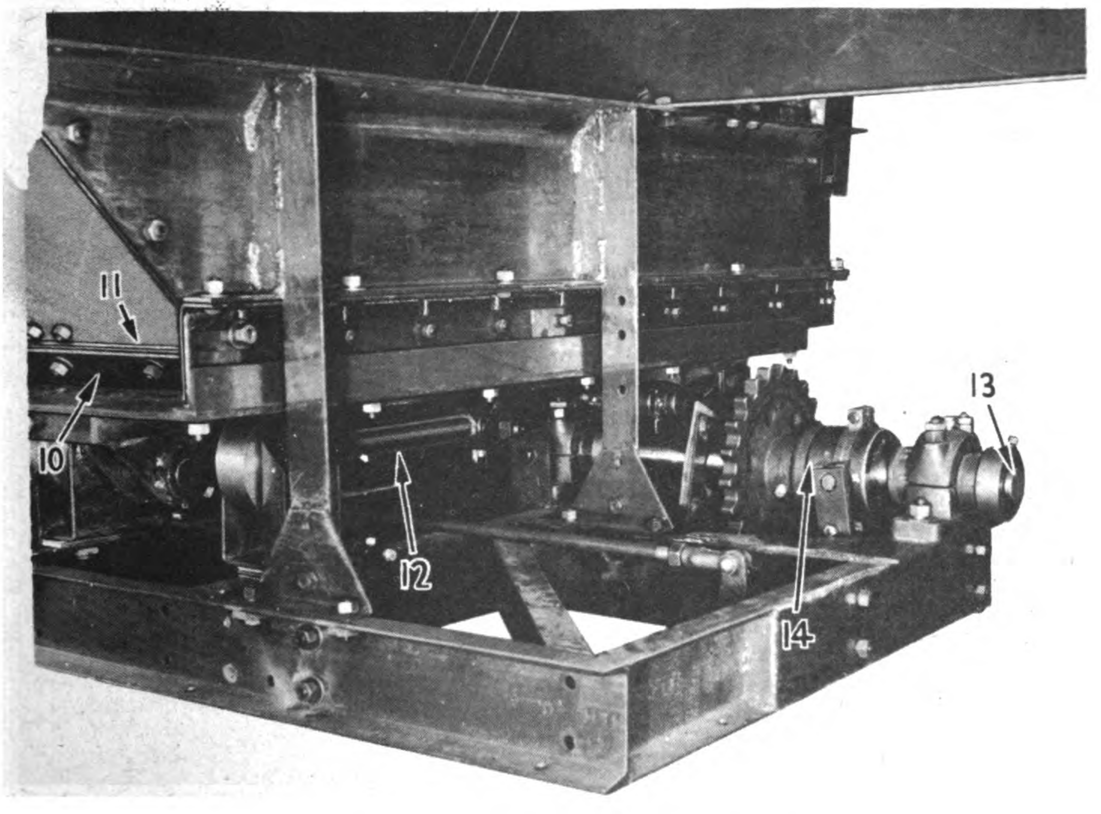


FIG. 7 - DRIVING SIDE OF RECIPROCATING FEEDER.

As wear develops on the seals, they should be lowered to maintain the same position as when new. When the vertical leg of the skirt angle has worn so that the clearance between the leg of the skirt angle and the sliding plate angle exceeds 3/8 of an inch, the angle should be lowered to within 1/8" of the sliding plate by inserting shims between the lower portion of the hopper side and the wearing angle. When the rubber flashing becomes worn sufficiently to allow any material to pass under it, it should be lowered until flush with the sliding plate by loosening the bolts securing it and forcing the flashing downward. The bolt holes in the flashing are slotted to permit lowering.

The seal at the rear of the sliding plate consists of a wear resisting steel plate (10) Fig. 7, and rubber belt flashing (11). Both the plate and flashing have slotted holes to allow for downward adjustment to compensate for wear. The flashing should be kept flush against the sliding plate, and the wearing plate should be kept 1/8" above the sliding plate.

The seals should be checked every 2 or 3 days, and adjusted immediately when any leakage occurs. When either the wearing angles, plate or flashing becomes worn to the extent that it is impossible to adjust them to prevent leakage, they should be replaced.

In order to inspect the condition and adjustment of the seals, it is necessary to completely empty the feeder. This process will be simplified greatly if the feeder is allowed to run empty before shutting the dryer down.

FEEDER DRIVING MECHANISM

The reciprocating action of the sliding plate is produced by a crank arm (12) Fig. 7, driven by the feeder crankshaft (13). The crankshaft is chain driven from the footshaft of the "cold elevator". The crankshaft is engaged by means of a jaw clutch (14), operated by a lever (15) Fig. 6, located opposite the drive side of the feeder. The clutch can be engaged or disengaged while the dryer is running. The clutch should be left disengaged when the dryer is started and should not be engaged until the dryer burners are lighted and adjusted for proper flame. When the dryer is to be shut down, the feeder clutch is disengaged before the flame is extinguished in the drums. This is very necessary in order to permit all aggregate to run out of the drums before the dryer is stopped.

Caution: Always engage the feeder clutch after the dryer is started and disengage before the dryer is stopped.

The crankshaft bearing caps and bases may have a tendency to loosen up after the feeder has been in operation for some time. Check the bearings periodically, and if any trace of movement is observed, the bolts in the caps and bases should be tightened promptly.

In applications where a bulkhead is built around the feeder, the feeder driving mechanism is apt to be neglected as the lower part of the feeder is housed in on three sides. The housing should be built with ample clearance to permit inspection and the lower part of the feeder should be inspected and lubricated as regularly as a more accessible unit. Any leakage of aggregate into or around the driving mechanism of the feeder should be cleaned out before it builds up sufficiently to come in contact with any of the mechanism.

FEEDER OPERATION

The flow of aggregate for any given gate opening will vary with the type and size of aggregate being fed. Coarse aggregates will feed through rather freely. Fine aggregates with rather high moisture content will have a tendency to bridge over in the hopper or around the bulkhead, preventing the flow down to the feeder sliding plate. If such a condition occurs, it will be necessary to keep the sand shoved down whenever it bridges over.

At no time should the feeder be set to feed more aggregate than the buckets on the "cold elevator" can carry, as this would result in choking up the foot end of the elevator and would also result in overloading the dryer.

FEEDER CAPACITIES TABLES

The reciprocating feeder will not feed various sizes and types of aggregate at the same rate of flow. Also, because of the fact that the feeder is of the sliding plate type, there will be a certain amount of slippage between the aggregate and the sliding plate. Also arching in the hopper and wet aggregates will cause variations in the amount fed. Because of these variables, no table can give exact feeds for different gate openings.

Field tests, however, have given a fairly accurate record of the efficiency of the feeder on various types of aggregate. It has been found that crushed stone or gravel with no fines feeds with about 52% efficiency. Crushed stone or gravel with fines feeds with about 60% efficiency and sand feeds with about 65% efficiency. The capacities shown in the following tables are computed on the basis of: area of gate opening times length of feeder stroke (6") times strokes per minute (68.25) times percentage of efficiency.

NOTE: Sand capacities must be checked carefully as damp or wet sand "fluffs" to a variable degree and the cu.ft. table reading may be misleading as to actual tonnage of dry sand. "Fluffed" sand will necessitate opening the gate wider to obtain the equivalent amount of dry sand.

TABLE I

24" RECIPROCATING FEEDER CAPACITY			
Gate Opening	Crushed Stone * Cu. ft. per Min.	Graded Aggregate ** Cu. ft. per Min.	Sand *** Cu. ft. per Min.
	Capacity for 15" Feeder Gate		
2"	3.65	4.21	4.56
3"	5.47	6.31	6.84
4"	7.30	8.42	9.12
5"	9.12	10.52	11.40
6"	10.95	12.63	13.68
7"	12.77	14.73	15.96
8"	14.60	16.84	18.24
9"	16.42	18.94	20.52
10"	18.25	21.05	22.80
11"	20.07	23.15	25.08
12"	21.90	25.26	27.36
13"	23.72	27.36	29.64
14"	25.55	29.47	31.92
15"	27.37	31.57	34.20
	Capacities for 9" Feeder Gate		
2"	2.18	2.51	2.72
3"	3.26	3.76	4.08
4"	4.35	5.01	5.44
5"	5.44	6.27	6.80
6"	6.53	7.52	8.16
7"	7.62	8.77	9.52
8"	8.70	10.02	10.88
9"	9.79	11.28	12.24
10"	10.88	12.53	13.60
11"	11.97	13.78	14.96
12"	13.06	15.04	16.32
13"	14.14	16.29	17.68
14"	15.23	17.54	19.04
15"	16.32	18.80	20.40
Capacities for 24" Gate (Both 15" and 9" Gate at Same Opening)			
2"	5.83	6.72	7.28
3"	8.74	10.07	10.92
4"	11.65	13.43	14.56
5"	14.57	16.79	18.20
6"	17.48	20.15	21.84
7"	20.39	23.51	25.48
8"	23.30	26.86	29.12
9"	26.22	30.22	32.76
10"	29.13	33.58	36.40
11"	32.05	36.94	40.04
12"	34.96	40.30	43.68
13"	37.87	43.65	47.32
14"	40.78	47.01	50.96
15"	43.70	50.37	54.60

* Feeder Efficiency 52%
** Feeder Efficiency 60%
*** Feeder Efficiency 65%

TABLE II

Capacities of a plant, whether travel or central plant, are usually expressed in tons per hour, but to simplify calculations, the output charts for the Mixer aggregate feed and the Dryer reciprocating feeder are shown in cubic feet per minute. The following table converts capacity in tons per hour into capacity in cubic feet per minute of various weight material.

Weight of Aggregate Per Cu. Ft.	CAPACITY IN CUBIC FEET PER MINUTE CONVERTED FROM TONS PER HOUR							
	70 T.P.H.	80 T.P.H.	90 T.P.H.	100 T.P.H.	125 T.P.H.	150 T.P.H.	175 T.P.H.	200 T.P.H.
	Cu.Ft./Min.	Cu.Ft./Min.	Cu.Ft./Min.	Cu.Ft./Min.	Cu.Ft./Min.	Cu.Ft./Min.	Cu.Ft./Min.	Cu.Ft./Min.
80 lbs.	29.20	33.30	37.50	41.70	52.10	62.50	72.85	83.30
85 lbs.	27.40	31.35	35.30	39.25	49.00	58.80	68.60	78.40
90 lbs.	25.90	29.60	33.33	37.10	46.30	55.60	64.70	74.00
95 lbs.	24.55	28.10	31.55	35.10	43.80	52.60	61.50	70.20
100 lbs.	23.32	26.66	30.00	33.32	41.70	50.00	58.30	66.66
105 lbs.	22.20	25.35	28.60	31.75	39.70	47.60	55.50	63.50
110 lbs.	21.25	24.22	27.30	30.30	37.90	45.50	53.00	60.60
115 lbs.	20.30	23.15	26.10	29.00	36.20	43.50	50.70	58.00
120 lbs.	19.45	22.20	25.00	27.80	34.70	41.60	48.60	55.60

Example: If material weighing 100 lbs. per cu. ft. is used and a capacity of 100 tons per hour is assumed, then the feeder gate should be set to deliver 33.32 cu. ft. per minute.

Cold Elevator

The "cold" elevator conveys undried and unheated aggregate from the reciprocating feeder up to the charging end of the dryer. The elevator is located at the charging end of the dryer and extends at right angles to the dryer drums. It is always erected on the left side of the dryer, when looking at the engine end. The elevator, in operating position, has an incline of approximately 25° off vertical. The foot end of the elevator rests on the bottom of a shallow pit. The upper half of the elevator is supported in correct position by braces to the super-structure of the dryer.

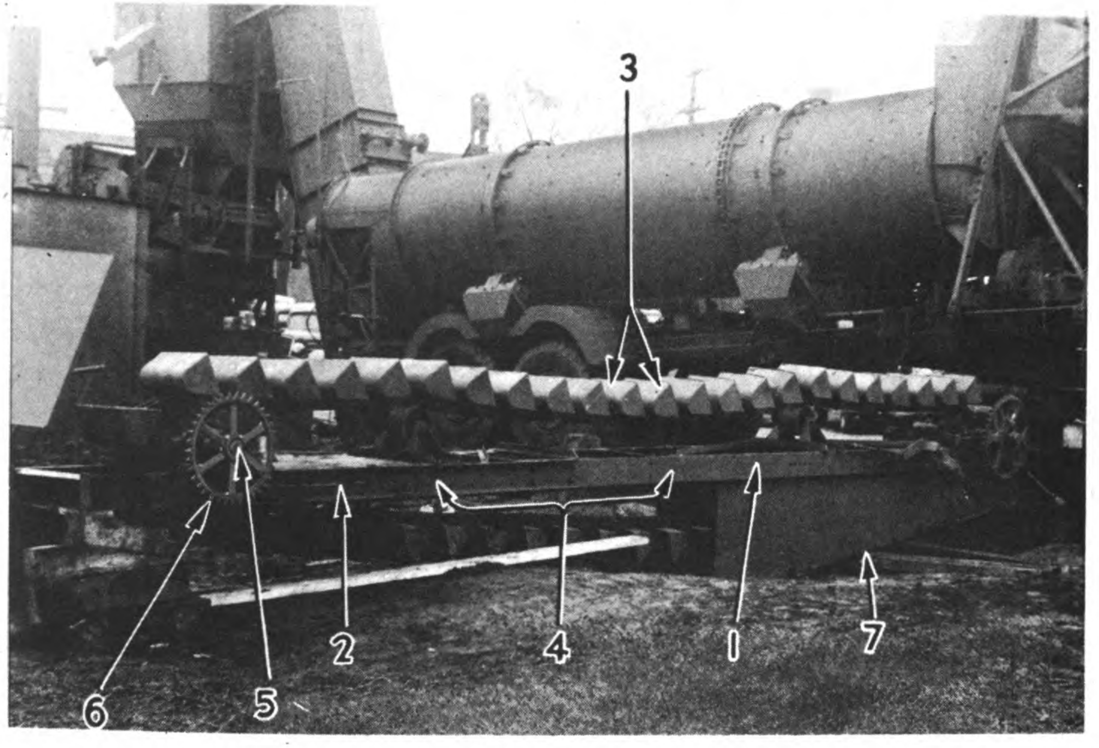


FIG. 8 - "ASSEMBLED COLD ELEVATOR BEFORE HOISTING INTO OPERATING POSITION.

The elevator is shipped knocked down in three sections consisting of the upper frame section, lower frame section, and bucket line. Assembly consists of bolting the two frame sections together and installing the bucket line. To assemble the two sections, the upper frame section (1) Fig. 8, is telescoped into the lower frame section (2). The telescoping joint allows the overall length of the elevator to be increased or shortened as necessary to fit existing erection conditions. A series of holes (4) in both frame sections is provided for bolting the sections together at the desired position. When assembled, the elevator is hoisted in place by means of two chain hoists (furnished with the dryer) or a crane, if available. Detailed instructions for assembly and erection are contained in the Erection Section.

The principle parts of the "cold" elevator are the bucket line, head and footshafts, idler rolls, discharge chute and spillage return chute.

BUCKET LINE

The bucket line consists of a series of malleable iron buckets (3) Fig. 8, spaced 12" apart and bolted to a strand of steel roller chain. The buckets are charged with aggregate as they round the footshaft and begin the upward run toward the headshaft. The aggregate is discharged from the buckets as they round the headshaft and begin the downward run.

The bucket line is supported at two points on the upward run by idler rollers. These rollers cut down the unsupported span of the bucket line and prevent the bucket line from whipping.

HEAD AND FOOTSHAFTS

The cold elevator headshaft (1) Fig. 9, drives the bucket line. The headshaft assembly consists of the shaft, bucket line sprocket, drive sprocket, breaker bolt and take-up bearings.

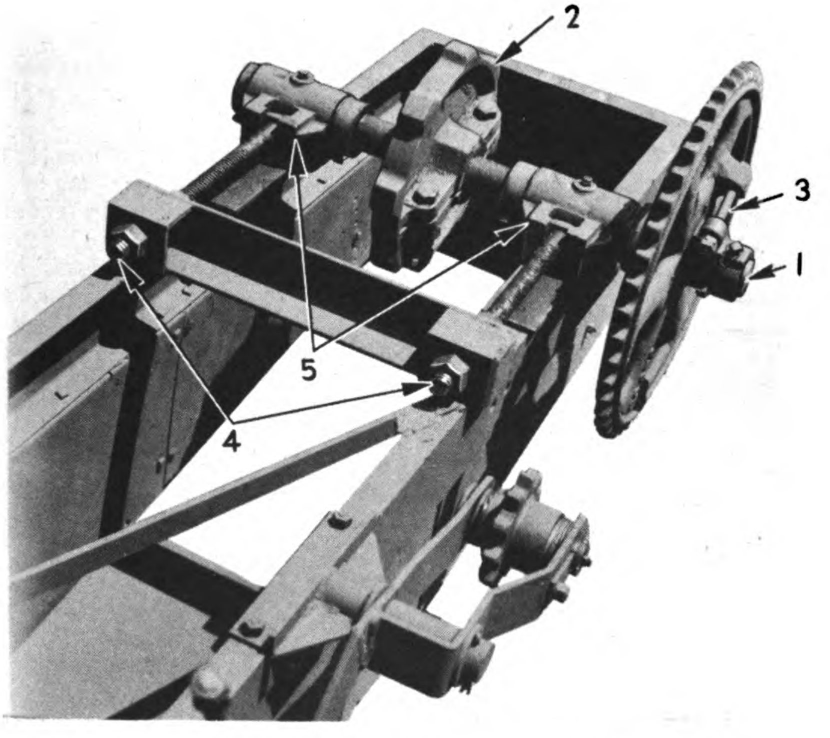


FIG. 9 - CLOSE-UP OF HEAD END OF COLD ELEVATOR.

The bucket line sprocket (2) is of the split type, making it unnecessary to remove the shaft when replacing.

The driving sprocket is equipped with a breaker bolt (3) for protecting the drives in the event of an overload. Should the bucket line or reciprocating feeder driving mechanism become locked for any reason, while operating, the breaker bolt breaks, preventing damage to the rest of the drives. The breaker bolt is 5/8" x 7" in size and is made of mild steel. The standard bolt should never be replaced with a larger bolt or one made of stronger steel. If the bolt breaks, find the cause of the overload and remedy it before attempting to start the elevator.

The adjustment of the bucket line for proper tension is provided by means of two take-up bolts (4) attached to sliding headshaft bearings (5). The headshaft bearings are designed to slide along the elevator frame, and after being adjusted properly are held rigid by locking the nuts on the take-up bolts.

The elevator footshaft (5) Fig. 8, is bolted rigidly to the lower conveyor frame and is not adjustable. The bucket line sprocket (6) on the footshaft is also split for convenience in replacing. One end of the footshaft is extended to take the reciprocating feeder drive sprocket. This sprocket and drive are enclosed in a chain guard to prevent aggregate from getting into the drive.

DISCHARGE CHUTE

The discharged aggregate from the bucket line is directed into each of the two dryer charging hoppers by the elevator discharge chute. The chute is made up in two sections, one section (1) Fig. 10, directing approximately half the aggregate into the drum farthest from the cold elevator, and the other section (4) directing the remainder of the aggregate into the drum nearest the cold elevator.

The sloping section (1) can be adjusted for varying degrees of slope. This section pivots at hinge point (2) and is held in position by inserting bolts through any of a series of holes (3).

The upright section (4) is provided with two adjustable baffles (5) and (6) for directing the aggregate into the center of the drum charging hopper. Baffle (5) pivots at hinge point (7) and is secured in position by inserting bolts through any of the series of holes (8). The small baffle (6) pivots from hinge point (9) and is secured in the desired position by bolts.

A divider plate (10) located between the two sections, divides the aggregate discharging from the cold elevator into the proper amount for each drum. The divider pivots at hinge point (11) and is held in the desired position by inserting bolts through any of a series of holes in adjusting brackets (12).

In applications where coarse aggregate is discharged from one side of the reciprocating feeder, and sand is fed from the other side, the divider plate must be adjusted on the basis of the amount of moisture and size of aggregate. Sand retains more moisture than coarse aggregate. As the two sizes of aggregate discharge into the elevator buckets, one side of the bucket is filled with mostly sand and the other side contains mostly coarse aggregate. If the divider plate in the elevator discharge spout is set to divide the discharged aggregate into equal parts, one drum will be fed mostly sand and the other drum will receive mostly coarse aggregate. Even though each drum receives an equal volume of aggregate, the drum receiving the sand may have to remove as much as 50% or more moisture than the coarse drum. With this condition existing, the dryer operator would have difficulty in getting properly dried aggregate from the sand drum, while at the same time the flame would have to be reduced in the coarse drum to keep from getting the coarse aggregate too hot.

To remedy this condition, the divider plate is adjusted to deflect more than half of the discharging aggregate into the coarse drum, and the remainder into the sand drum. The proper division of material will result in the operator being able to adjust the burners on both drums at the same setting, and at the same time get approximately the same aggregate heat and dryness from each drum.

All surfaces subjected to the abrasive action of the discharging aggregate are protected by liner plates. Each plate should be replaced immediately when worn through to prevent wear on the surface beneath the plate.

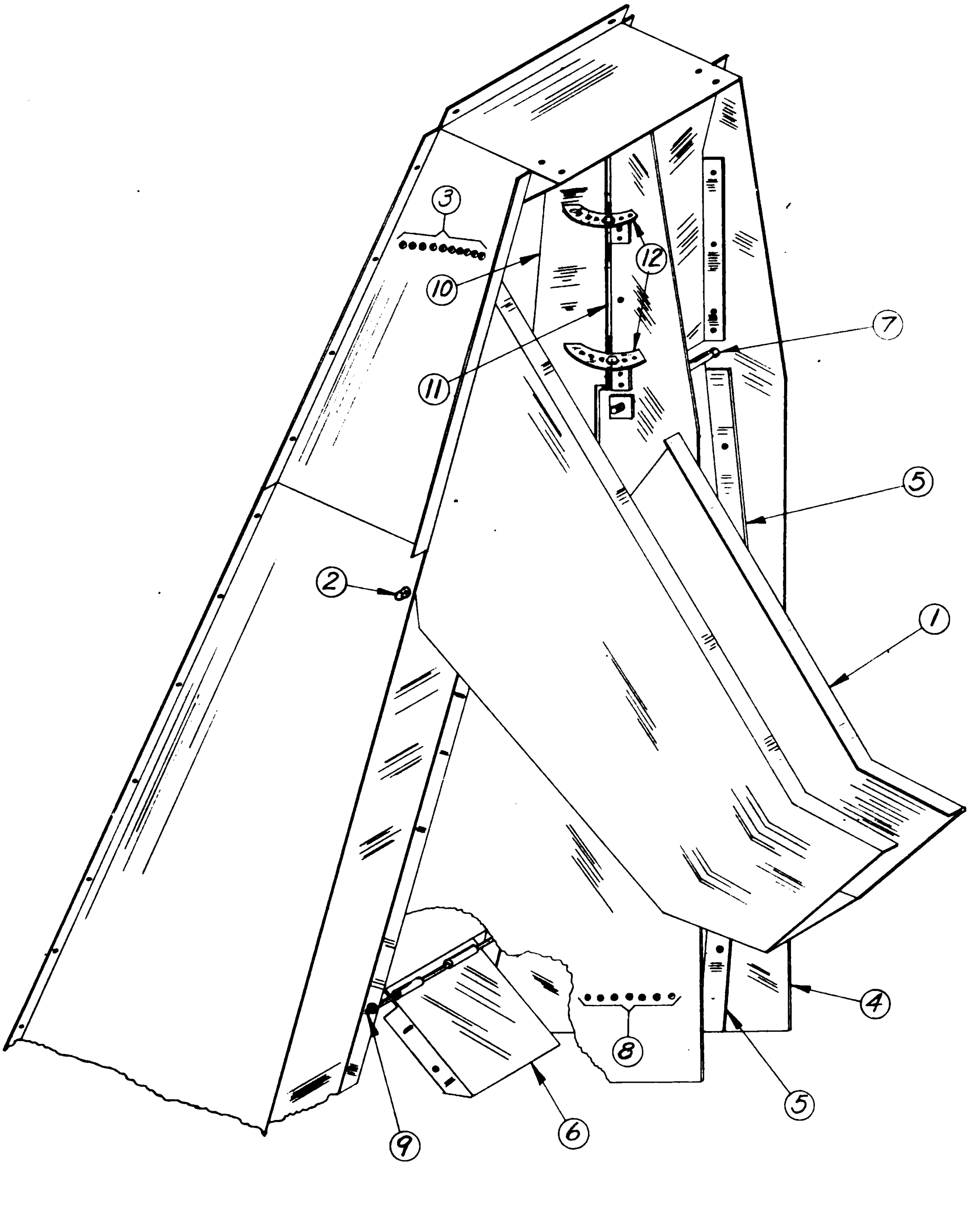


FIG. 10 - COLD ELEVATOR DISCHARGE CHUTE.

SPILLAGE RETURN CHUTE

The spillage return chute (7) Fig. 8, is bolted to the under side of the cold elevator frame and extends from the discharge spout downward to a point about half way down the elevator frame. Its function is to divert any spillage from the buckets back to the elevator foot end.

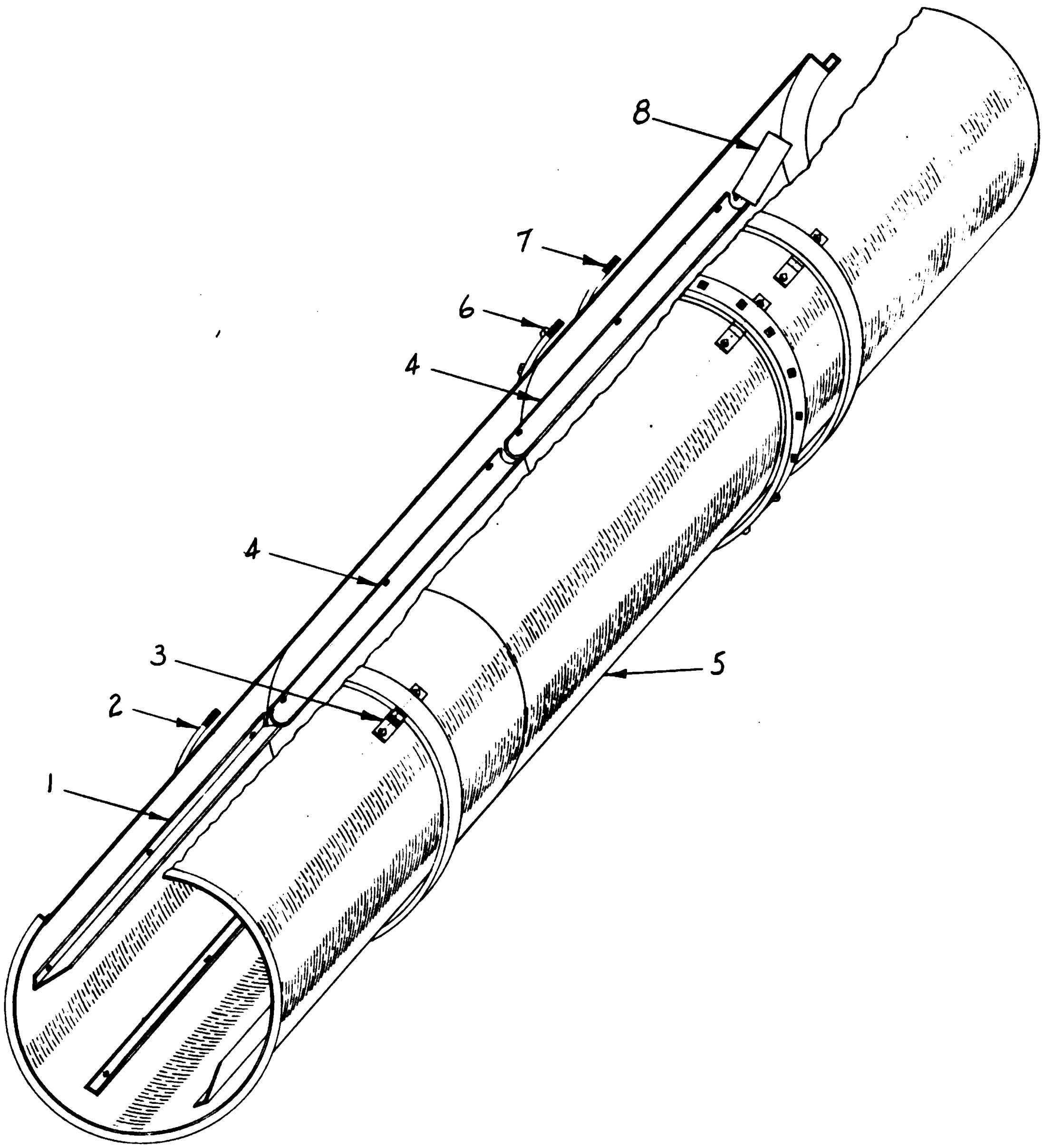


FIG. 11 - DRYER DRUM ASSEMBLY AND TRUNNION TIRES.

Dryer Drums

The dryer drums consist of two large rotating cylinders, mounted in parallel, through which the aggregate passes while being dried, Fig. 11. The drums are 4'6" in diameter and 20' long.

The drum performs the mechanical means of exposing each individual particle of aggregate to the flame and hot gases from the burners. As the drums revolve, the aggregate is carried from the lower to the upper part of the drum by a number of cup shaped lifting flights (4), bolted to the inner circumference of the drum. As each flight moves through the lower part of its arc, it is filled with aggregate. As the flight moves through the upper part of the arc, it progressively discharges its load of aggregate across the cross-sectional area of the drum. In this manner, the aggregate particles are exposed again and again to the hot gases on the way through the drum.

EFFECT OF INCLINATION OF DRUMS

The rate of aggregate flow from the charging end to the discharge end of the drum is controlled by the slope at which the drums are set. For average drying requirements the drum slope is set at 6°. At this setting each aggregate particle moves approximately one foot toward the discharge end of the drum, for every revolution of the drum. The drums revolve 10 revolutions per minute. Consequently, it requires approximately 2 to 3 minutes for each particle of aggregate to pass from the charging end of the drums to the discharge end.

When the aggregate is extremely difficult to dry, such as sand containing a high moisture content, the drum slope can be flattened to 4°. This retards the rate of flow through the drums and allows each aggregate particle to be exposed to the hot gases a greater number of times. Easy drying aggregates, such as coarse crushed rock containing a low percentage of moisture, may permit the drum slope to be set as high as 8°. The steeper slope accelerates the flow of aggregate through the drum, and permits higher capacities, provided the heat and volume of the hot gases is sufficient to cause complete drying.

It is important to remember that if the drum slope is decreased to 4° from 6°, the dryer capacity must be lowered 1/3 to prevent overloading the drums. If the drum slope is increased from 6° to 8°, the dryer capacity may be increased 1/3 without overloading the drums. It is not advisable for the drum slope to be changed from the standard 6° until the operator is thoroughly familiar with the operation and operating principles of the dryer.

DRUM OPERATION

The drum should be turning and the burners lighted before starting the flow of aggregate through the drum.

Caution: Never stop the drums while operating unless absolutely necessary. If the drums are stopped with hot aggregates in them, unequal cooling of the drum will cause severe warpage of the drums. Also do not operate dryer burner with empty drums (other than for the warming up period at starting) as this will cause over-heating of the drum and may burn or warp them.

Keep all bolts securing the drum tires (2 & 7) Fig. 11, and drum sprocket (6) tight at all times. A loose bolt may shear off and cause the tires or sprockets to become loose on the drum.

When shutting the dryer down, continue to run the drum for 20 to 45 minutes after the burners have been closed. This will permit the drum to "cool out" evenly and will prevent the drum from warping.

Even after observing all the cautions for preventing the drum from warping, it may be found that the drums may still warp slightly. Should the drum warp sufficiently to allow the charging end of the drum to rub against the stack base, it will be necessary to move the stack base away from the point where it is rubbing. For instructions on performing this adjustment, refer to the Maintenance Section.

DRUM TIRES AND TRUNNIONS

Each drum is supported by two steel tires (2 & 7) Fig. 11, bolted to the outer circumference of the drum. Each tire revolves on and is supported by two trunnion rollers (9).

The trunnion rollers perform two important functions; that of supporting the weight of the drum, and that of maintaining the proper uphill-downhill position of the drum.

The tendency of the drums, while rotating, is to move downward toward the discharge end of the dryer. The trunnion rollers, when properly adjusted, neutralize the downhill thrust and cause the drums to maintain proper position. The principle of the counteracting thrust developed by the trunnion rollers is the same as that of a flat belt running on a pulley. If the pulley is in line, the belt will run in the center of the pulley. If, however, the pulley is slightly out of line, the belt will run to the side of the pulley. Similarly, if the trunnion rollers are set in line with the drum tires, the tires would run true on the trunnions if the drums were set level. With the drum set on a slope, however, the trunnions are purposely adjusted "out of line" to cause an uphill thrust to be exerted on the drum tires. This adjustment will be hereafter referred to as trunnion "skew".

BEARING BETWEEN DRUM TIRES AND TRUNNION ROLLERS

Each drum tire should ride on its trunnion roller with the full width of the tire contacting the roller. When only one side of the drum tire is riding on the roller, that side of the tire will wear rapidly. This wear is evidenced by flakes of steel forming around the edge of the tire. If the trunnion is skewed, the counteracting thrust of the roller will be less than half what it would be if the full width of the tire were in contact with the roller.

The trunnions are adjusted at the factory for full bearing at the point of contact between the tire and trunnion. In operation, however, one side of the tire may wear more rapidly than the other side of the tire. Check all trunnions every two or three days. If only the edge of any of the tires is contacting its roller, the roller should be adjusted immediately. This adjustment consists of inserting a shim under the bearing on the low side of the trunnion roller. This will bring the low side of the roller up against the drum tire.

TRUNNION ADJUSTMENT

The rear trunnion rollers are adjusted at the factory so that, with the empty drums rotating, the upper drum tire rides evenly between the thrust rollers. The forward trunnions are not skewed. When the dryer is started under load, however, the drums will, in all probability, shift downhill until the forward drum tire is riding hard on the rear thrust roller. In such a case the rear trunnions will require more skew to center the forward drum tire between the thrust rollers. The forward trunnions are skewed only when, after the rear trunnions have been skewed to the practical limits of 3/8", the drum still rides downhill. Then and only then should the forward trunnions be skewed.

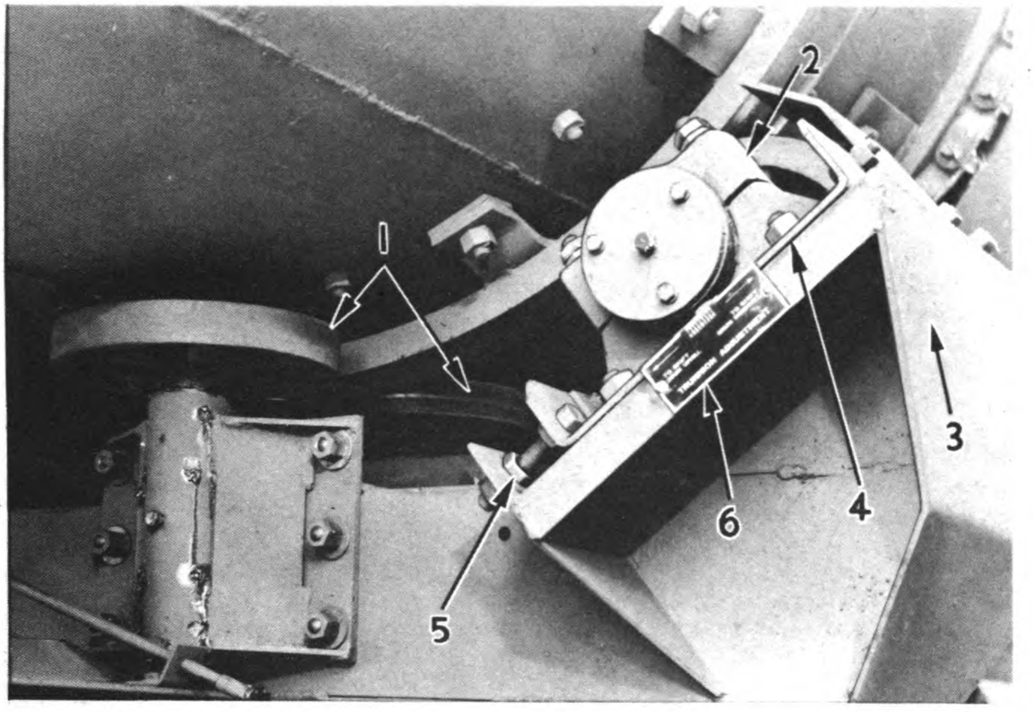


FIG. 12 - TRUNNION AND THRUST ROLLER ASSEMBLIES.

The skewing of a trunnion roller is done by pivoting the entire trunnion assembly on the trunnion support frame. Each trunnion assembly consists of the trunnion roller, shaft, two bearings, pivot frame and two adjusting screws. The roller, shaft and bearings are mounted rigidly to the pivot frame. When the trunnion assembly is mounted on the trunnion support frame, a pin in the exact center of the pivot frame enters a hole in the exact center of the support frame. This allows the entire assembly to pivot, in either direction, on the support frame for obtaining the proper adjustment. The mechanics of skewing or pivoting the trunnion assembly, is performed by means of two adjusting screws.

In order to simplify the adjustment of each trunnion, a brass instruction plate (6) Fig. 12, is attached to each trunnion support frame. This plate not only shows which way to skew the trunnion to shift the drum, either uphill or downhill, but has a scale to show the distance that the trunnion assembly has been skewed. The scale has a zero point that denotes "No Skew". On either side of the zero point, the scale is calibrated in eighths and sixteenths of an inch. The eighths are numbered 1, 2, 3, and 4. The sixteenths marks are not numbered. A chisel mark in the trunnion pivot frame, directly above the instruction plate, serves as an indicator to show the amount of skew. If the chisel mark lines up with the two on the scale, this denotes 2/8 of an inch, or 1/4" skew. If the chisel mark lines up with the sixteenth mark between 2 and 3, this denotes 2/8" plus 1/16", or 5/16" total skew. Although the scale is calibrated to 4, or 1/2" skew, the practical limit of adjustment is reached at 3, or 3/8".

The final adjustment of the trunnion should be made with the dryer in operation. The trunnion adjustment while operating, however, can only be performed on the outer trunnions. The heat of the drums and limited accessibility make it very difficult to adjust the inner trunnions while operating. Consequently, the procedure for adjusting the trunnions should be as follows:

1. Assume that one of the drums is riding down-hill with the front drum tire riding hard against the rear thrust roller.

2. With the dryer operating, skew the outer rear trunnion not to exceed 1/16 of an inch and observe the results. If this is sufficient to cause the drum to shift forward to the proper position, the inner rear trunnion need not be adjusted.

3. Should the 1/16" skew on the outer trunnion be insufficient, stop the dryer and adjust the inner rear trunnion for 1/16" skew. Again start the dryer. In the event that the drum now runs either up-hill or down-hill, adjust the outer rear trunnion, while operating, as necessary, but not to exceed 1/16 of an inch either way from its previous position until the drum maintains its correct position.

4. CAUTION: Remember that no trunnion should be skewed to exceed 1/16 of an inch more than the corresponding trunnion on the opposite side of the drum.

5. If, after the rear trunnions have been skewed 3/8 of an inch and the drum still does not maintain its correct position, skew the the front trunnions as necessary. Do not skew any trunnion more than 3/8 of an inch off center.

6. CAUTION: Do not grease the drum tires or trunnion rollers. Grease will destroy the counteracting thrust developed by the trunnions and may eliminate the friction between the drum tire and trunnion rollers to such an extent that the roller will stop turning. This will cause a flat spot to be worn on the trunnion rollers.

7. Final adjustment of the trunnion should be made only when the dryer is operating at full capacity.

The mechanics of skewing a trunnion assembly is as follows:

1. Loosen the four bolts (4) Figure 12, that secure the rear trunnion pivot frame (4) to the support frame. CAUTION: Do not confuse these bolts with the bolts that secure the trunnion bearings to the pivot frame.

2. Slack off the nut on the adjusting bolts (5) on the end of the trunnion that will be pulled away from the drum while adjusting. Take up on the opposite adjusting bolts (5) until the trunnion has been skewed not more than 1/16 of an inch. Remember that as the nuts on one adjusting screw are taken up, the nuts on the opposite adjusting screw must be slacked off. Tighten nuts on the adjusting bolts. Tighten bolts securing the pivot frame to the support frame.

THRUST ROLLERS

In addition to the trunnion rollers, two thrust rollers (1) Fig. 12, for each drum assist in maintaining the proper uphill-downhill position of the drum. The thrust rollers are located at the bottom of the front drum tire and mounted on either side of the drum tire. The principle of the thrust rollers is not to absorb the thrust of the drums, but rather to limit the distance that the drum can move uphill or downhill. If the trunnions are properly adjusted, the upper drum tire should ride evenly between the thrust rollers without coming in contact with either of them. If the drum tire rides hard against either of the thrust rollers, the trunnions should be adjusted to bring the tire away from the thrust roller.

Caution: Excessive and continuous thrust on either of the thrust rollers will cause the thrust roller bearing to heat, and will cause extensive wear to the edge of the drum tire. When this condition exists, adjust the trunnions immediately.

Fuel and Fuel Supply System

FUELS

The fuel recommended for use in the burners, for best efficiency and most satisfactory results is a #4 furnace oil conforming to the specifications in the following table:

TYPICAL FUEL OIL SPECIFICATIONS

	#2	#3	#4	#5
A.P.I. Gravity at 60° F.	34-38	20-28	12-20	8-14
Flash Point °F. (C.C.) not less than	150	165	150-250	200
Sulphur, % not more than	1.0	1.5	1.5	1.5
Water & Sediment, % not more than	.05	1.0	1.0	1.0
Pour Point °F. not more than	0	10	0	15
B.T.U.'s per Gallon not less than	from 120,000 to 135,000	142,000	145,000	148,000
Saybolt Universal Viscosity @ 100° F. not more than	--	55	90-125	500
Saybolt Furol Viscosity at 77 °F.	--	--	--	50-100
Saybolt Furol Viscosity at 122 °F.	--	--	--	--
Conradson Carbon, % not more than	--	0.5	--	--
Pounds per Gallon at 60° F.	--	--	--	--
Initial Boiling Point, °F.	--	--	--	--
10% Recovery, °F.	440	--	--	--
90% Recovery, °F.	570	--	--	--
End Point, °F.	--	--	--	--

All tests A.S.T.M. Method

Note: Gravity should not be considered a part of specification.

Other fuels, however, will burn satisfactorily, but will not produce quite as high efficiency or uniformity of results. These fuels include #2 and #3 furnace oils. The #2 furnace oil is so similar to regular Diesel fuel, that Diesel fuel can be used in place of the #2 furnace oil. No fuel of a lighter viscosity than #2 furnace oil should be used.

#5 furnace oil can be burned satisfactorily, without preheating, providing the viscosity is not greater than 125 at atmosphere temperatures. Fuels with a viscosity greater than 125 must be either heated before using, or be cut back by mixing with #2 or #3 furnace oils. The proper proportion of each fuel to use, when mixing, must be determined by results obtained by experimenting with various proportions.

FUEL TANK

The fuel storage tank is not provided as a part of the dryer. The tank used should have sufficient capacity for at least 5 hours run. This would mean a tank of approximately 1,000 gallons capacity.

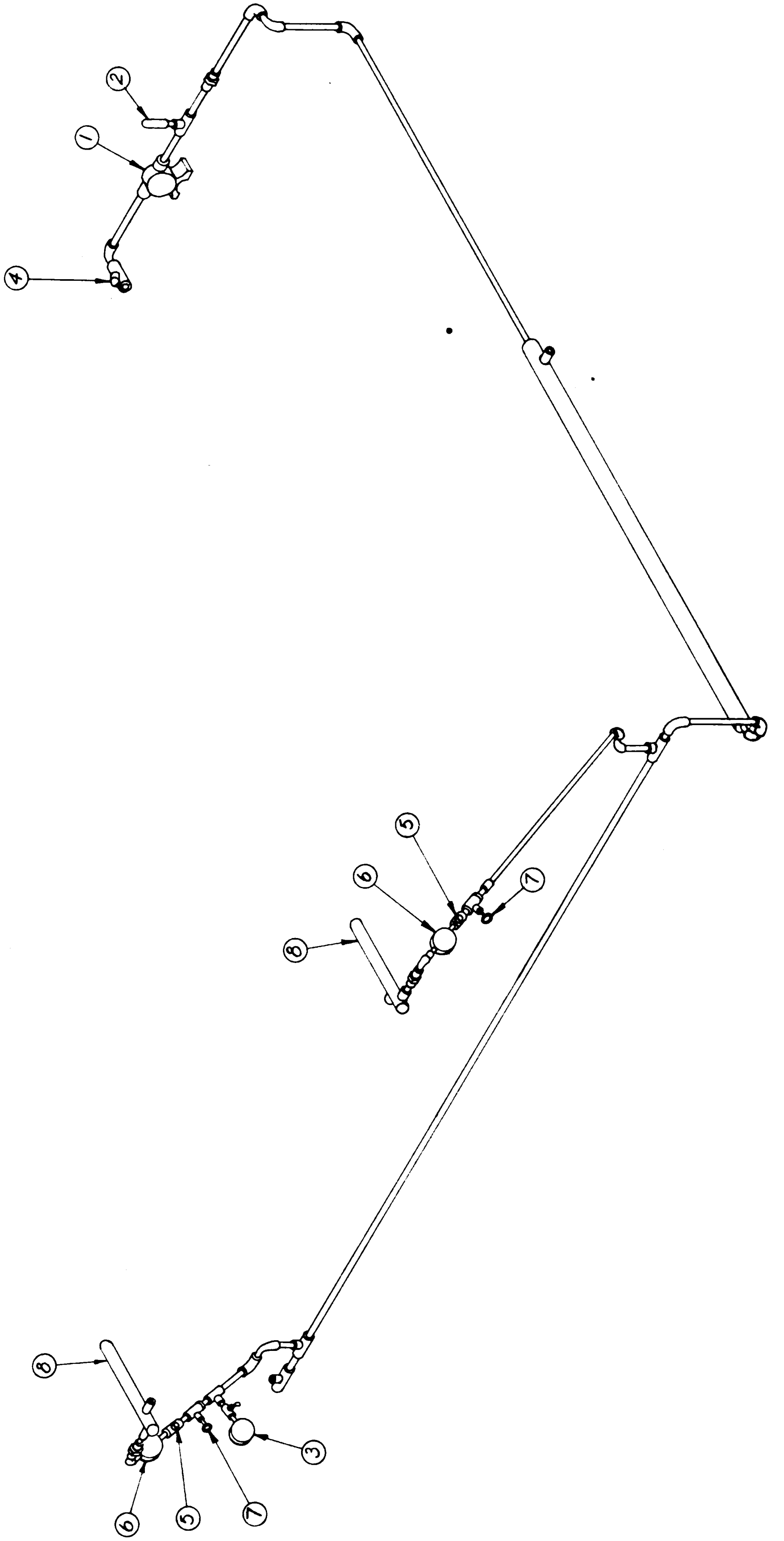


FIG. 14 - DRYER FUEL SYSTEM.

The tank should be set as close to the dryer fuel pump as possible without interfering with any phase of the dryer operation. The bottom of the tank should not be more than 10 feet below the fuel pump.

The tank and pump are interconnected by two lines; one to supply fuel to the burner, and one to return the fuel from the relief valve back to the tank. The supply line can be made up of ordinary 1 inch pipe. The return line is made up of 3/4 inch pipe. The intake end of the supply line should be 1 inch to 3 inches above the bottom of the supply tank to prevent picking up sediment from the bottom of the tank. A foot valve at the suction end of the supply line is desirable, although not absolutely necessary. All fittings in the supply line should be screwed up tightly to prevent air being drawn into the line.

FUEL PUMP (1, Fig. 14)

Fuel is supplied to the burners by a rotary type fuel pump (1) Fig. 15, mounted on the dryer main frame below the charging end of the drums. The pump is V belt driven from a pulley (2) on the end of the speed reducer shaft. The suction side of the pump is connected to a fuel supply tank as described above. The discharge side of the pump is piped directly to the dryer burners.

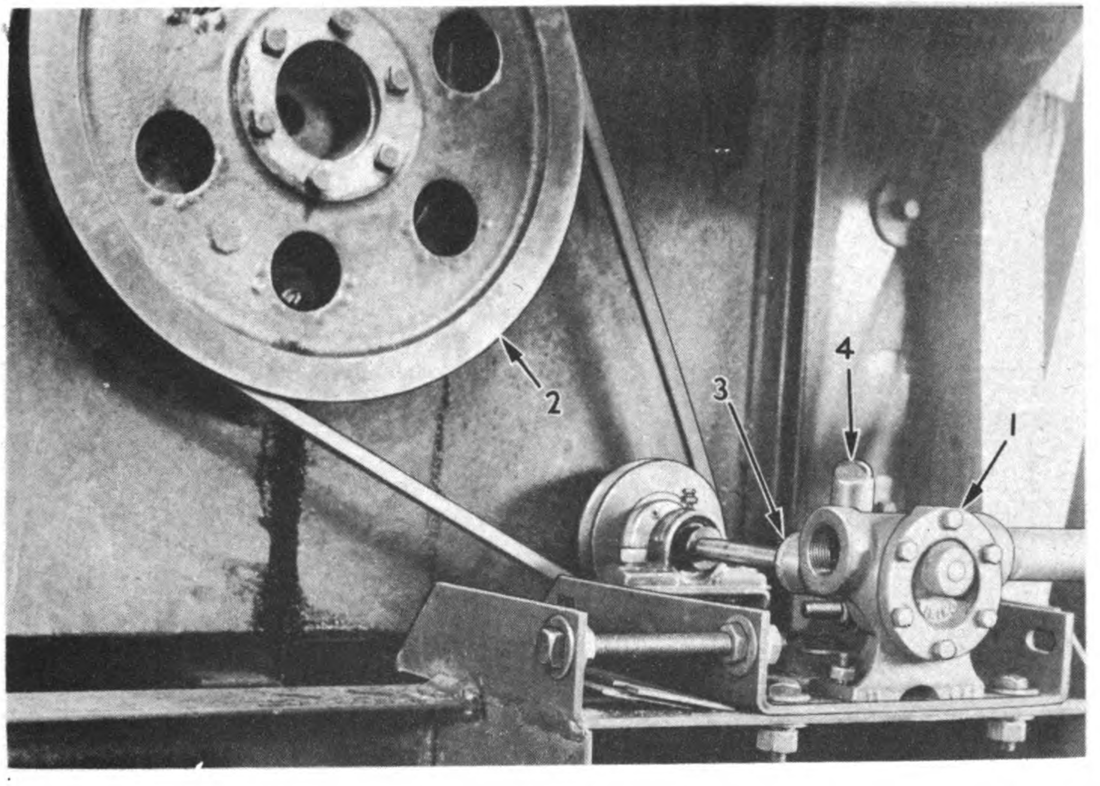


FIG. 15 - DRYER FUEL PUMP ASSEMBLY.

The point where the pump shaft extends into the pump housing is protected from leakage of fuel by an adjustable packing gland. This gland is of the same type as used on most automobile water pumps. The packing nut (3) is turned clockwise to tighten the packing. Although holes in the nut are provided for using a spanner wrench to take up the nut, the nut can usually be turned up sufficiently tight with the fingers. Should a leak develop, turn the nut down 1/4 turn and observe the results. If this does not stop the leak, turn down another 1/4 turn and so forth until the leak is stopped. Do not take up the packing nut too tight as this will cause the packing to heat.

The pump should not be run for sustained periods without fuel in the pump. Such a condition may cause the entire pump to run hot.

Observe the pump rather closely when the dryer is started for the first time. If the pump heats, loosen the packing nut until fuel starts to drip from the packing gland. Screw the grease cup (4) down two turns. After the pump has cooled down, readjust the packing nut as described.

The pump is driven in such a manner that it cannot be operated until the rest of the dryer is in operation. This makes it impossible to light the burners until the drums are revolving.

RELIEF VALVE (2, Fig. 14)

A relief valve, located in the fuel line on the pressure side of the pump, serves the purpose of maintaining the fuel at proper pressure. The operating parts of the relief valve consist of a piston, piston spring, pressure adjusting screw, adjusting screw lock nut, cap and valve housing. When the pressure of the oil in the line exceeds the pressure exerted by the piston spring, (1) Fig. 16, the piston (2) is forced away from its seat, allowing the fuel to enter the valve and escape into the fuel return line (3). The fuel return line is piped back to the fuel tank.

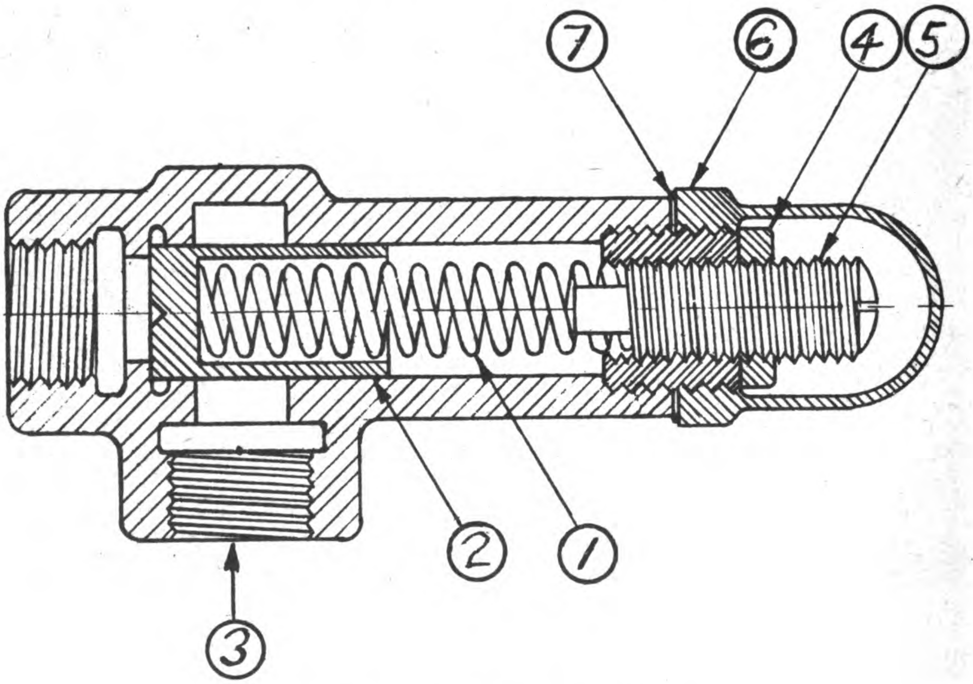


FIG. 16 - FUEL RELIEF VALVE.

To increase the fuel pressure, the lock nut (4) is loosened and the pressure adjusting screw (5) is turned clockwise, increasing the spring tension, until the desired pressure is obtained. To decrease the fuel pressure, the pressure adjusting screw is turned counter-clockwise.

The pressure range for satisfactory burner operation, should not be less than 50#, or more than 75#, while operating. An average pressure of 60# will give best results. It should be remembered that, with the burners closed, and all fuel being by-passed back to the fuel tank, the pressure will be from 10 to 15# higher, at the same relief valve setting, than when the dryer is operating with the micro-valves open. Consequently, a fuel pressure of 75#, with the micro-valves closed, will drop to around 60 to 65# when the micro-valves are open.

PRESSURE GAUGE (3, Fig. 14)

A pressure gauge, located in the fuel line close to the left hand burner (looking at the burner end of the dryer) is provided for the purpose of showing the fuel pressure to the burners. The gauge (1) Fig. 17 is of the dial type with pointer hand at the center of the dial. The dial face is graduated to show the number of pounds per square inch of fuel pressure.

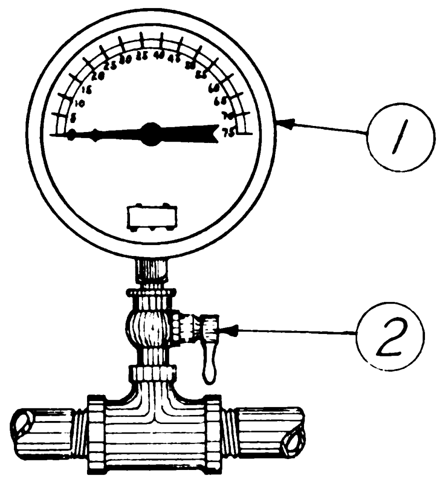


FIG. 17 - FUEL PRESSURE GAUGE.

A shut-off cock (2) Fig. 17 is provided for opening or closing the fuel passage to the gauge. The life of the gauge will be lengthened considerably if the cock is open only when necessary to determine the amount of fuel pressure, and left closed at all other times. This reduces the wear on the internal mechanism caused by extreme pressure fluctuations, vibration, and starting pressures.

The shut-off cock must be closed when starting the dryer, and left closed until all the cold oil has been run out of the lines. The cold oil in the lines may be sufficiently heavy to cause excessive pressures to be built up at the relief valve. High viscosity oil will not bypass thru the relief valve fast enough and as a result, the pressure will build up in the line greater than the setting of the relief valve. Such pressure, if greater than the pressure range of the gauge, would cause the gauge to be damaged. After the burners have been lighted a while, the cock can be safely opened to determine the fuel pressure.

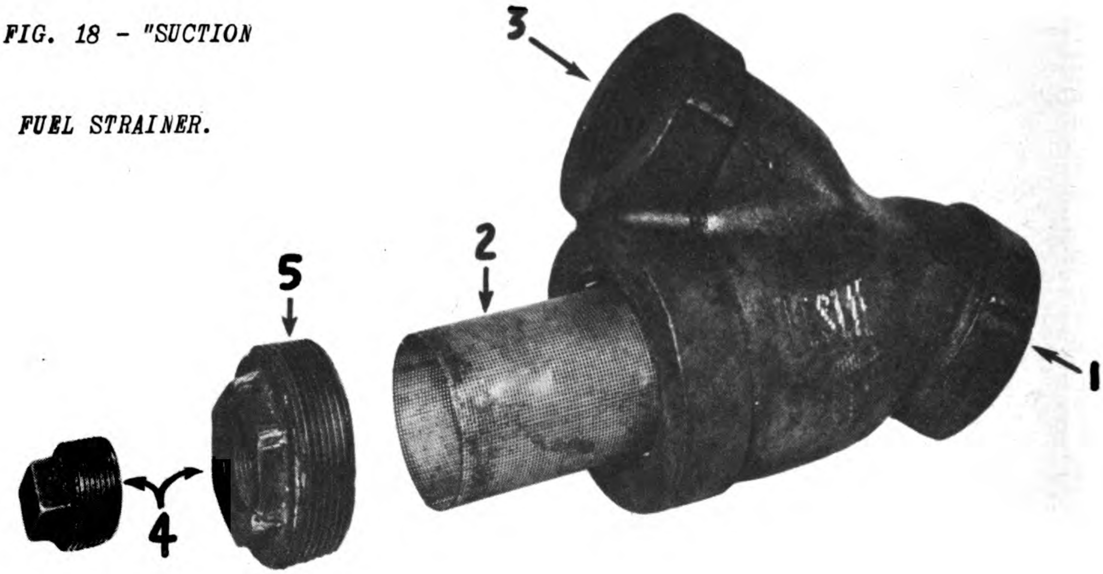
Should the hand of the gauge flutter excessively, it is an indication that the fuel strainers are dirty, causing an irregular flow of fuel, or air is being pulled into the line through a loose connection in the suction side of the pump.

FUEL STRAINERS (4 & 5, Fig. 14)

The flow of fuel to each burner passes through two strainers. A suction strainer is located in the suction line next to the fuel pump, two burner strainers, one in each line to the burners, located next to the micro valves.

FIG. 18 - "SUCTION

FUEL STRAINER.



The suction strainer resembles a "Y" shaped pipe fitting. The fuel entering the inlet side Fig. 18, must pass through a strainer screen before discharging through the outlet. The accumulated sediment is drained from the strainer by removing the small pipe plug (3) from the drain port. To clean the strainer screen, remove the large pipe plug (2) and remove the screen.

The burner strainers (5) Fig. 14, function much the same as the suction strainer. No provisions are made, however, for draining the sediment from the strainers. To clean the strainer, unscrew the cap from the strainer housings and slide out the screen.

Both strainers should be cleaned once a day, or oftener if necessary. If the flame is irregular, pulsates, or goes out, the strainers should be checked immediately.

It is a good plan to have an extra screen available for the burner strainers so that a clean element will be available to replace the dirty element. This will keep shut-down time, caused by cleaning and replacing the strainer elements, at a minimum.

MICRO-CONTROL VALVES (6, Fig. 14)

The micro-control valves are located in the fuel line next to the burner. The purpose of these valves is to obtain very accurate control of the amount of fuel being consumed by each burner. The principle of operation of the micro-valves is the same as that of an ordinary globe valve, in that it provides an infinitely variable range of adjustment for controlling the flow of fuel. A glove valve, however, does not provide an absolutely steady flow of fuel at any given setting.

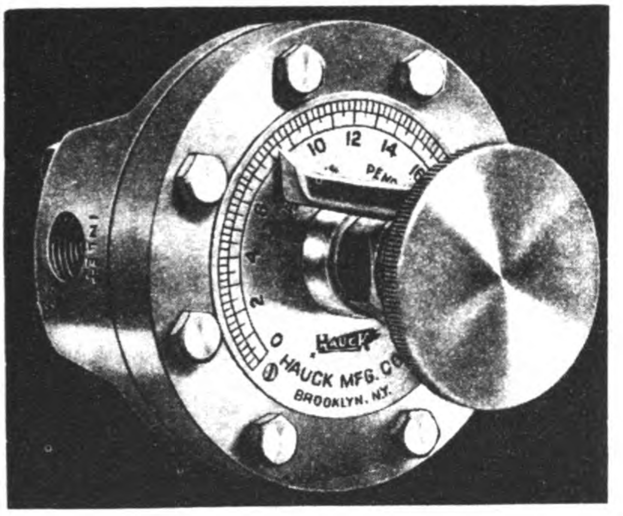


FIG. 19 - "MICRO-CONTROL FUEL VALVE."

The dial on the micro-valve Fig. 19, is calibrated from one to twenty. These markings are for the express purpose of serving as an indicator by which the operator can read the opening of each valve. After getting each valve set correctly to obtain proper aggregate temperature, the reading is taken. Each time the dryer is started after a shut down, the valves are set to their previous reading, and the same aggregate temperature should result, provided all other conditions are the same. This eliminates having to re-set the valves each time the dryer is started after a shut down. The number on the dial, at which the valve is set, cannot be used to determine the volume of fuel being burned during any given length of time.

The micro-valves will not shut off completely the flow of oil to the burners. Ordinary globe valves (7) Fig. 14, in the fuel line ahead of the micro-valves, are used for this purpose. When shutting the dryer down, the micro-valves are first closed gradually as the flow of aggregate through the drum decreases. When most of the aggregate has been run through the drums, the globe valves are closed completely, after which the micro-valves for each burner are closed.

BURNERS (8, Fig. 14)

The burners are located at the discharge end of the dryer and are mounted at the small ends of the combustion cones. The function of the burner is to convert liquid fuel into an atomized spray by means of high pressure steam. The steam pressure also forces the spray well into the drums.

Its principle of atomization is that of passing steam at high velocity past a series of small passages through which the fuel is fed under pressure.

The burner is simple in construction and practically fool-proof in operation. There are no moving parts within the burner to get out of order. There is a possibility of a few of the small fuel passages within the burner becoming plugged with foreign material if the fuel strainers are not kept clean. Should this happen, the burner can be taken apart and fuel passages cleaned with a piece of wire.

BURNER TUBE

The burner tube consists of a steel cylinder, 8" in diameter and 14" long. The tube is mounted on a bracket in the combustion cone just ahead of the burner.

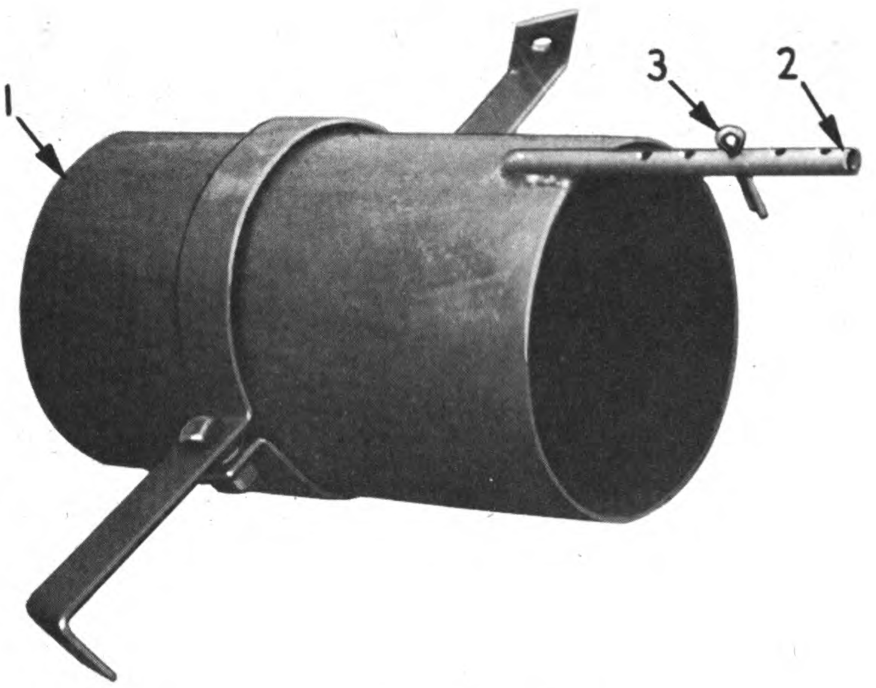


FIG. 20 - BURNER TUBE.

The purpose of the tube (1) Fig. 20, is to confine the flame to a relatively small cross sectional area. By keeping the flame from spreading out, as it enters the drum, better penetration of the flame is obtained. The flame, in normal operation, should penetrate approximately one half the length of the drum.

The tube is adjusted by moving it towards, or away from the burners. The tube is moved by means of a steel rod (2) extending through the small end of the combustion cone. The rod has four holes in it, spaced one inch apart allowing the tube to be moved in one inch increments. The tube is held in place at any given setting by inserting a cotter pin (3) through a hole in the rod, and a hole in a small clip welded to the end of the cones. The tube is moved away from the burners to increase the penetration of the flame.

Combustion System

The dryer combustion system is comprised of the functional parts or groups of parts of the dryer that aid in the proper combustion of the fuel. These units consist of the combustion cone, combustion chamber and exhaust stacks.

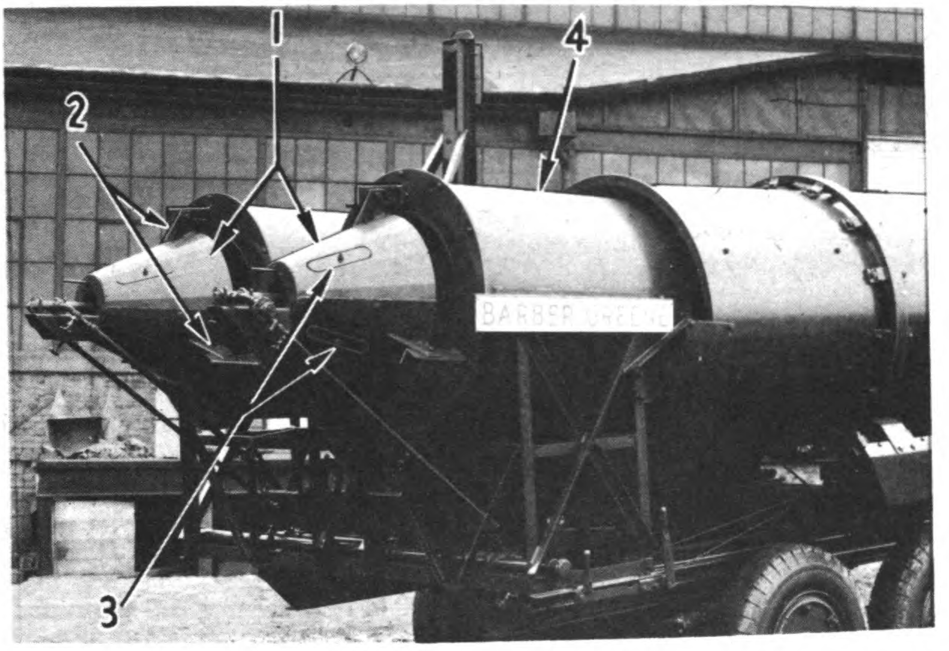


FIG. 21 - REAR END OF DRYER SHOWING PRINCIPAL PARTS OF COMBUSTION SYSTEM.

COMBUSTION CONE

The function of the combustion cone is to control the amount of secondary air necessary for proper combustion. Each dryer drum is provided with a combustion cone (1) Fig. 21, located between the burner and the combustion chamber.

The brackets (2), upon which each cone is mounted, are drilled with a series of holes, allowing the cone to be moved towards, or away from the combustion chamber. The cone is moved towards the combustion chamber to decrease the flow of air into the chamber, and is moved away to increase the flow of air into the chamber.

Each cone has four slotted (3) holes equally spaced around its circumference. An adjustable cover plate for each hole permits control of the amount of air entering each cone. The slotted hole, below and to the right of each burner is usually left open for inserting a torch when lighting the burner.

CONTROL OF AIR

The air that enters the dryer for supporting combustion, falls into two separate classifications; primary air and secondary air. The primary air is that which enters the dryer drum through the space between the discharge end of the dryer drum and the combustion chamber. The flow of primary air is controlled only by the amount of draft present to pull the air into the drum.

The secondary air is that which enters the combustion chamber through the space between the combustion cone and the combustion chamber, and that which enters the combustion cone through the slotted holes in the cone.

Too much secondary air may result in any one, or all, of the following conditions:

1. Pulsating, irregular flame.

2. Flame may be blown out.

3. Flame pulled too far away from the burner.

The atomized spray should start burning about 12" away from the tip of the burner. If the spray does not ignite until well into the combustion chamber, it is an indication of too much secondary air.

To correct the above conditions, first close the slotted holes in the cone. If this does not remedy the condition, move the cone inward toward the combustion chamber until the flame burns properly.

Too little secondary air may result in any one, or all of the following conditions:

1. Inability to obtain proper heat from flame.

2. Flame lacks proper penetration.

3. Smoke issues from stack even after amount of steam, to burners, is increased.

4. Traces of incompletely burned fuel in the combustion chamber.

To correct the above conditions, first open the slotted holes in the cone. If this fails to correct the condition, move the combustion cone away from the combustion chamber one hole in each bracket. If this adjustment causes improvement but still does not produce satisfactory results, move the cone outwards another hole, etc., until a proper flame is formed.

NOTE: If the various cone adjustments have little or no effect in improving the flame, the trouble possibly is not caused by the amount of secondary air, but rather may be caused by the fuel being burned. Refer to section on fuel for further information.

COMBUSTION CHAMBER

The combustion chamber (4) Fig. 21, consists of a steel drum, the inner circumference of which is lined with fire brick. A combustion chamber is mounted at the discharge end of each drum.

The function of the combustion chamber is to assist in obtaining complete burning of the fuel. After a few moments of operation, the lining of the chamber becomes very hot. The atomized spray from the burner, passing through the chamber, comes in contact with the intense heat. The heat converts the spray to a gas, in which form it burns instantly.

If, for any reason, any of the lining of the chamber becomes damaged, the missing brick should be replaced immediately to prevent the outer shell of the chamber from burning through.

EXHAUST STACKS

The purpose of the exhaust stacks is to furnish draft to pull fresh air into the discharge end of the drums, and to pull the spent gases of combustion, and moisture vapor out of the charging end of the drum.

The stacks are mounted at the charging end of the drums. The lower section of the stack fits closely around the end of the drum and acts as a collector for the gases. The upper part of each stack consists of two 6' sections. Both sections are installed for central plant operation, while only one of the sections is used for travel plant operation.

The point at which the upper stack section fits onto the stack base, is hinged to allow the upper stack to be laid down, parallel to the drum, for traveling clearance.

The natural stack draft is supplemented by steam jets in the upper part of the base of each stack. The natural draft is usually sufficient when coarse aggregate only is being dried. When dense aggregates are dried, however, the heavy veil of material falling through the cross sectional area of the drum retards the force of the natural draft to such an extent that the steam jets must be opened to pull the flame into the drum.

TEMPERATURE INDICATORS

The dryer is equipped with two aggregate temperature indicators -- one for each drum. These indicators register the temperature of the aggregate discharging from each drum.

The indicators are located directly below each combustion chamber, and are enclosed in steel housings to protect the instrument from dust and weather. Each housing has a hinged door that is opened for reading the indicator and is kept closed at all other times. A padlock is furnished for the door to prevent anyone tampering with the instrument.

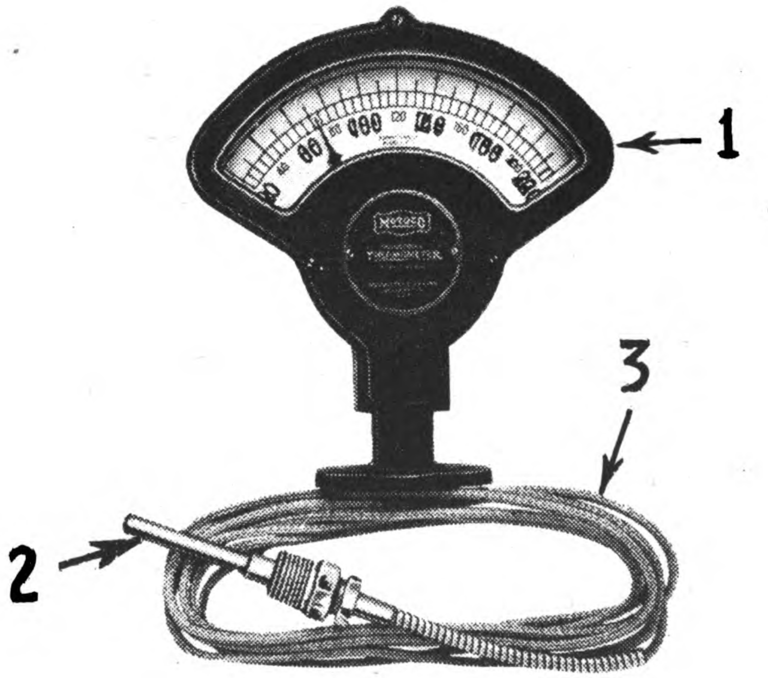


FIG. 22 - THERMOMETER FOR INDICATING TEMPERATURE OF AGGREGATE AS IT LEAVES THE DRYER. THERMOMETER READS TO 550°.

Each temperature indicator assembly consists of the indicator proper (1) Fig. 22, a bulb (2), and a capillary tube (3) connecting the two.

The bulb, capillary tube, and a Bourdon coil spring within the indicator, are all filled with liquid under pressure. As the bulb absorbs heat from the aggregate, the liquid expands, causing pressure to be built up within the Bourdon spring, causing it to expand. The spring is connected with the indicator hand, so that as the spring expands, the hand registers on the dial.

The bulb is mounted in the aggregate discharge chute, extending upward from the bottom of the chute into the path of the discharging aggregate. The bulb is enclosed within a socket and further protected from direct abrasion of the aggregate by a deflector that causes the aggregate to flow to either side of the bulb. Because the aggregate does not contact the bulb directly, the indication of correct aggregate temperature is delayed slightly. Consequently, when the flame is increased, while operating, there will be an interval of five to ten minutes before the increased heat of the aggregate is registered on the dial.

NOTE: Do not allow socket to wear to the extent that the bulb is exposed.

The indicator registers from a minimum of 50° F. to a maximum of 550° F. The dial is graduated so that each successive 50° and 100° marks are numbered. The smaller graduations between each 50° marking constitutes 10°.

INDICATOR ADJUSTMENT

Due to the fact that no two aggregates will cause the same temperature reading on the dial, the setting of the indicator is not necessarily correct as it leaves the factory. It is necessary to adjust each indicator in the field under existing conditions. The method of setting the indicator so as to register correct temperature is as follows:

1. The dryer should be in operation with a steady flow of aggregate passing thru the drums. The burner controls should be adjusted for proper flame and not readjusted during the test.

2. Catch a pail of hot aggregate from the discharge chute and check its temperature with an accurate pocket thermometer. Be careful to catch aggregate only from the drum being checked.

3. As quickly as possible, set the indicator hand to correspond to the temperature shown by the pocket thermometer. This is done as follows:

   a. Remove two bolts from indicator housing and lift housing from around the indicator.

   b. Remove the adjusting screw cover plate in the back side of the indicator. This plate is marked "remove to adjust".

   c. Using a screwdriver, turn adjusting screw to the right or left until indicator hand points to the place on the dial that corresponds to the pocket thermometer reading.

4. After setting indicator, check another sample to determine if indicator is registering accurately. Then replace adjusting screw cover plate and indicator housing.

Steam Supply System

To insure satisfactory performance, the dryer must be supplied with adequate high-pressure steam. Steam is required at the burners to convert the raw fuel into an atomized spray. The natural stack draft is supplemented by steam jets located in the base of the exhaust stacks. A section of fuel supply line, between the pump and burner, is jacketed, using steam to heat the fuel passing thru the fuel line.

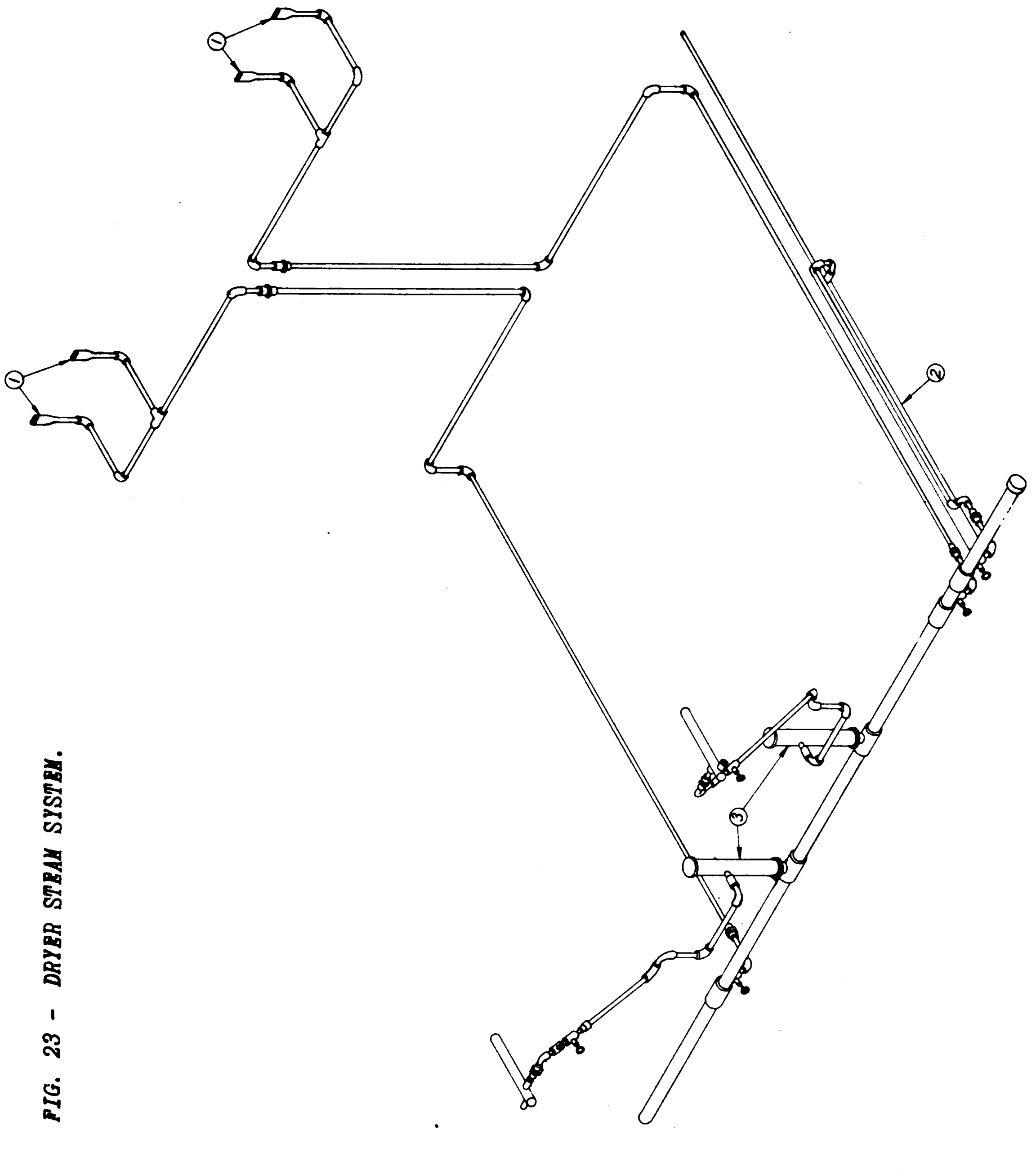


FIG. 23 - DRYER STEAM SYSTEM.

BOILER REQUIREMENTS

The boiler used should be in good condition and inspected and stamped, by a reputable boiler inspecting concern, for 125 lbs. steam pressure. Higher pressures than 125 lbs. can be used to advantage. Steam pressures below 125 lbs., however, may cause inefficient atomization of the fuel, and may cause wet steam to be supplied to the burner.

An oil fired boiler is to be preferred to a hand fired coal burning boiler, as the steam pressure can be maintained easily by merely controlling the flame. It is difficult to maintain the proper steam pressure on a coal burning boiler, unless the fireman is exceptionally capable.

The sizes of boiler required for the various types of dryer applications are as follows:

For Central Plant Operation - to furnish steam for dryer only, -	60 H.P.
For heating Model 848 Mixer jacketing and flues, -	5 H.P.
For heating each 10,000 gal. railroad tank car, -	15 H.P.
For heating asphalt storage tanks (insulated) each 1000 gal., -	1-1/2 H.P.
For heating asphalt storage tanks (uninsulated) each 1000 gal.,-	2 H.P.
For heating each 50' length of 3" jacketed asphalt line, -	1/3 H.P.

When the dryer is used in Central Plant applications where every piece of equipment is designed for the greatest possible portability, two portable boilers are used for supplying steam to the dryer. These boilers are of the type originally designed for the purpose of heating asphalt tank cars. Each portable boiler is referred to as a "three-car" boiler and developes from 40 to 45 actual H.P. Two of these boilers are required to run the dryer efficiently for Central Plant operation.

If the dryer is to be used as a traveling unit, a single portable boiler, of the type mentioned, must be used. The use of one boiler, instead of two, for this application is possible by the fact that aggregate drying by the travel dryer method generally consists of reducing the moisture content to a certain percentage, but no attempt is made to dry the aggregate completely. Also, the dryer only is supplied with steam, so that the entire boiler output is available. The use of two portable boilers for the travel dryer is impracticable because of the complications encountered in the hook-up.

STACK JETS (I) Fig. 23

The jet in the upper part of the base of each exhaust stack operates on the same principal as the blower in a locomotive smoke stack. By exhausting steam under pressure from the bottom to the top of the stack, a partial vacuum is created in the stack and stack base, causing the exhaust gas and the moisture vapor to be pulled from the drums into the stack.

In some cases, the natural draft, caused by the principle that hot air raises, is sufficient without using the stack jets. This condition exists principally when coarse aggregates are being dried. The coarse aggregate, falling thru the cross sectional area of the drum, does not cause as heavy a veil of material as do the denser aggregates. Consequently, less draft is needed for the flame and gases to effectively penetrate the veil of material.

When the flame enters the drum only a short distance, and puffs back intermittently around the discharge end of the drum, it is an indication that the natural draft is insufficient and the stack jet valves require opening to increase the draft. When using the stack jet, open the valves a small amount and observe the results. If the flame continues to puff back, open the valves slightly more, and etc. until the flame penetrates about 1/2 the length of the drum. Do not open the stack jet valves more than is necessary to obtain proper flame penetration. Excessive stack draft consumes large volumes of steam and will cause a large percentage of the aggregate fines to be blown out of the stack.

FUEL LINE JACKET (2, Fig. 23)

A section of the fuel line is jacketed for heating the fuel, when necessary. The flow of steam thru the jacket is controlled by a globe valve. A bleeder cock is provided on the end of the jacket opposite where the steam enters the jacket. The bleeder cock is opened just enough to allow a small spray of steam to issue from it. This allows all condensate to drain from the jacket.

The jacket should be heated only when oils of 125 viscosity or more are being used. Heat is needed only when the viscosity of the oil is sufficiently high that the fuel will not atomize properly. If the fuel has such a high viscosity that it does not atomize properly even when the jacket is heated, provisions must be made to heat the fuel in the fuel supply tank.

Fuels in the Diesel fuel and #2 and #3 furnace oil classifications do not require the use of the heating jacket.

STEAM TRAPS (3, Fig. 23)

A steam trap is provided for each burner to trap the condensate and prevent it from getting into the burners. The traps are located in the steam lines between the main steam header and the burners. A bleeder cock at the base of the trap is provided for draining off accumulated condensate. The cock should be opened before starting the dryer, and left open until dry steam escapes, and should be closed down so that only a small spray of steam escapes continuously while in operation.

Dryer Slope Control (Travel Plant)

When the dryer is set up for central plant application, the charging end is raised sufficiently to obtain proper drum slope. A cribbing is then built under the main frame to support the dryer in this position. When the dryer is used for travel dryer application, however, the weight of the charging end is borne by the bucket loader that tows the dryer. In order to maintain correct slope while operating over uneven ground, the dryer is equipped with a hydraulic towing frame for maintaining the proper drum slope.

TOWING FRAME (1) Fig. 24

The towing frame (1) Fig. 24, is fabricated of heavy steel structural members, welded together to form a rigid unit. One end of the frame attaches to the dryer main frame, at a point just below the front trunnion support frame. The towing frame is secured by means of pin extending thru the sides of the main frame, allowing the towing frame to pivot from that point. The towing end of the towing frame is designed to attach to the hitch on the bucket loader.

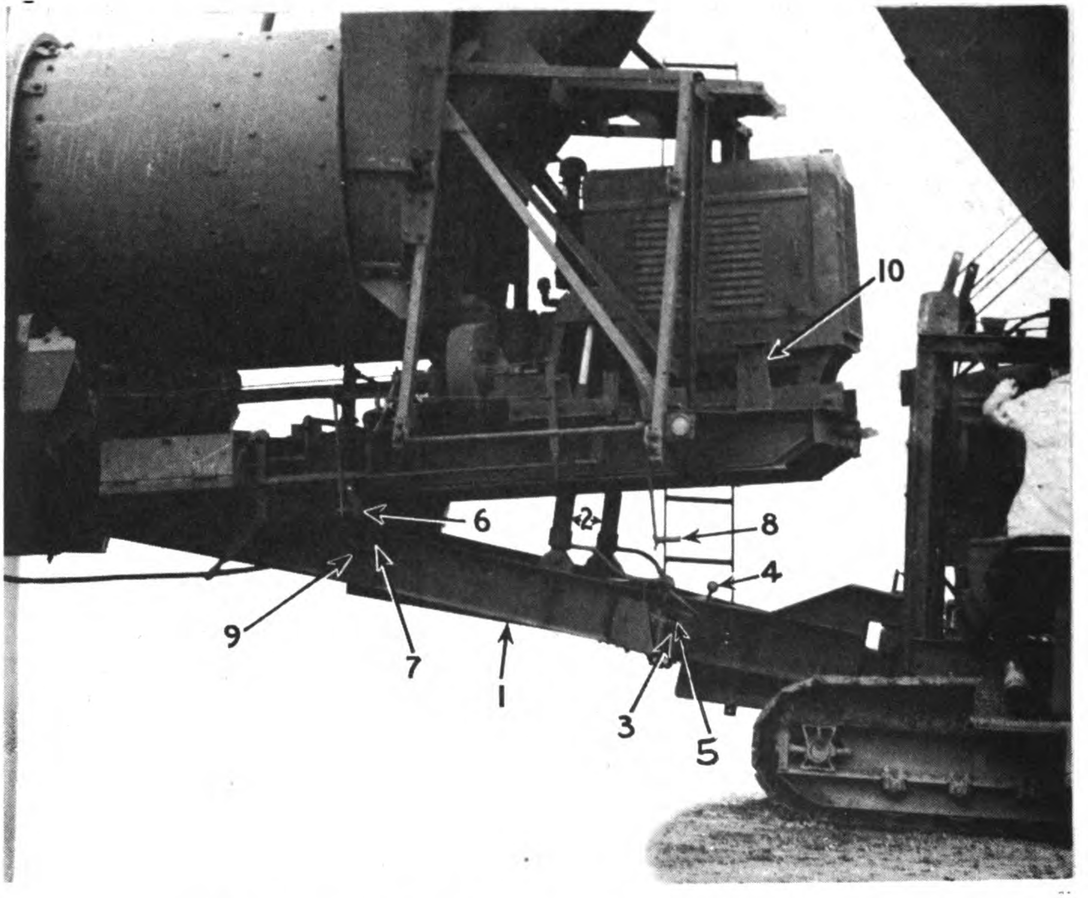


FIG. 24 - HYDRAULIC TOWING TONGUE ASSEMBLY.

HYDRAULIC RAMS (2, Fig. 24)

Two hydraulic rams (2) Fig. 24, one on either side of the towing frame, are provided for raising the charging end of the dryer. The ram housing attaches to the towing frame, and the piston attaches to the dryer main frame. As the pistons extend, the main frame and towing frame are forced apart. With the outer end of the towing frame anchored to the bucket loader, the dryer main frame is raised as the pistons extend, causing the dryer's slope to be increased.

HYDRAULIC PUMP (3, Fig. 24)

A hand operated hydraulic pump (3) Fig. 24, mounted to the side of the towing frame, supplies hydraulic pressure to operate the rams. The pump is of the double action type, producing hydraulic pressure on both the forward and backward strokes of the pump lever (4).

To increase the dryer slope, the release lever (5) is closed (turn clockwise) and the pump is operated until the dryer is up to the desired slope. To decrease the dryer slope, the release lever is opened slowly (turn counterclockwise) to release the pressure in the rams.

Refer to Maintenance Section for maintenance suggestions on the hydraulic system.

SAFETY LATCHES

The purpose of the safety latches is to relieve, when possible, the hydraulic system of the constant pressure caused by the weight of the dryer. The latches also maintain the dryer slope, if for any reason, the hydraulic system should fail.

The latch assembly consists of the latch dog (6) Fig. 24, latch plate (7), and lever (8) for retracting or engaging the dogs.

The principal of operation of the latch assembly is identically the same as the latch on an ordinary door. The latch plates are fastened to the towing frame. The latch dogs and control linkage are mounted on the dryer main frame. As the dryer is raised, the bevel surface on the latch dog allows the dog to slip past the series of holes in the latch plate. As the dryer is lowered, the latch dogs are forced into the holes in the latch plate by pressure of the latch spring. Once the dogs are engaged, the dryer cannot be lowered further until the dogs are retracted. If it is desired to lower the dryer past any of the holes in the latch plate, the latch dogs must be held in retracted position by the latch control lever. The latch control lever is pulled away from the machine to engage the dogs and is pushed toward the machine to retract the dogs.

Caution: Make sure the dogs are fully engaged before releasing hydraulic pressure.

There are five square holes (9), in the latch plate. With the dryer on level ground, the dryer slope is 6° when the latch dogs engage the center holes in the latch plate. Each successive hole above or below the center hole changes the dryer slope 2°. More specifically, the top hole represents a dryer slope of 10°, the second hole from the top represents an 8° slope, the center hole 6°, the fourth hole from the top, 4°, and the bottom hole represents a 2° slope.

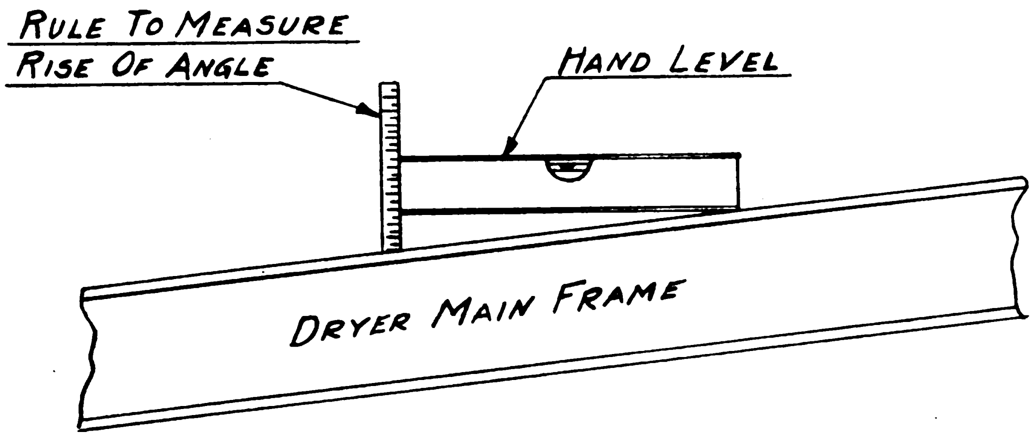
When towing the dryer, or when the dryer is not in operation, the weight of the dryer should be borne by the safety latches, and the pressure of the hydraulic system released.

When the dryer is in operation as a traveling unit, the latches should be engaged whenever possible, yet at the same time maintain the correct dryer slope. This can be done when operating on level ground by keeping the dogs engaged in the center holes in the latch plates. In this position, the weight of the dryer can be supported by the latches, and the dryer slope will remain at the standard 6°. When operating either uphill or downhill, at a slope where it is impossible to engage the latches and still maintain the 6° slope, the latches must remain disengaged, and the weight of the dryer must be supported by the hydraulic system. While in operation, the operator watches the slope indicator and raises or lowers the dryer as necessary to maintain the 6° slope.

SLOPE INDICATOR

The slope indicator (10) Fig. 24, continuously registers the slope of the dryer drums. The indicator is located on the right front corner of the dryer main frame. The internal mechanism consists of a weighted pendulum which is geared to the pointer shaft. The pendulum is in a vertical position at all times. As the dryer slope varies, the entire indicator, with the exception of the pendulum, moves causing the pointer to indicate the correct slope. The numbers on the base of the indicator correspond to the number of degrees of slope at which the dryer is set.

The dryer slope may also be determined by the use of an ordinary level and rule. To check the slope in this manner, the level is held along the dryer main frame, with the uphill end of the level resting on the main frame. The downhill end of the level is then raised, or lowered, until the instrument registers exact level. Then measure the distsnce from the main frame up to the downhill end of the level. The distance found can be converted to degrees of slope by consulting the chart shown in Figure 24A.



LENGTH OF LEVEL USED	RISE IN INCHES PER ANGLE OF SLOPE					
	3°	4°	5°	6°	7°	8°
0'-6"	5/16"	13/32"	17/32"	5/8"	25/32	27/32"
0'-9"	15/32"	5/8"	25/32"	15/16"	1 3/32"	1 1/4"
1'-0"	5/8"	27/32"	1 1/32"	1 1/4"	1 15/32"	1 5/8"
1'-6"	15/16"	1 1/4"	1 9/16"	1 7/8"	2 3/16"	2 1/2"
2'-0"	1 1/4"	1 11/16	2 3/32"	2 1/2"	2 15/16"	3 11/32"
2'-6"	1 9/16"	2 3/32"	2 5/8"	3 1/8"	3 5/8"	4 3/16"
3'-0"	1 7/8"	2 1/2"	3 1/8"	3 3/4"	4 3/8"	5"

FIG. 24A - "USE OF HAND LEVEL TO DETERMINE DRYER SLOPE."

Dryer Controls

MASTER CLUTCH LEVER

The master clutch is a single plate, dry disc type. It is enclosed in the bell housing located between the speed reducer and the engine. This clutch drives all the machinery of the dryer.

The clutch can be engaged or disengaged by the use of either of two levers (1) Fig. 25 provided. One lever is located near the engine platform on the cold elevator side of the dryer. The other is mounted at the discharge end of the dryer, also on the cold elevator side. Two strands of 1/4" wire rope interlock both levers. The purpose of the two levers is to enable the operator to engage or disengage the clutch from either end of the dryer. Either lever is pulled toward the discharge end to engage and pushed toward the charging end to disengage. The clutch should be engaged slowly to relieve the driving machinery of undue strain. Either lever starts and stops all machinery except the engine.

Before becoming completely acquainted with the operation of all other levers, and if in doubt as to which one of the other levers to disengage to stop any part of the dryer, always disengage the master clutch.

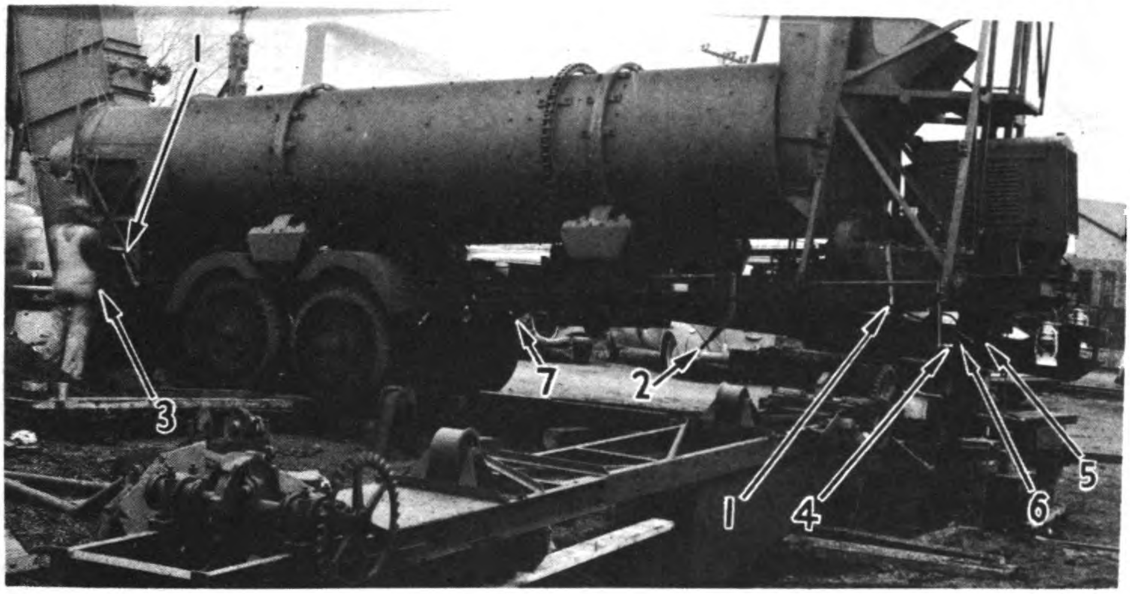


FIG. 25 - DRYER OPERATING LEVERS.

COLD ELEVATOR JAW CLUTCH LEVER

A jaw clutch on the elevator drive shaft is provided for the purpose of disengaging the cold elevator when it is desired to run the dryer separately, such as when "cooling out" the drums or checking the operation of the dryer and etc. The lever (2) Fig. 25, used to engage the cold elevator is located immediately ahead of the tool box. To engage the lever, pull toward discharge end of dryer, and push back to disengage. The master clutch should be disengaged before engaging this lever to prevent damage to the clutch when the jaws fall in place.

HOT ELEVATOR JAW CLUTCH LEVER

The hot elevator drive is engaged by means of a sliding jaw clutch on the elevator drive shaft. The clutch is engaged by a lever (3) Fig. 25, located at the bottom of the combustion chamber support frame. The lever guide, along which the lever moves, is notched for engaged and disengaged positions. The lever is moved toward the charging end of the dryer to engage, and back toward the discharge end of the dryer to disengage. Always disengage the master clutch before engaging this clutch.

SAFETY LATCH LEVER

The function of the safety latch lever (4) Fig. 25, is to engage, or retract, the latch dogs on the towing frame. The lever is pulled away from the machine to engage and is pushed inward to disengage the latch dogs.

Each dog is equipped with a spring that exerts pressure on the dog to force it into the holes in the latch plate. In most cases, as the dryer is raised, or lowered, the springs will engage the dogs automatically when the holes and dogs are in proper alignment. The operator should not, however, depend upon the springs to fully engage the dogs, but should move the latch lever to fully engaged position before releasing the pressure from the hydraulic rams. The springs are provided only for the purpose of engaging the latch dogs automatically in event of failure of the hydraulic mechanism.

HYDRAULIC PUMP CONTROLS

The hydraulic pump lever (5) Fig. 25, is stroked alternately forward and back to create pressure for increasing the dryer slope.

Before the dryer can be raised, the pressure release lever must be closed (turn clockwise as far as it will go). The release lever (6), should always be operated by hand. The use of a tool to close the lever will result in damage to the valve seat. To release the hydraulic pressure, for lowering the dryer, the release lever should be opened (turn counterclockwise) very slowly to prevent the dryer lowering rapidly. If the dryer slope is to be lowered more than 2°, the safety latch lever must be held in disengaged position to prevent the latch dogs falling into place.

PARKING BRAKE LEVER

The parking brake lever (7) Fig. 25, is located on the cold elevator side of the dryer about midway between the rear axle fender and the front trunnion support frame.

The brake lever is pulled toward the discharge end of the dryer to set the brakes and back to release them. The lever is held in engaged position by a ratchet dog engaging teeth on the lever quadrant.

RECIPROCATING FEEDER LEVER

The reciprocating feeder is driven thru a sliding jaw clutch on the feeder crankshaft. The lever (15) Fig. 6, controlling the clutch is located on the side of the feeder opposite the driving side. To engage the clutch, raise the lever sufficiently to clear the stop and push inward toward the feeder. To disengage, pull the lever away from the feeder. This jaw clutch can be engaged, or disengaged with the rest of the dryer in operation.

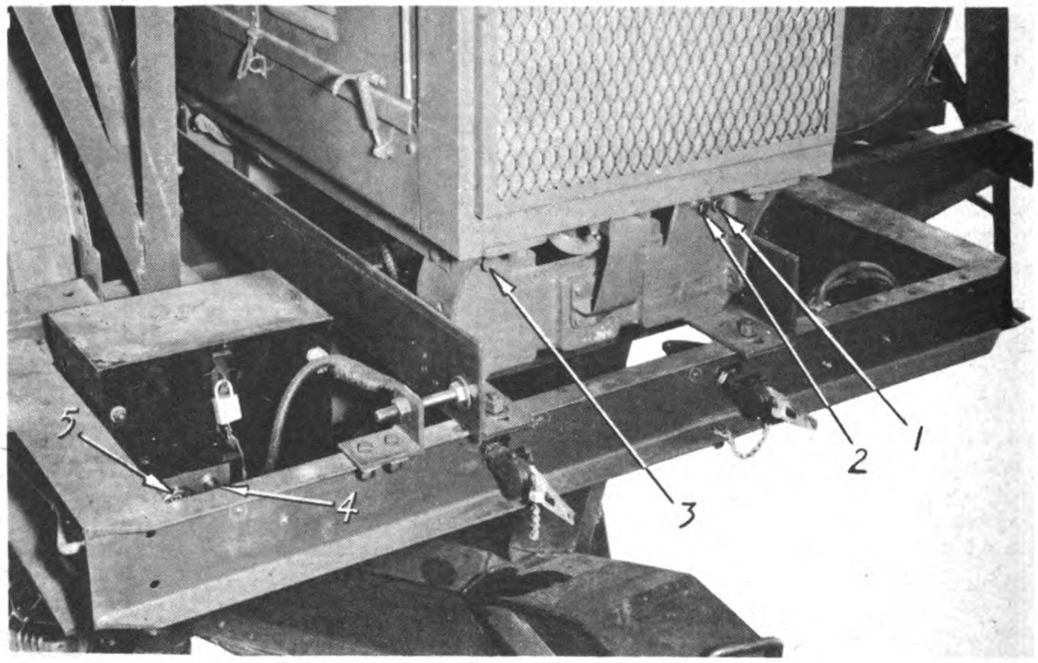


FIG. 25A ENGINE CONTROLS

ENGINE CONTROLS

Choke, Throttle, and Spark Controls

The choke, throttle, and spark controls are mounted to the front engine support casting. When standing directly in front of the engine, the choke control is at the far right of the support casting, the throttle control is approximately 2" to the left of the choke control, and the spark control is located at the far left of the engine support casting. Each control is of the button, or knob type. Each knob is connected to the unit it controls by means of a flexible wire.

The operation of the controls is as follows:

1. Choke control knob -- to choke, pull out. In when running.

2. Throttle control knob -- to open throttle, push in; to close throttle, pull out.

3. Spark control knob -- to retard spark, pull out; to advance spark, push in.

Starter and Ignition Controls

The starter and ignition controls are located in a control box mounted next to the battery box on the front end of the dryer main frame.

The starter control is of the button type. When the button is pressed, a magnetic starter switch is engaged, which in turn, engages the starter.

4. The ignition control is of the standard key type. To turn the ignition on, the key is turned clockwise. To turn ignition off, the key is turned counterclockwise.

Ammeter and Oil Pressure Gauge

5. The ammeter is located in the control box along with the starter and ignition switches.

The oil pressure gauge is mounted in the engine housing panel on the right side of the engine, when looking at the radiator end.

Operating the Dryer

Preparing the Dryer for Operation

The following instructions are based on the supposition that whether the dryer is being used as a central dryer or as a travel dryer, the erection has been completed and that the dryer is ready to operate. The sequence of functions to be performed before starting the dryer are as follows:

1. Lubricate the dryer thoroughly. (See Lubrication Section).

2. Determine capacity at which the dryer will operate. (Refer to Dryer Capacity Table).

3. Convert the capacity from tons per hour to cubic feet per minute by the following formula:

$$\frac{\text{Tons per hr.} \times 2000}{\text{Lbs. per cu. ft.} \times 60} = \text{cu. ft. per minute}$$

See conversion Table #2 on Feeder Section.

4. Having found the number of cubic feet of aggregate per minute to be dried, refer to Reciprocating Feeder Capacity Chart to determine the gate openings required to produce the desired capacity, and set the feeder gate at the proper opening.

5. Fashion a torch by wrapping the end of a 4' piece of stiff wire around a wad of rags soaked with fuel oil. Never use gasoline. When not in use the torch should be kept immersed in a small pail of fuel oil.

6. Check the steam supply. The steam pressure should be about 125 lbs.

7. Open bleeder cock at base of steam traps to allow accumulated condensate to escape. The cock should be left "cracked" slightly while in operation to allow a small amount of steam to escape continuously.

8. The globe valve and micro valve to each burner should be closed.

9. Fill reciprocating feeder with aggregate.

Starting Dryer

1. With all clutches disengaged, start engine and allow it to warm up for a few minutes.

2. Engage cold elevator clutch lever. Engage hot elevator clutch lever if hot elevator is used. Start conveyor if conveyor is to be used.

3. Apply full throttle and engage master clutch. This will start the dryer and cold and hot elevators.

4. If #4 furnace oil, or heavier, is being burned, open the valves in the fuel line and run the cool oil out of the line (approximately one gallon). Failure to do this may result in sufficiently high pressures built up at the relief valve to cause damage to the pressure gauge.

5. Open cock at base of pressure gauge and check fuel pressure. The pressure should be not less than 50 lbs. or more than 75 lbs. Close cock after reading the fuel pressure. If the pressure is not within the recommended range, adjust the relief valve (see Relief Valve Section).

6. Light the torch and insert into the combustion cone just ahead and a little below the burner nozzle. Open steam valve slightly until a slight spray of steam issues from the burner. Open globe valve in fuel line.

7. Open the micro valve slowly until a flame is formed at the end of the burner. Gradually increase the steam and fuel until the flame enters the drum 1/3 to 1/2 of the drum length. When increasing the flame, the fuel should be increased slightly in advance of the steam, to prevent blowing out the flame.

8. Immediately light the other burner in the same manner.

9. Observe the stacks. If no smoke, or light grey smoke is produced, the proportions of steam and fuel are correct. If black smoke is produced, the amount of steam should be increased.

10. Immediately after proper flame is obtained, engage the reciprocating feeder clutch to start the aggregate flow thru the drums.

11. The first material discharged may be hotter than desired. Do not decrease flame because of this as the temperature will decrease somewhat when a continuous flow of material is passing thru the drums. When approximately 1/2 ton of aggregate has been discharged, the aggregate temperature can be checked and the burners adjusted accordingly.

12. If smoke and flame puffs back around either combustion chamber, the stack draft valve on that side should be opened slowly until the flame penetrates evenly into the drums. Do not use more stack draft than is necessary as this will cause an excessive amount of steam to be used, and considerable aggregate fines will be blown out the stack.

    Caution: If either flame should go out, always close fuel valve before closing the steam valve.

Shutting Down Dryer

A certain sequence of operations should be observed when shutting down the dryer. These are as follows:

1. Disengage reciprocating feeder clutch. This will stop the flow of aggregate to the drums. If travel dryer, stop the bucket loader.

2. Approximately 30 seconds after the reciprocating feeder has been stopped, start decreasing the flame gradually, until the flame goes out. This process should require from 1 to 1-1/2 minutes. The reason for "tapering off" the flame is that the amount of aggregate in the drums steadily decreases, after the aggregate supply has been shut off, until all the aggregate has been discharged. If the flame is not decreased proportionately, the last of the aggregate will be too hot.

3. When the flame is extinguished, first close the globe valve in the fuel line, then the micro valve. The micro valve will not stop the flow of fuel completely.

4. The drums should be left running 20 to 45 minutes after shutting off the flame, to allow the drums to "cool out" evenly. The engine can be run at half throttle for this process. Both the hot and cold elevator clutches should be disengaged while "cooling out" the drums. The drums should be stopped only when the hand can be placed on the warmest part of the drum.

5. <u>Never stop the drums when loaded with aggregate, unless absolutely necessary</u>. See "Drum Operation" under Dryer Drum.

Operating Adjustments for Hot Elevator

GENERAL - This unit requires little attention other than lubrication, alignment and adjustment of chain tensions. A jaw clutch and lever on the Model 833 Dryer permits control of power to the elevator. Of prime importance is shutting off the flow of material from the Dryer to the Boot Hopper on the Elevator in the event of accidental shut down of the Elevator. Note the following adjustments:

BREAKING BOLT - This transmits power from the drive sprocket on the headshaft to the collar which is keyed to the shaft. It is a 5/8 x 7" machine bolt, designed to break if the buckets catch or the Boot becomes flooded with material, causing overloading of buckets. To prevent flooding of Boot when this bolt breaks, the cover should be immediately slid into place over the Boot Hopper to keep material from the Dryer from completely filling the Boot Section.

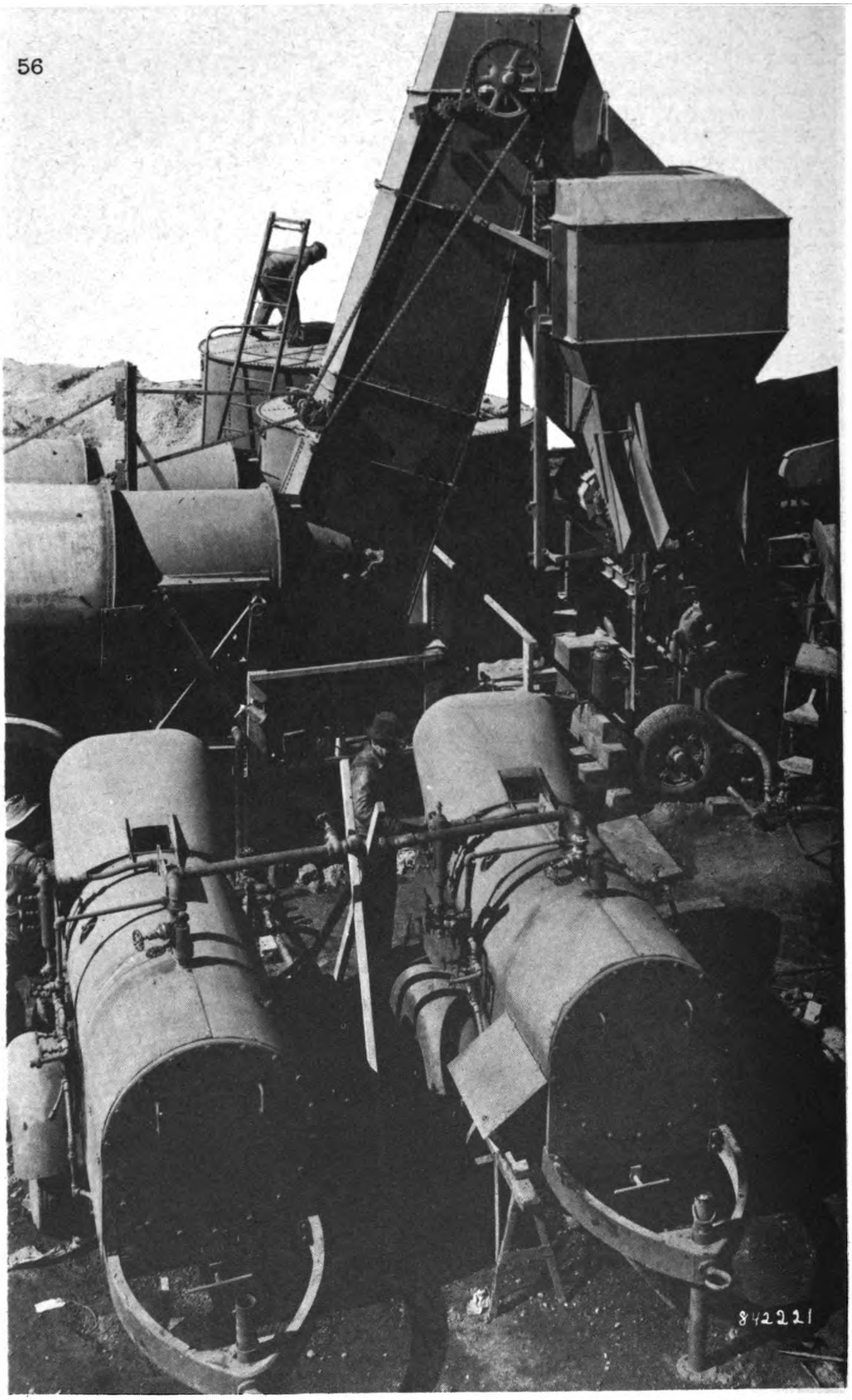


FIG. 26 - ENCLOSED ELEVATOR FOR ELEVATING
DRIED AGGREGATE FROM DRYER TO MIXER.

Before replacing this breaking bolt, check the elevator, especially the Boot Section, to determine what caused it to break. Clean out and inspection doors are provided at Head and Boot Sections.

BUCKET CHAIN - This chain should be kept snug at all times and the take-ups on the Boot should be adjusted equally. If this chain is too tight, excessive bearing and chain wear will result.

If the chain stretches beyond the limit of the takeups, remove one chain link and one bucket link with bucket.

HEAD DRIVE CHAIN - Tension is maintained on this chain by means of a counterweighted idler sprocket. If the chain stretches too much for this idler to be effective, remove one or two links of the chain.

BUCKETS - Check bolts which hold buckets to chain occasionally to be sure they are tight.

CHAIN DRIVE FROM DRYER - This chain may be tightened by raising the position of the idler sprockets. A series of holes is provided for this purpose in the frame on which these sprockets are mounted. Remove links from this chain when it stretches beyond the limits of adjustment.

Operating Adjustments for Dryer, Cold Elevator & Feeder

Chain and Belt Adjustments

MAIN DRIVE CHAIN (Speed Reducer to Main Jackshaft)

This chain may need adjusting after preliminary stretch is removed. To adjust, first loosen guard hold down bolts and loosen bolts that hold the sliding plates in position around the main jackshaft and cold elevator drive shaft. Then mark the location of engine base (1) Fig. 27, on engine support frame (2) and loosen engine hold down bolts. Next turn thrust take-up bolts (3) until sag on top run (4) of the chain is not more than 1/4". Be sure that both ends of engine have been moved the same amount. This can be done by measuring the distance from new position of engine base to marks made before moving. Tighten the lock nuts on the take-up bolts and tighten down engine bolts.

Important: When the main drive chain is tightened, the chain driving the cold elevator drive shaft and the V belt to the fuel pump are automatically loosened. Because of this, before tightening the guard hold bolts, or the bolts that secure the sliding plates, it is necessary to first tighten the cold elevator drive shaft chain and the V belt. Instructions for these adjustments are contained in the following sections.

DRIVE CHAIN (Speed Reducer to Elevator Drive Shaft)

To tighten the cold elevator primary drive chain, loosen bearing hold down bolts (1) Fig. 28, and seal plate bolts (5). Move all three bearing bases (2) in even amounts until the sag on the top run of the chain is not more than 1/4". Be sure that all bearings have been moved the same amount, by inserting an equal amount of shims (3) between the clips (4) and all bearing bases - then tighten bolts. The bolts (5) that secure the sliding seals (6) are then tightened to prevent grease from leaking or dust from entering into the guard.

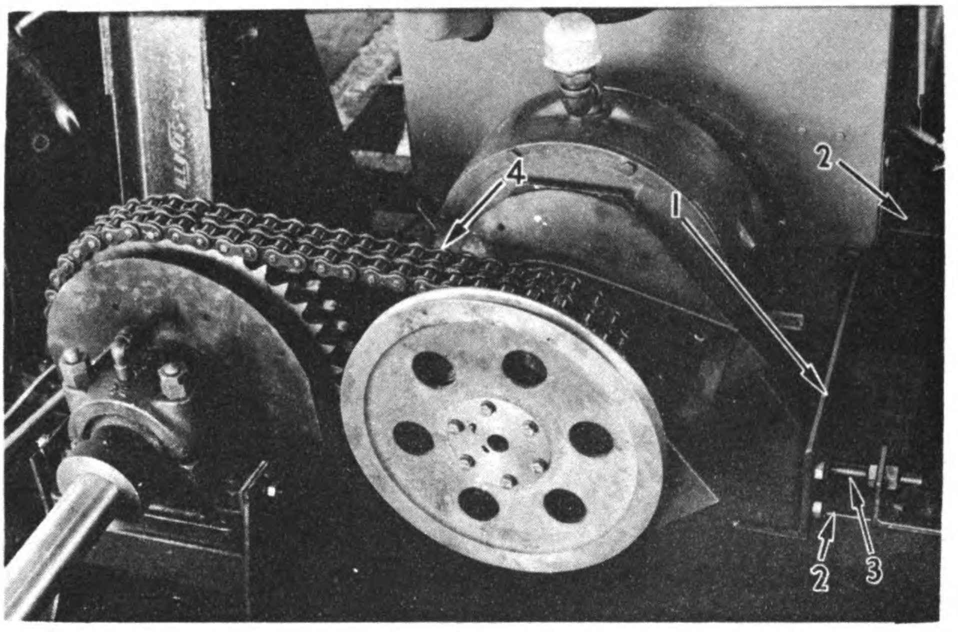


FIG. 27 - DRYER MAIN DRIVE CHAIN WITH CHAIN GUARD REMOVED.

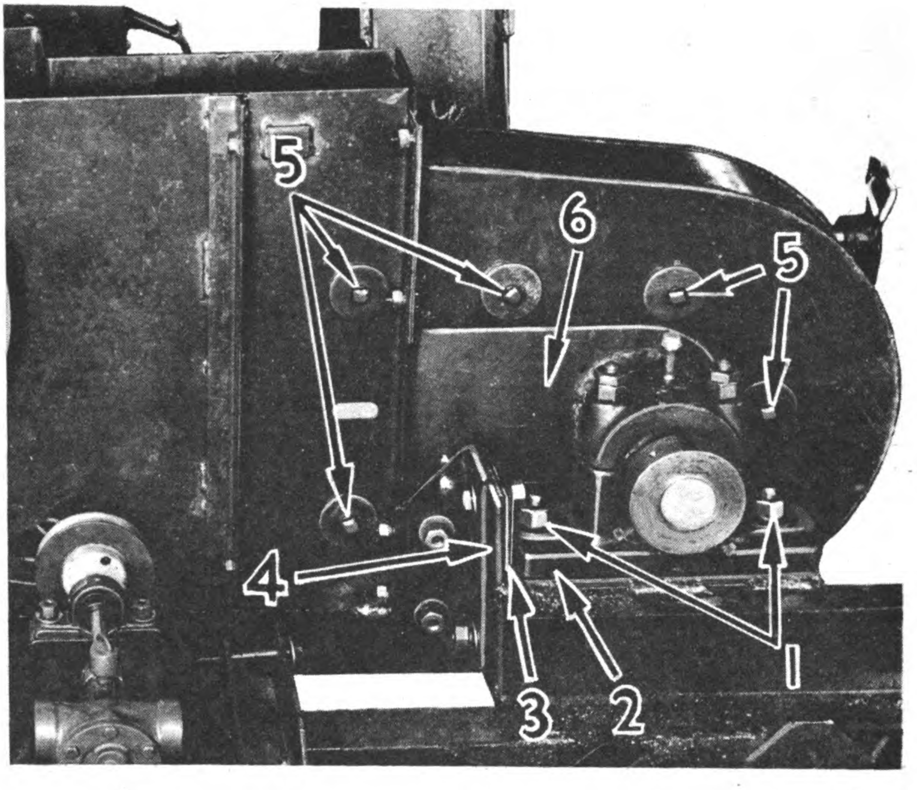


FIG. 28 - ADJUSTMENT OF DRIVE CHAIN BETWEEN SPEED REDUCER AND ELEVATOR DRIVE SHAFT.

FUEL PUMP V BELT

The V belt is tightened by moving the fuel pump and shaft away from the drive pulley (1) Fig. 29. This is done by loosening the four bolts (2) that secure the adjustable base plate (3) to the support frame (4). Then loosen lock nuts on thrust take-up bolts (5) and turn down nuts on adjusting bolt. The belt should be tightened sufficiently so that no sag remains, but the belt should not be tightened enough to cause it to stretch. Be sure that both ends of the adjustable base plates have been moved the same amount so as to maintain proper alignment of pulleys. Tighten all bolts.

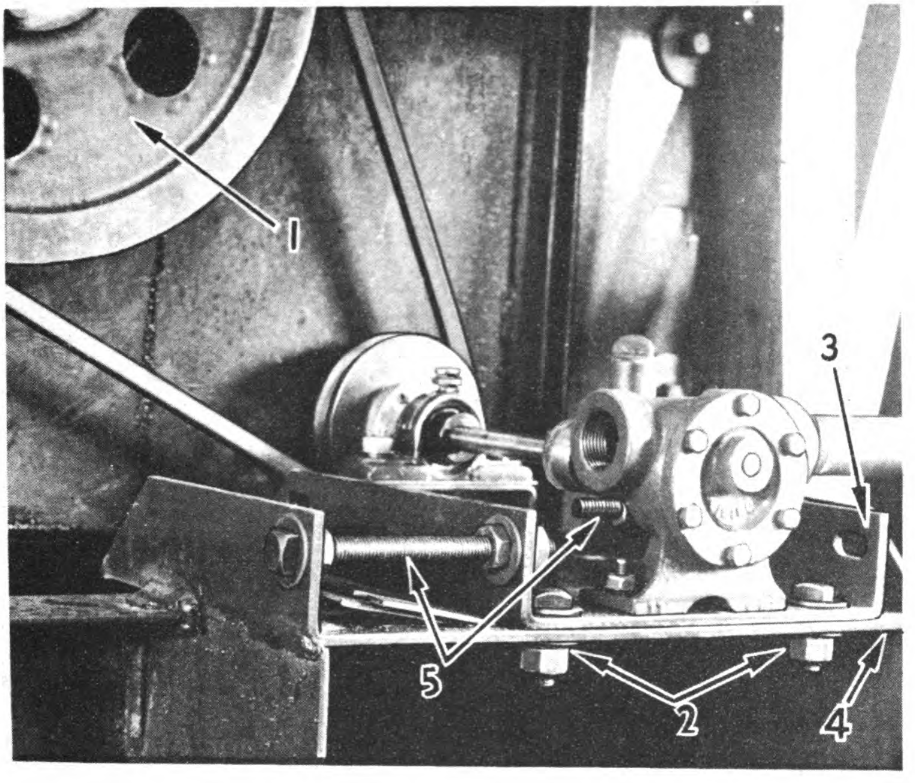


FIG. 29 - ADJUSTMENT OF V-BELT TO FUEL PUMP.

COLD ELEVATOR BUCKET LINE (Elevator Footshaft to Elevator Headshaft)

The bucket line chain is properly adjusted when the distance between the return chain (1) Fig. 30, and the underside of the elevator frame (2) is from 8" to 12". To adjust this chain take up on each of the two headshaft bolts an equal amount until the chain is properly adjusted.

Caution: When the bucket line is tightened, the elevator drive chain (4) is automatically tightened also. Therefore, it may be necessary to add one or more links in the drive chain so that the bucket line can be properly adjusted.

COLD ELEVATOR DRIVE CHAIN (Elevator Drive Shaft to Elevator Headshaft)

This chain is kept in proper tension by a spring loading idler sprocket (5) Fig. 30. If the chain should require additional adjustment, remove links from the drive chain.

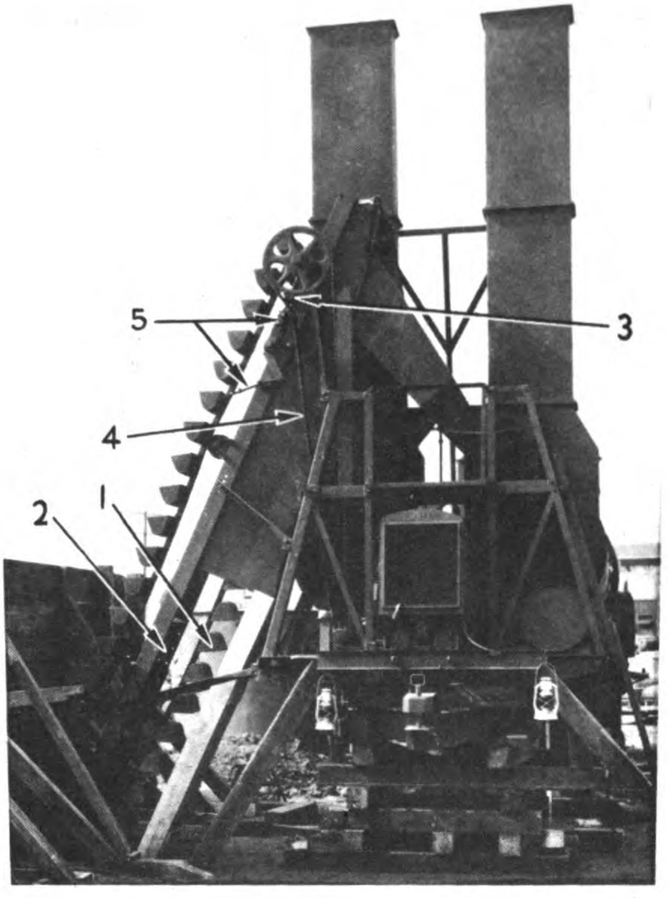


FIG. 30 - ADJUSTMENT OF COLD ELEVATOR DRIVE CHAIN AND BUCKET CHAIN.

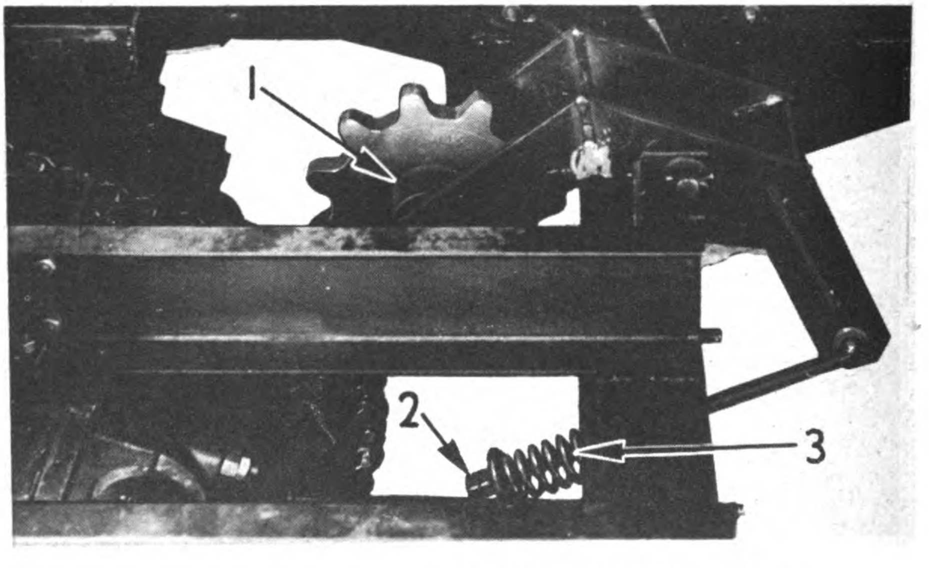


FIG. 31 - "SPRING LOADED IDLER SPROCKET WHICH MAINTAINS CORRECT ADJUSTMENT OF DRUM DRIVE CHAIN."

RECIPROCATING FEEDER DRIVE CHAIN (Feeder Crankshaft to Elevator Footshaft)

The reciprocating feeder drive chain is adjusted with approximately 1/4" slack at the time of setting up the plant. This will in all probability remain in proper adjustment until the plant is set up on another location. If, however, the chain becomes loose enough that there is a possibility of the chain jumping the sprocket teeth, it should be tightened. To tighten, loosen dust seals in guard, and jack up entire elevator until foot end is free. Then take up on adjustable push arms until chain is in proper adjustment and re-set the cold elevator.

DRUM DRIVE CHAINS

Proper adjustment of each drum drive chain is maintained by individual spring loaded idler sprockets (1) Fig. 31. To check for proper adjustment, the chain should be observed while the dryer is in operation. When in operation, there should be no slack at any point on either chain. To tighten, loosen lock nuts (2) on threaded take-up rod (3) and turn down on adjusting nut until all slack is removed. Then tighten lock nut.

COUNTERSHAFT DRIVE CHAIN (Main Jackshaft to Countershaft)

There should be no slack in this chain when properly adjusted. To determine if chain is in proper tension, check the lower run (1) Fig. 32 between the drive sprocket on the main jackshaft and the countershaft sprocket nearest to the jackshaft. To remove slack, lower the countershaft (2). The countershaft should not be lowered, however, to the extent that it will cause the upper run (3) of the chain to come in contact with the lower run (1). A clearance of 1/2" should be maintained between both runs of the chain. If this is not possible, remove the bearing base stop shims (5) from above the bearing bases (6) of the lower countershaft and raise the shaft high enough so that an offset link can be removed from the drive chain.

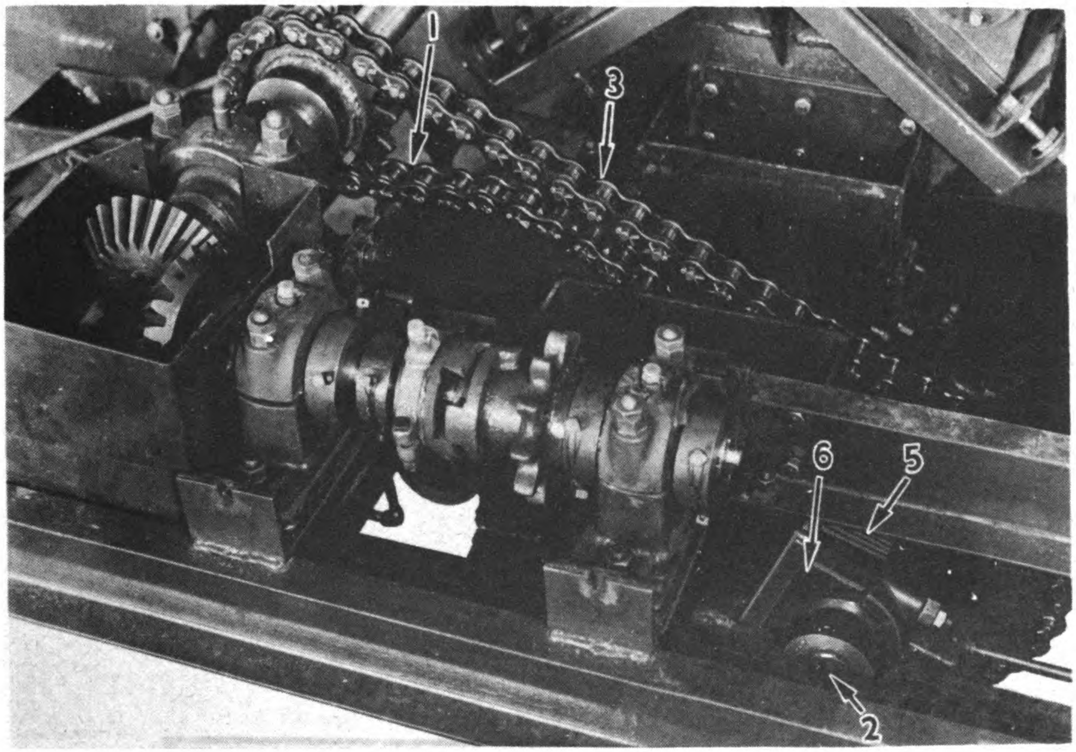


FIG. 32 - ADJUSTMENT OF DRIVE CHAIN FROM MAIN JACKSHAFT TO DRUM DRIVE COUNTERSHAFTS.

HOT ELEVATOR DRIVE CHAIN (Hot Elevator Drive Shaft to Hot Elevator Countershaft)

This chain is tightened at the time of setting up the plant by means of two adjustable sprocket idlers. Any additional adjustment required is accomplished by raising the upper idler sprocket (20) Fig. 58 located between the combustion chambers at the discharge end of the dryer.

Miscellaneous Adjustments

MASTER CLUTCH

If clutch does not pull,heats, or operating lever jumps out of engagement, the clutch should be adjusted. To adjust, remove hand hole plate on clutch housing and turn clutch until adjusting lock pin (1) Fig. 33 can be reached. Pull out on adjusting lock pin and turn adjusting yoke (2) to right or clockwise, until adjusting lock pin recedes itself in the next notch provided. The clutch is in proper adjustment when the clutch lever requires a distinct pressure to engage. A new clutch may require several adjustments until the friction discs are worn in. One or two notches on the adjusting yoke are usually sufficient to adjust the clutch properly.

Caution: Do not attempt to adjust clutch with engine running.

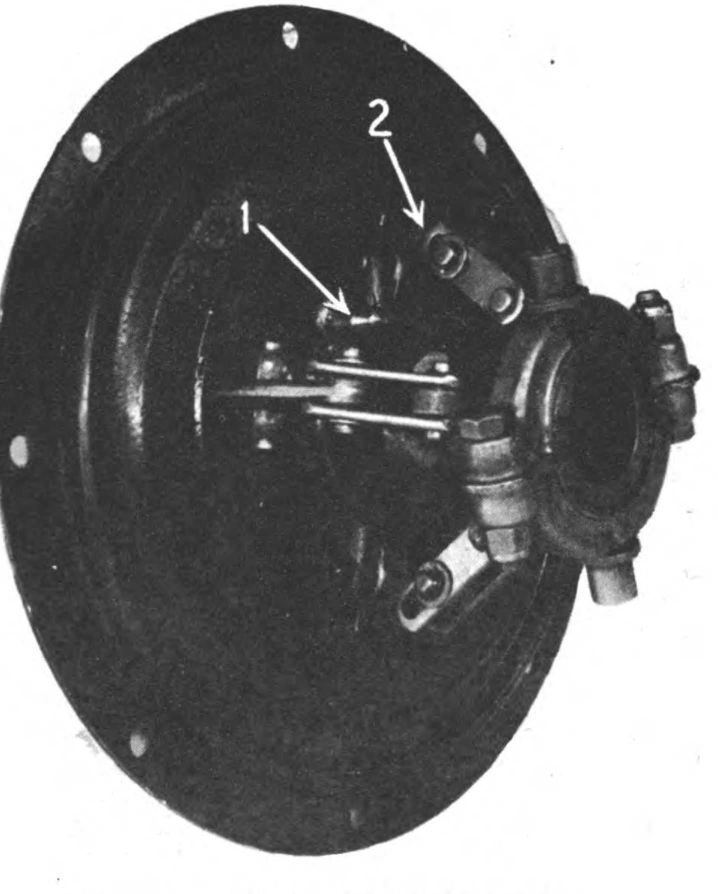


FIG. 33 - MASTER CLUTCH ADJUSTMENT.

ELEVATOR HEADSHAFT SPROCKET BREAKER BOLTS

Should the breaker bolt, on the cold elevator headshaft sprocket, break while the dryer is in operation, the aggregate in the drums should be run out before disengaging the master clutch. Disengage the cold elevator clutch lever. The headshaft sprocket can then be turned to line up the breaker bolt holes. Insert new breaker bolts and lock the half nut.

RECIPROCATING FEEDER SKIRT PLATES AND BELT FLASHING

Leakage of aggregate around the base of the reciprocating feeder is prevented by adjustable skirt plates and rubber belt flashing. If leakage develops along the sides of the feeder, insert sufficient shims between skirt plate (1) Fig. 34 and feeder side plate (2) so that the clearance between the skirt angle and the feeder sliding plate (5) does not exceed 1/8 of an inch. Then loosen bolts (4) and pry down on belt flashing (3) until flashing is flush against the sliding plate.

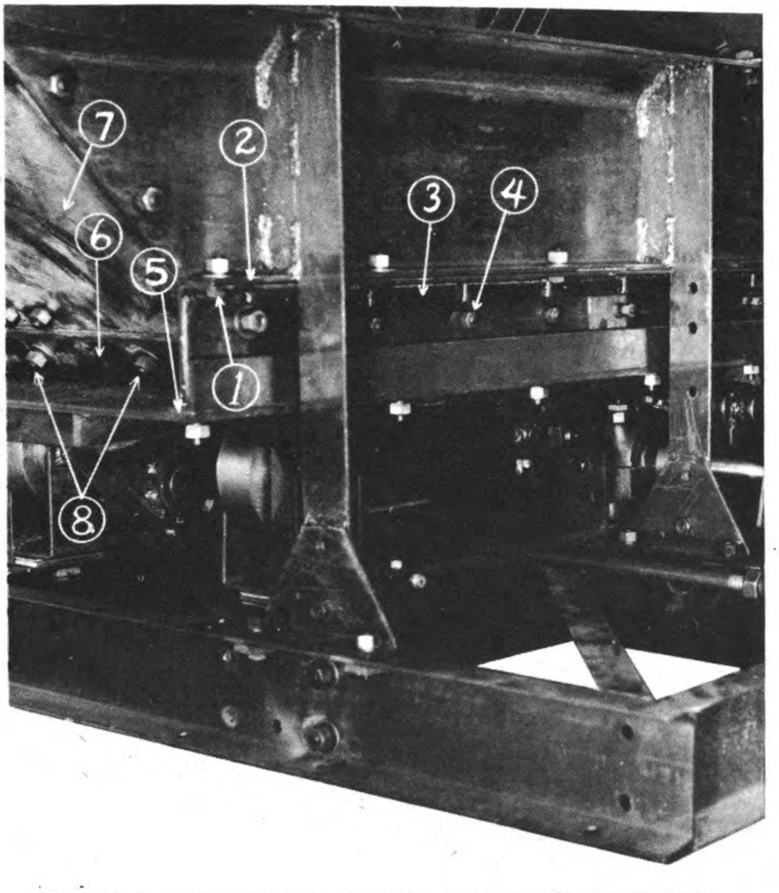


FIG. 34 - DRIVING SIDE OF RECIPROCATING FEEDER.

If leakage develops at the rear of the feeder, loosen bolts (8) and lower skirt plates (6) and belt flashing (7) so that the skirt plate clears the sliding plate 1/8" and the flashing is flush with the sliding plate.

COLD ELEVATOR DISCHARGE CHUTE

The cold elevator discharge chute is adjustable for slope, for proper division of aggregate to each drum, and for centering the discharging stream of aggregate in the drum charging hoppers.

The discharge chute (1) Fig. 10 that feeds the drum on the far side of the cold elevator is adjustable for slope. This chute pivots at hinged points (2). A series of holes (3) are provided for securing the chute at any slope desired.

The discharge chute (4) that feeds the drum nearest the cold elevator, is equipped with two adjustable baffles (5) and (6) for centering the flow of aggregate in the drum charging hopper. Baffle (5) pivots on hinge (7), and is secured in any of several positions by means of a series of holes (8). Baffle (6) pivots on hinge (9) and can be adjusted to a flatter or steeper slope.

The divider plate (10) pivots on hinge (11) and can be swung right or left to divide the aggregate into the desired proportions for each drum. The divider is secured in position by inserting bolts through any of the series of holes in adjustment arms (12).

COMBUSTION CONES

There are four slotted holes with cover plate (3) Fig. 21 in each combustion cone (1) that allows air to be drawn in for supporting combustion. The area of the openings can be varied from wide open position to completely closed position by adjusting the cover plates over holes.

The frame supports (2) for each cone have evenly spaced holes to allow the cone to be moved toward or away from the combustion chamber (4) for further controlling the amount of secondary air.

Too little secondary air will cause insufficient air for proper combustion and may cause the flame to go out. Too much secondary air may cause sufficient air velocity to blow out the flame. No hard or fast rule for setting the cones in proper position can be made because of the variable factors involved. Because of this the cone adjustment will need to be made by trial and error.

BURNER TUBES

The 8" diameter burner tubes inside the combustion cones are adjustable to help control the depth to which the flame will penetrate into the drums. There is a series of holes in the support rod of the burner tube. To increase the penetration of flame, move tube toward the combustion chamber. To decrease penetration of flame move back toward the burner. The distance tube is to be moved, depends on the amount of penetration desired.

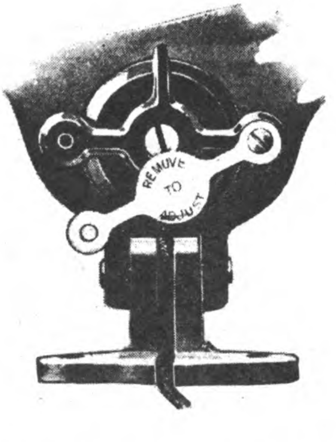


FIG. 35 - BACK OF AGGREGATE THERMOMETER.

HOW TO ADJUST TEMPERATURE INDICATORS (See Fig. 35)

The indicators are set by performing the following steps:

1. The Dryer should be in operation, and a steady flow of aggregate passing through the drums. The burner controls should be set for proper flame, and not require adjustment during the test.

2. Remove the housing over the indicators. These housings are held in place by two 3/8" bolts. With housing removed, take off plate on back of the indicator. This plate has "remove to adjust" stamped on it and is held in place with two screws.

3. Catch a pail of hot aggregate from the Dryer discharge chute and check its temperature with an accurate pocket thermometer.

4. As quickly as possible, set the hand of the indicators to correspond to the thermometer temperature by turning the exposed adjusting screw head to the right or left until the pointer registers correctly.

5. Recheck the recorded heat shown by the indicators against the temperature shown by testing another sample of aggregate with the pocket thermometer.

When the flame in the drums is increased or decreased, the corresponding temperature rise or loss will not be registered immediately as the discharging aggregate does not come in direct contact with the thermometer bulb. Consequently, a few minutes should be allowed after a burner adjustment before accepting the new reading as being correct.

Caution: Care should be taken that the tubing is not kinked. This may break the capillarity and render the indicator useless. Be careful not to dent the bulb as this will affect the accuracy of the instrument.

ADJUSTMENT OF FUEL OIL PRESSURE RELIEF VALVE

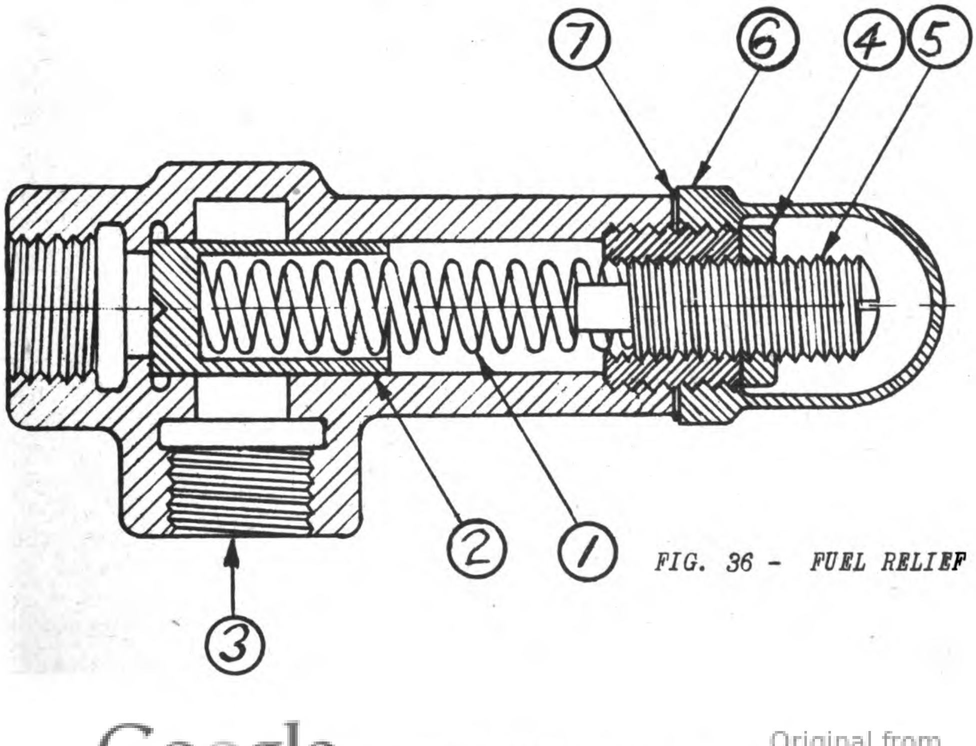


FIG. 36 - FUEL RELIEF VALVE.

To adjust pressure at which valve will operate remove cap (6) Fig. 36, and loosen nut (4). When the valves leave the factory, they are usually set to release at 40 lbs. pressure. If it is desired to increase the pressure at which the valve will operate, turn the adjusting screw (5) to the right until the desired pressure is indicated on the oil pressure gauge located near the burner. To decrease the operating pressure, turn adjusting screw (5) to left until the desired pressure is reached.

Be sure to tighten lock nut (4) after pressure is adjusted. Also replace gasket (7) and cap (6).

Lubrication

Dryer, Cold Elevator and Feeder

LUBRICANTS

Nothing can add to the life of the machine more than thorough lubrication of the moving parts, properly executed at the correct intervals. When time and availability of the machine are at a premium, it is absolutely inexcuseable to have a breakdown resulting from improper lubrication, since this can so easily be avoided. A machine which cannot be used in an emergency because it requires repairing loses all of its value and, instead, becomes a handicap. Therefore, it is very important to maintain the machine carefully, following the instructions which have been prepared.

LUBRICATION CHART KEY

Numbers appear inside symbols on the lubrication chart at every important lubrication point. The symbol indicates type of lubricant as shown below. The number indicates the paragraph giving detailed instructions on following pages.

◯ High Pressure Grease

Operating Temp. ° Fahrenheit	Commercial Grade & or Trade Name	Nearest U. S. Army Equivalent
Below 0°	Stazon (Light Oil-300S/100° F Viscosity - lime soap base)	#0 General Purpose Chassis Grease *
0° to 32°	Marfak #0	#0 General Purpose Chassis Grease
32° to 200°	Marfak #2; Superla 2X or their equivalents	#1 General Purpose Chassis Grease #2 General Purpose Chassis Grease

◎ High Temperature Grease

Operating Temp. ° Fahrenheit	Commercial Grade & or Trade Name	Nearest U. S. Army Equivalent
200° to 300°	Marfak #3; Kalrex #4; Superla 3X	#3 Heavy Duty Wheel Bearing Grease *
300° to 375°	Marfak #3; Kalrex #2	#3 Heavy Duty Wheel Bearing Grease *

* More frequent lubrication and greater care is required at these temperatures.

◇ Motor Oils

Below 0°	SAE-10	U.S. Army Spec. #2-104A of corresponding viscosity. Blend when correct viscosity is not available.
0° to 32°	SAE-20	
32° to 90°	SAE-30	
Above 90°	SAE-40	

□ Transmission Lubricant

Below 0°	SAE-80	Federal VV-L-761 SAE-80
0° to 32°	SAE-90	Federal VV-L-761 SAE-90
Over 32°	SAE-140	Federal VV-L-761 SAE-90; or SAE-80-140 *

* SAE-80-140 can be used at - 20° F and above if other lubricants are not available.

LUBRICATION INTERVALS

Every 2 hours -	Nos. 5, 6 & 7
Every 4 hours -	Nos. 7, 8, 13, 14, 15, 18, 20, 21, 22, 23, 24, 25 & 26
Every 8 hours -	Nos. 1, 14, 16, 18, 19 & 25
Every 50 hours -	Nos. 1, 17 & 27
Every 100 hours-	No. 1
Every 200 hours-	Nos. 4, 9 & 17
Once yearly -	Nos. 2 & 12
Before Trailing-	Nos. 3, 10 & 11

DRYER LUBRICATION INSTRUCTIONS

1. **Engine**-Points to Lubricate

   a. Crankcase
   b. Air Cleaner
   c. Oil Filter
   d. Water Pump
   e. Generator
   f. Starter
   g. Governor
   h. Fan
   i. Distributor

   See Engine Section for details.

2. **Front and Rear Wheel Bearings**
   Remove front and rear wheels and repack with wheel bearing grease once a year.

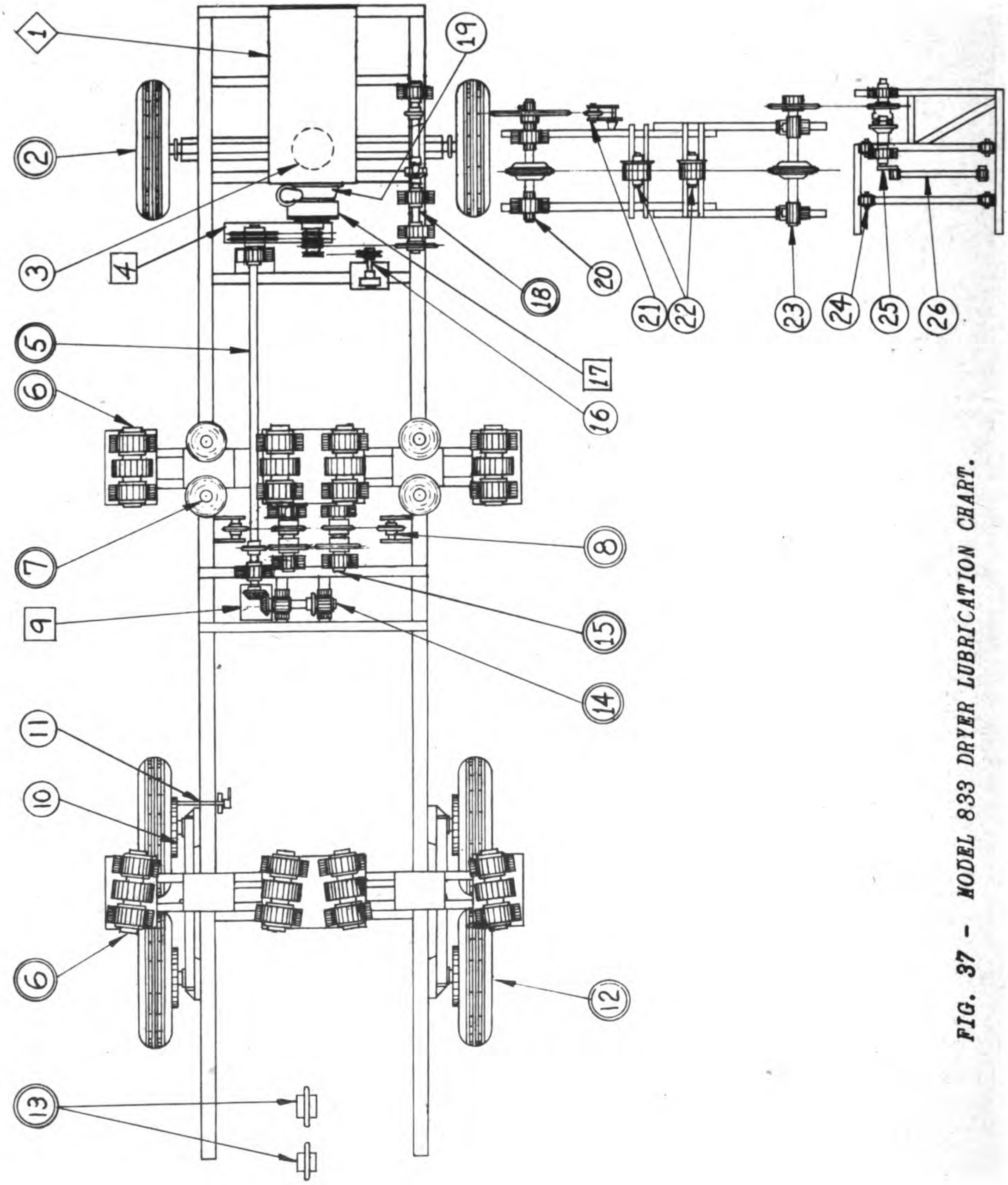


FIG. 37 - MODEL 833 DRYER LUBRICATION CHART.

3. Front Axle Turntable
Three Alemites, Grease before trailing with four to six strokes of gun. Use high pressure grease.

4. Main Drive Chain Guard
Maintain oil level in guard so that the bottom run of the chains dip in oil. Drain and refill every 200 hours of operation with transmission lubricant.

5. Main Jackshaft
Two Alemites, one to each of two bearings. Grease every two (2) hours with four (4) strokes of gun. The fittings are piped to side of machine for accessibility. Use high temperature grease.

6. Trunnions
Sixteen Alemites, two to each trunnion assembly, eight trunnion assemblies. Grease every two (2) hours with four (4) to eight (8) strokes of gun. Use high temperature grease only in these bearings. The fittings for the inside trunnions are piped to outside of machine for accessibility.

7. Thrust Rollers
Four Alemites, one to each of four thrust rollers. Grease every four (4) hours with four (4) to six (6) strokes of gun. If thrust is excessive, grease every two (2) hours. The fittings are piped to outside of machine for accessibility. Use high temperature grease.

8. Drum Drive Idlers
Two Alemites, one to each of two idlers. Grease every four (4) hours with four (4) strokes of gun. These fittings are located on the ends of the idler shafts. Use high temperature grease.

9. Bevel Gear Box
Maintain oil level so that bottom of gears dip 1/2" to 1" into the oil. Drain and refill every 200 hours of operation with transmission lubricant.

10. Brake Shoe Anchor Pins
Eight Alemites, two to each rear wheel. Fittings extend from brake housing toward center of machine. Grease before trailing with one stroke of gun. Excessive grease at the points might get onto brake bands rendering the brakes ineffective. Use high pressure grease.

11. Brake Camshaft Slack Adjuster and Brake Cam Bearing
Twelve Alemites, two to each rear wheel. One fitting located in camshaft bearing and one fitting located on slack adjuster arm. Grease each fitting before trailing with one stroke of gun. Use high pressure grease.

12. Front and Rear Wheel Bearings
Remove front and rear wheels and repack with wheel bearing grease once a year.

13. Hot Elevator Drive Idlers
Two Alemites, one for each of two idlers. Grease every four (4) hours with four (4) strokes of gun. Use high temperature grease.

14. Hot Elevator Drive Shaft
Four (4) Alemites, one to each of two bearings, one on shifter yoke, and one at end of shaft for greasing sprocket. Grease bearings every four (4) hours with four (4) strokes of gun. Grease sprocket and shifter every eight (8) hours eith two strokes of gun. Use high temperature grease.

15. Drum Drive Counter Shafts

Four Alemites, two to each of two shafts. Grease every four (4) hours with four (4) strokes of gun. The fittings are piped to outside of machine for accessibility. Use high temperature grease.

16. Fuel Pump

Grease anti-friction outboard bearing with one stroke of gun every 8 hours. Use high pressure grease only. Turn down grease cup every 8 hours. Refill cup as often as necessary.

17. Speed Reducer

Check oil level by removing oil level plug at the side of speed reducer case. If lubricant does not flow from hole, add transmission lubricant. Drain and refill every 200 hours of operation.

Speed Reducer Breather Cap

Remove breather cap, wash in gasoline, and dip in motor oil every 50 hours of operation.

18. Cold Elevator Drive Shaft

Six Alemites, one to each of three bearings, one each on universal joint, sprocket and shifter yoke. Grease bearings every four (4) hours with four (4) strokes of gun. Grease sprocket and universal joint every four (4) hours with two strokes of gun. Grease shifter yoke every eight (8) hours with two strokes of gun. Use high temperature grease.

19. Master Clutch Throw-out Collar

One Alemite on the side of bell housing. Grease every 8 hours with one stroke of gun. Excessive grease will eventually get into clutch facings, causing slippage. Use high pressure grease.

COLD ELEVATOR LUBRICATION INSTRUCTIONS

20. Headshaft

Two Alemites, one to each of two bearings. Grease every four (4) hours with four strokes of gun. Use high pressure grease.

21. Drive Chain Idler

One Alemite. Grease every four (4) hours with two to four strokes of gun. Use high pressure grease.

22. Bucket Line Idler Rolls

Two Alemites, one for each Idler roll. Grease every four (4) hours with two strokes of gun. Use high pressure grease.

23. Footshaft

Two Alemites, one to each of two bearings. Grease every four (4) hours with four strokes of gun. Use high pressure grease.

RECIPROCATING FEEDER LUBRICATING INSTRUCTIONS

24. Support Rollers

Four Alemites, one for each of four rollers. Grease every four (4) hours with two to four strokes of gun. Use high pressure grease.

25. Crankshaft

Four Alemites, one for each of two bearings, one on sprocket, and one on clutch shifter yoke. Grease bearings every four (4) hours with four strokes of gun. Grease sprocket and shifter yoke every eight (8) hours with two strokes of gun. Use high pressure grease.

26. Crank Arm

Two Alemites. Grease every four (4) hours with two strokes of gun. Use high pressure grease.

MISCELLANEOUS

27. All Chains Not Running in Oil

Apply motor oil to all chains not running in oil, with the exception of the cold elevator bucket chain, every 50 hours.

HOT ELEVATOR

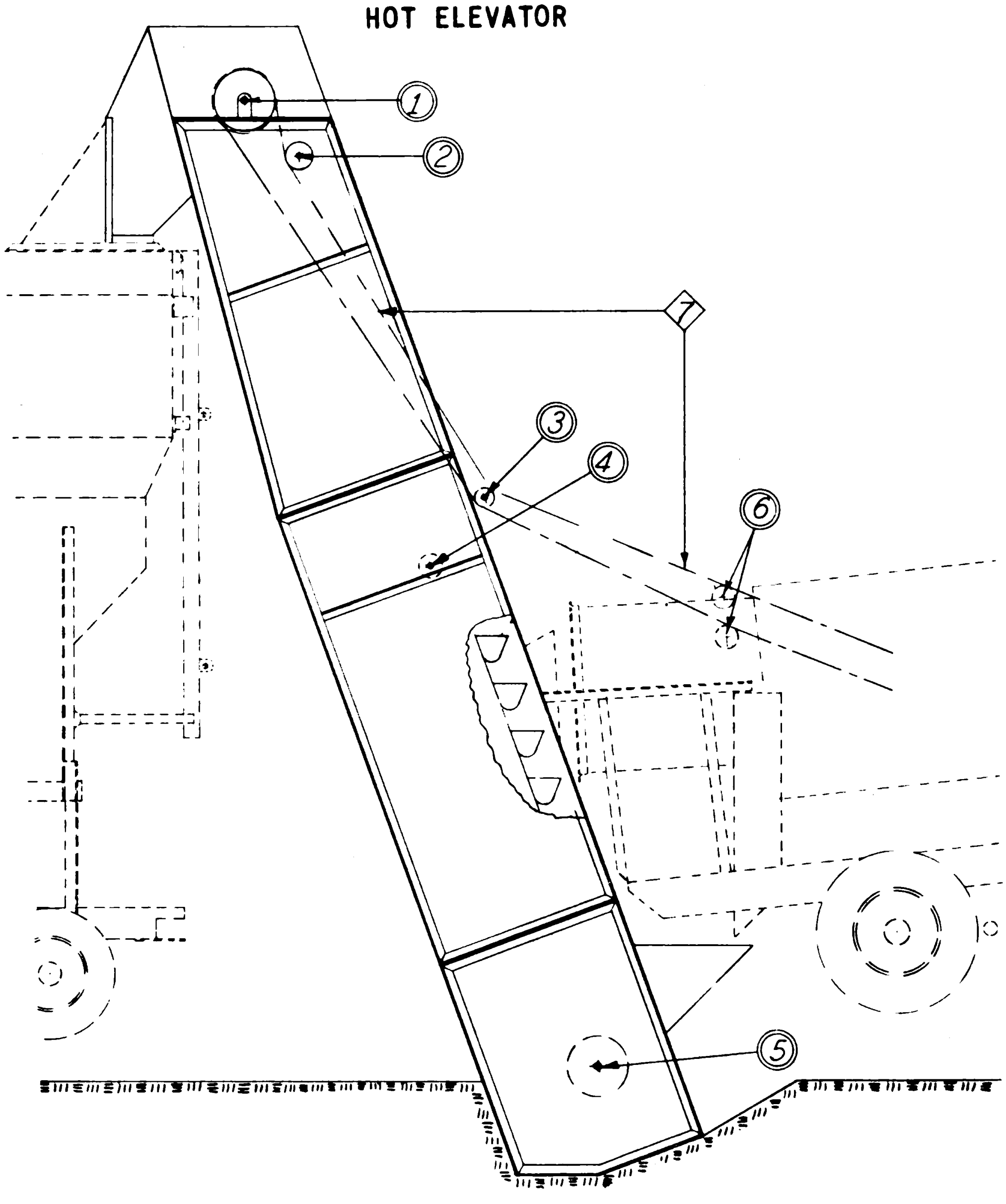
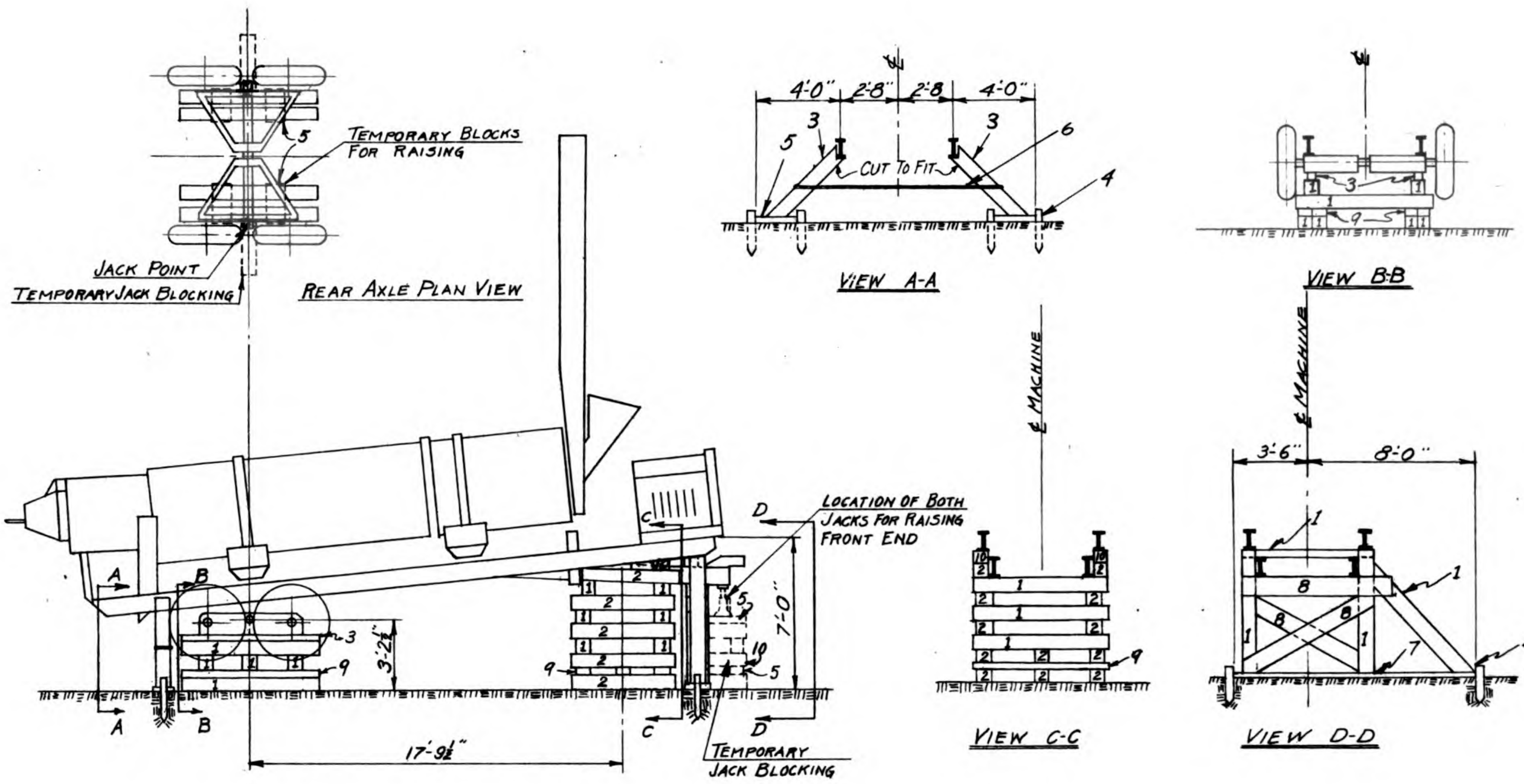


FIG. 38 - "HOT ELEVATOR LUBRICATION CHART.

Lubrication Periods

4 hours - Items 1, 2, 3, 4, 5 & 6.
50 hours - Item 7 (Fig. 38).

1. Headshaft - two alemite fittings, one on each bearing.
2. Spring Tension Idler - one alemite fitting in end of shaft.
3. Countershaft - two alemite fittings, on pipes extended down.
4. Bucket Chain Idler - one alemite fitting on pipe extended down.
5. Takeup Shaft - two alemite fittings, one on each takeup bearing.
6. Dryer Drive Idler Sprockets - two alemite fittings, one each end of idler shafts.
7. Lubricate drive chains with motor oil.



BLOCK NO.	NO. REQ.	DESCRIPTION
1	13	8"x8" TIMBER x 6'-6"
2	12	8"x8" TIMBER x 5'-0"
3	4	4"x4" TIMBER x 6'-6"
4	6	4"x4" TIMBER x 3'-0
5	20	2"x10" TIMBER x 2'-0"
6	1	#9 WIRE x 50'-0"
7	1	2"x10" TIMBER x 11'-6"
8	4	2"x10" TIMBER x 7'-0"
9	7	8"x8" TIMBER x 6'-6"
10	12	8"x8" TIMBER x 2'-6"

DRYER BLOCKING DIAGRAM

FIG. 39 - DRYER BLOCKING DIAGRAM.

Dryer Erection and Assembly

Central Dryer Application

When the dryer is used for central plant operation, it is necessary to raise the entire machine and build a rigid support cribbing to take the weight of the machine.

The raising and cribbing of the dryer accomplishes the following purposes:

1. It relieves the tires of the weight of the loaded machine.

2. It establishes a rigid contact between the dryer and the ground, preventing the machine from swaying while in operation.

3. It provides proper slope of the drums, assuring the required rate of flow of aggregate thru the drums.

JACKING AND CRIBBING

In the following instructions for jacking and cribbing, a list of cribbing timbers is given, along with the size and length of each member. This list of timbers should be procured, if possible, but in the event that a certain size of timber cannot be obtained, other sizes can be substituted. For instance, two 4" x 8" timbers will make the equivalent of an 8" x 8" timber, or two 2" x 4" members will make the equivalent of a 4" x 4" member, and etc.

The jacks used are furnished with the equipment; one with the mixer and one with the dryer.

The instructions have been written to make the jacking as safe and foolproof as possible. The rear, or heavy end, of the dryer is cribbed first, jacking only one side at a time with the opposite side supported by temporary cribbing. In this manner the danger of the machine slipping off the jacks is minimized. In jacking the front end, the entire front end is raised from one jack point, but the fact that the rear end has been previously supported on cribbing eliminates most of the tendency for the front end to shift in the jacking process. Instructions are given to keep the cribbing "caught up" to the dryer frame as an added measure of safety in case the jack should slip. It should be remembered, however, that the dryer weighs close to 20 tons, and extreme care and caution should be exercised in the jacking and cribbing operations to insure safety while jacking and to insure a sturdy, rigid cribbing support for the dryer when finished.

Before towing the dryer into position, determine the exact location from dimensional drawings in the "Plant Erection Book". Then proceed with the following sequence of operation:

1. Level off the ground over which the dryer is to be located.

2. Back the dryer in position making sure that the center line of the dryer is directly above the center line cord originally staked out.

3. The discharge end of the dryer is cribbed first. Refer to the Dryer Blocking Diagram, Fig. 39. Place the four timbers, comprising the first tier of cribbing, in position as shown in View "B-B".

4. Place a hydraulic jack in position with the top of the plunger contacting the collar on the end of the rear axle pivot shaft. Place a thin piece of wood between the collar and the top of the jack plunger to prevent the jack from slipping. The jack should be set on a piece of heavy timber to provide a good foundation for the jack.

5. Raise the dryer approximately 2 to 3 inches, then place sufficient temporary cribbing, consisting of pieces of 2" x 10" planking in position as shown to fill the space between the first tier of cribbing and the rear axle frame. This temporary planking should be placed crosswise to the first tier of cribbing members already installed, and in position so that both the straight side and the diagonal side of the rear axle frame will bear firmly upon these members when the jacks are lowered. Release the pressure from the jacks, letting the weight of this side of the dryer to bear on the temporary members.

6. Jack the opposite side of the dryer in the same manner, except that this side is raised 4 to 6 inches. Place pieces of temporary planking at points shown sufficient to "fill in" the cribbing between the first tier members and the axle pivot frame. Release the jack pressure after the temporary cribbing is in place.

7. The above jacking procedure is continued, alternating from side to side, raising each side 3 inches to 4 inches each time until the dryer is high enough to place the second tier of permanent cribbing in position. If the temporary cribbing was properly placed, the three timbers comprising the second tier of cribbing can be placed in position without interference.

8. The last stage of the jacking operation, for placing the third and fourth tiers of cribbing, is performed in the same manner as when jacking for the second tier, except that the pieces of 2" x 10" temporary cribbing are placed crosswise over the second tier of cribbing, and are put in place as soon as either side of the dryer has been raised sufficiently to permit. When the combined height of the temporary cribbing exceeds the thickness of the regular cribbing members, the temporary cribbing is removed and the regular members put in place.

9. With the discharge end of the dryer raised to proper height and the weight supported entirely by the cribbing, the distance from the center of the axle frame pivot shaft to the ground should be approximately 3' 2-1/2". This distance can vary one inch either way, however, without materially affecting the correct dryer position.

10. With the rear end of the dryer raised and cribbed into position, the front end is ready to be raised into position. First lower the towing frame until the latch dogs engage the bottom hole in the latch plate. Make sure the dogs are completely engaged, then release the pressure on the rams.

11. Place both jacks under the front end of the towing frame, as shown, and raise the front end so that the front wheels just clear the ground. Then remove the front axle assembly by unbolting the front axle support frame from the towing frame. Remove the front wheels to an out-of-the-way place.

12. Raise the front end of the dryer to the height shown in the Erection Diagram, placing each tier of cribbing in place as soon as there is sufficient room to permit. Each time the jacks reach the end of their travel, build up from the cribbing already installed to the towing frame and release the jack pressure. Retract the jack rams and build up the blocking under the jack sufficiently to get a new "hitch" with the jack.

NOTE: The dimension, 7'0", from the ground to the front end of the dryer main frame is based on the assumption that the plant site is level. If the plant site slopes either uphill, or downhill along the center line of the dryer, the amount of slope from the center of the rear axle pivot shaft to the front end of the dryer main frame will have to be added or subtracted, as the case may be, to or from the dimensions shown to obtain correct dryer slope.

13. When the dryer is raised to slightly above the proper slope, the short blocks extending from the top tier of the cribbing to the dryer main frame are put in position. These blocks should be beveled to conform to the slope of the dryer main frame. With these blocks beveled to fit, lower the dryer until the main frame clears the bevel block approximately 1/8". Then construct the towing frame support (View "D-D") consisting of upright 8" x 8" timbers tied together with 2" x 10" diagonal cross bracing. First lay the piece of 2" x 10" planking, upon which the support frame rests, in position on the ground. Then, put the upright 8" x 8" timbers in position and cut to fit, leaving 1/8" between the ends of the upright and the dryer main frame. Spike the horizontal 2" x 10" members to the two uprights, leaving 1/8" clearance between the horizontal members and the lower sides of the towing frame. The diagonal bracing cannot be added until after the pressure is released from the jack and the jack cribbing has been removed.

14. When the entire front end cribbing structure and towing frame structure has been constructed and fitted, slowly lower the jack until the entire weight of the front end rests upon the cribbing and support structure. If all bearing points on the mixer main frame and towing frame do not contact their respective cribbing and support member firmly, the jack should again be raised and thin shims inserted to obtain equal bearing at all points.

15. The dryer slope should be 6° if the cribbing instructions were followed closely. Make sure that both ends of the dryer main frame are level transversely by laying a level between the main frame members at the front and rear end of dryer. NOTE: Never set dryer less than 5°.

16. Spike each piece of timber cribbing to the member below it to prevent the cribbing shifting from vibration, when in operation.

17. Install diagonal timber brace at the front end of the dryer as shown (View "D-D").

18. Install two diagonal brace members at the discharge end of dryer as shown (View "A-A").

ERECTION OF EXHAUST STACKS

The procedure for erecting the exhaust stacks is as follows:

1. Lay out the two sections (1) and (2) Fig. 40, comprising each stack, on the ground and bolt the sections together at the joint (3).

2. Lift the stack section up over the dryer and lay it on the dryer drum, in parallel with the drum and with the hinged end on the underside and toward the stack base.

3. Lift the hinged end and move it in position so that the hinged part of the stack section (4) coincides with the hinged part of the stack base (5).

4. Connect the hinge by inserting 1/2" x 2-1/2" bolts thru each of the three hinges.

5. Swing the stack up into position, as shown, and secure the stack to the stack base by inserting bolts in all holes in the joint flange (6).

6. After both stacks have been bolted in position, install the stack brace (7), the upper end fastening to the joint of the upper stack sections, and the lower end fastening to a point between the dryer drums on the dryer main frame.

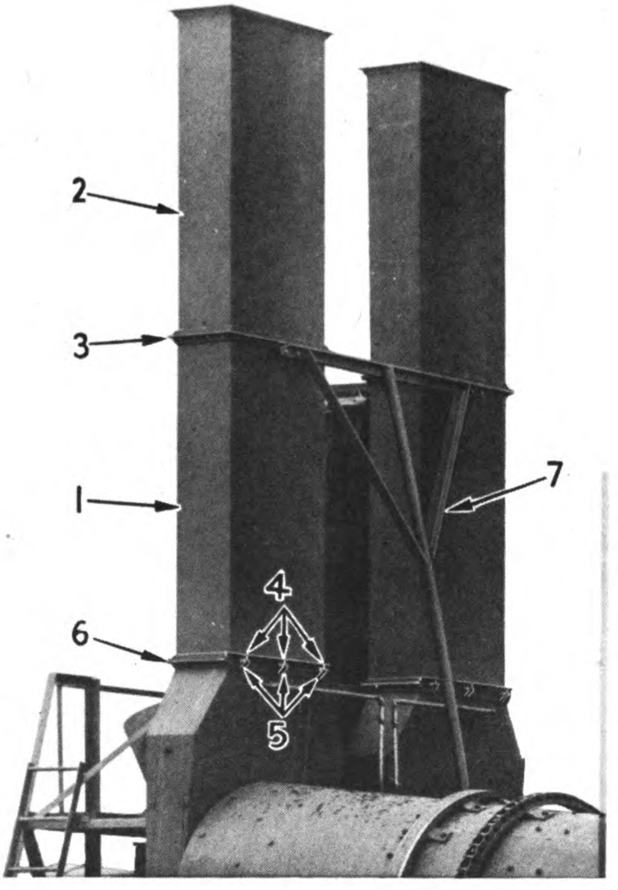


FIG. 40 - DRYER EXHAUST STACKS.

ASSEMBLY AND ERECTION OF COLD ELEVATOR

The cold elevator, as shipped, is knocked down into sections to facilitate handling. These sections are as follows:

1 - Head end section.

1 - Foot end section.

3 - Bundles of bucket line.

3 sets - Push arms.

1 - Discharge chute.

The Elevator is Assembled as follows:

1. Digging Pit-

When in operating position, the elevator foot end extends into a shallow pit. With the aid of the dimension shown in the Staking diagram in the Central Plant Book, lay out and excavate the pit to shape and depth shown. The pit should be dug before bringing the head and foot end sections of the elevator into position so that the sections will not interfere with the digging of the pit. Place the pit flooring as shown in the feeder and cold elevator cribbing diagram, Fig. 47.

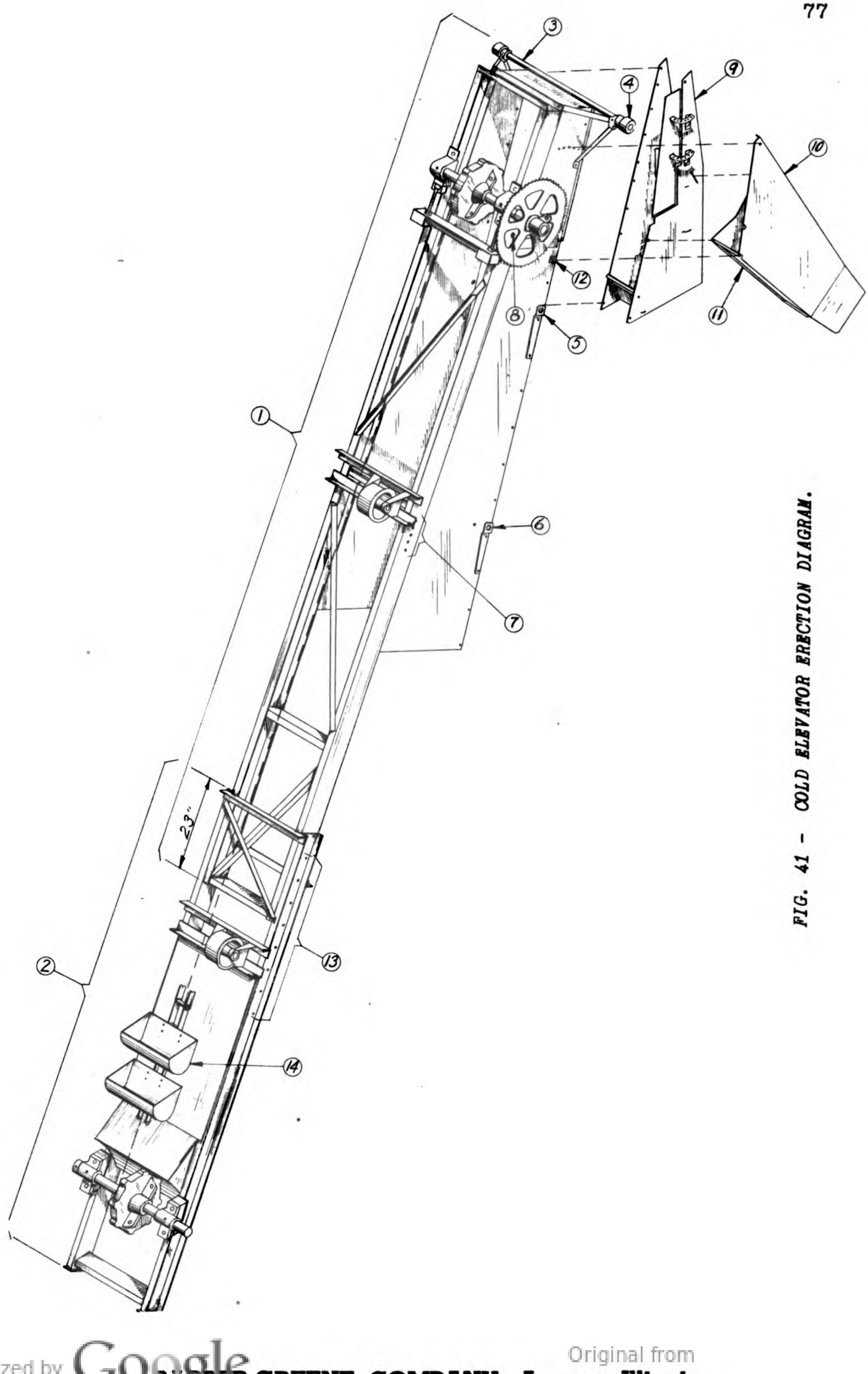


FIG. 41 - COLD ELEVATOR ERECTION DIAGRAM.

2. Connecting Head and Foot End Sections-

Lay two or three pieces of planking lengthwise over the pit. Place the head end section (1), Fig. 41 on the ground at right angles to the dryer and in line with the elevator erection guides so that the guide rollers (4), are directly beneath the lower ends of the erection guide channels. Bring the foot end section (2), into position in line with the head end section and telescope the ends of the conveyor frame for a distance of 23". Insert four 5/8" bolts through each side of the frame at the joint, making sure that there is at least 12" between the upper two bolts and the lower two bolts. This distance between bolts must be maintained to insure rigidity of the frame at the joint.

3. Installing Bucket Line-

Attach all three sections of the bucket line (14) Fig. 41, together into a single strand, making sure that all buckets face the same way. Loosen the take-up bolts at the headshaft and move the headshaft down the frame toward the foot end as far as it will go. Thread the bucket line around the head and footshafts with the open end of the buckets, on the upward run of the chain, facing toward the headshaft. Connect the two ends and take up on the headshaft until the sag in the return run of the bucket line is approximately 1'. Make sure the headshaft is square with the elevator frame before locking the jam nuts on the take-up bolts. This is necessary to insure proper alignment of the headshaft.

4. Installing Hoist Extension Frame-

If a crane is available, a hitch can be made at the head end and the elevator can be hoisted into position quickly. If, however, a crane is not available, provisions have been made to hoist the elevator into place with two chain hoists. To prepare for this operation the hoist extension frame (1) Fig. 42, is bolted in place on the superstructure over the dryer engine.

5. Elevator Hoisting Procedure- Refer to Fig. 43 for different positions of elevator in the hoisting process.

Hook a chain hoist into each of the hoist hook brackets (2) Fig. 42, at the lower end of the erection guide channels (10). Fasten the hoist chains to either side of the erection roller shaft (3) Fig. 41, and hoist the head end of the elevator until the limit of the hoists is reached. Block up under the head end to support the elevator while another hitch is made. Hook the chain hoists into the second pair of hoisthook brackets (3) Fig. 42, and fasten the hoist chains to the guide trunnion shaft as before and continue the hoisting process. Guide the erection trunnions (4) Fig. 41, into the erection guide channels (10) Fig. 42, when the elevator has been raised sufficiently to permit. When the limit of the hoist has again been reached, insert a bolt through each guide channel immediately below the trunnion roller. This will hold the elevator in position while changing the hoists for another hitch.

The same hoisting procedure is continued for the remainder of the hoisting operation. The points at which the hoists are hooked for the remaining lifts are as follows:

	Guide Channel Hook Brackets	Elevator Hook Brackets
3rd lift	(4) - Fig. 42	(3) - Fig. 41
4th lift	(4) - Fig. 42	(5) - Fig. 41
5th lift	(4) - Fig. 42	(6) - Fig. 41

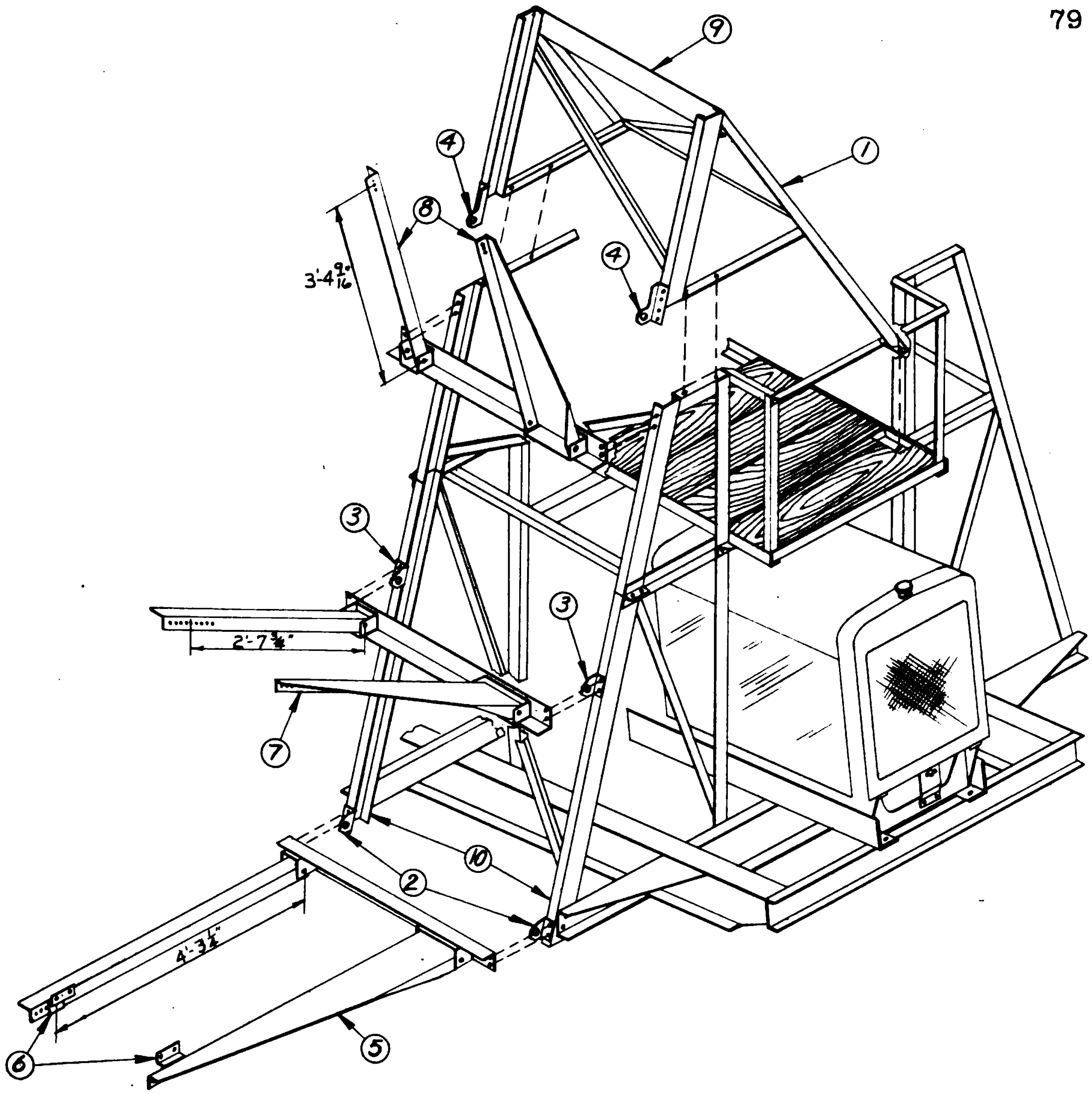


FIG. 42 - DIAGRAM FOR INSTALLATION OF HOIST EXTENSION FRAME AND COLD ELEVATOR PUSH ARMS.

As the trunnion rollers emerge from the upper end of the guide channels, the elevator will rest on the top cross member (9), Fig.42, of the hoist extension frame. The elevator should be in correct position when the distance from the centerline of the dryer to the centerline of the elevator footshaft is 12' 9½".

6. Securing Elevator In Position-

With the elevator hoisted to position, remove the hook brackets (2), from the guide channels. Attach the lower push arm assembly (5), to the guide channels using the holes in the guide channels where the lower set of hoist hook brackets were originally located. Secure the lower push arms to the elevator frame by attaching the angle brackets (6), to the elevator channel frame, using any of the series of holes (13) Fig. 41, (at the joint of the two frame sections) that match. At this point the foot end of the elevator should be shifted sideways, if necessary, to make it plumb. Remove the hook brackets (3) Fig. 42, and attach the middle push arm assembly in the same manner as the lower push arm assembly was installed. When raising the push arms into place, it may be necessary to move each push arm to one side or the other to permit the push arms to straddle the elevator frame equally. A series of holes in the push ar

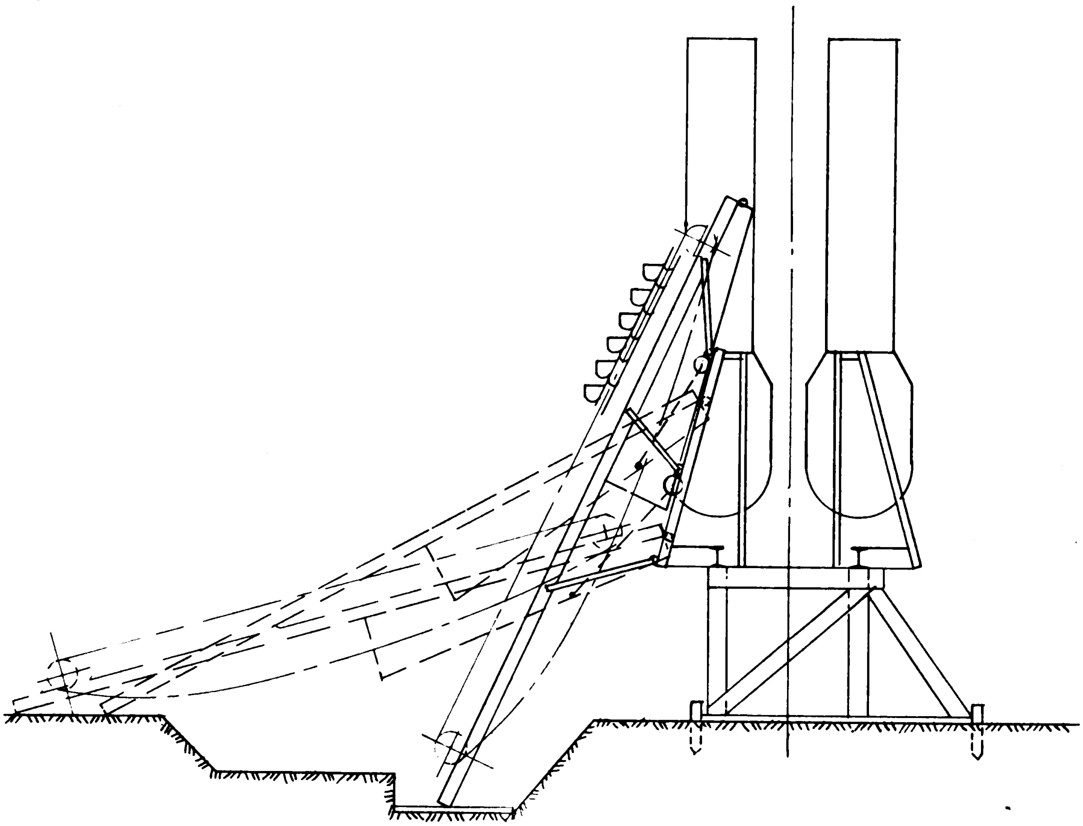


FIG. 43 - SEQUENCE OF POSITIONS ASSUMED

BY COLD ELEVATOR IN HOISTING PROCESS.

support angle are provided for this purpose. With the arms properly aligned, bolt the ends of the arms to any one of the series of holes, (7) Fig. 41, that match. Before installing the upper push arm assembly, the hoist extension frame (1) Fig. 42, must be removed. The extension is used only for erection purposes and must be removed before the upper push arms and discharge spout can be installed. Proceed in the same manner for installing the upper push arm (8). The upper push arms bolt to a hole (8), Fig. 41, in the elevator frame, a few inches below the headshaft.

7. Installing Discharge Spout-

The discharge spout consists of two sections, one section (9) Fig. 41, comprising the spout that directs the aggregate into the drum nearest the cold elevator, and the other section (10), comprising the section that directs the aggregate into the drum furthest from the cold elevator. Bolt the first section (9) in place as shown. Attach the section (10), in place by inserting hinge rod through points (11) and (12). Raise or lower the spout as necessary to obtain proper position in relation to the dryer charging hopper, then insert bolt through matching holes in elevator return housing and upper end of chute section, as shown.

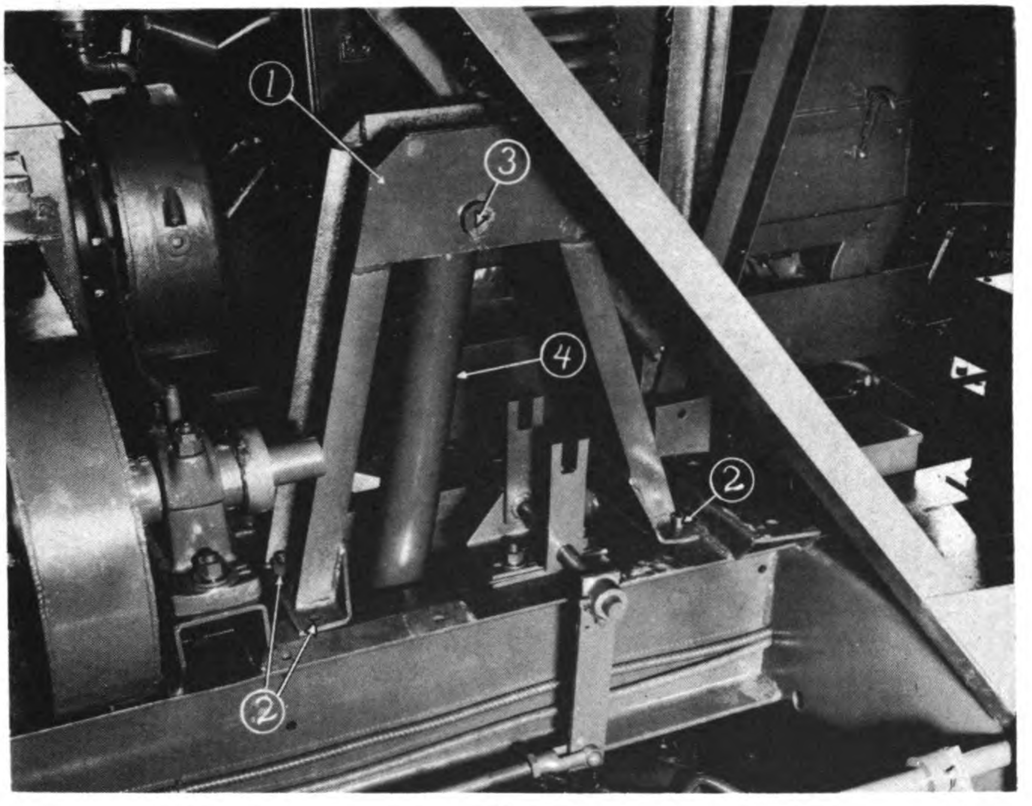


FIG. 44 - HYDRAULIC HOIST "A" FRAME SUPPORT .

8. Installing Cold Elevator Extension Drive Shaft-

When the dryer is set up for travel dryer operation, the "A" frame supports for the hydraulic rams are installed in place as shown in Fig. 44. When the dryer is set up for central plant operation the ram support frame (1), must be removed before the elevator driveshaft extension can be installed. To remove the ram support frame, first make sure that the weight of the dryer is either borne by the latch dogs on the towing frame or by the front end cribbing. Release the hydraulic pressure in the rams. Remove the bolts (2), at the base of the "A" frame that secure it in position. Remove the pin (3) at the top of the "A" frame that extends through the top of the hydraulic plunger. The "A" frame can then be removed. The hydraulic ram assembly (4) need not be removed, but should be moved away from the shaft extension and secured by wire so that it will not interfere with the shaft or the elevator drive chain. Refer to Fig. 45. Lift the driveshaft extension (1) into position for installing, insert the key in keyway of driveshaft and slide the hub (2), of the extension shaft universal joint onto the driveshaft. Guide the slotted ends of the shifter fork (3) over the ears of the shifter yoke (4) as shown. Insert sufficient shims (5) under bearing (6) to make the extension shaft level, insert bolts (7), in bearing base and tighten slightly. Move the bearing end of the shaft toward or away from the engine, as necessary to square up the shaft transversely. Turn down bearing bolts tight.

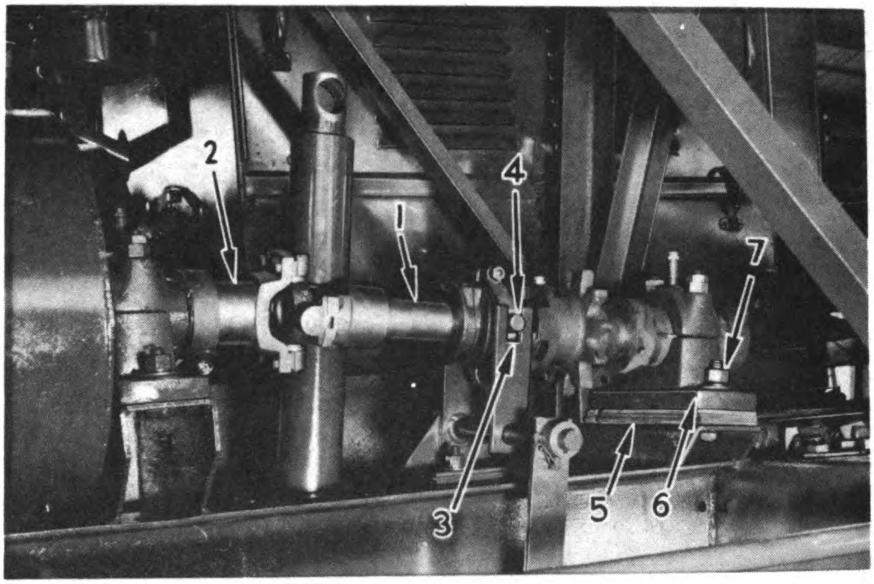


FIG. 45 - "COLD ELEVATOR EXTENSION DRIVESHAFT.

9. Installing Cold Elevator Drive Chain- Refer to Fig. 46

Slack off nuts on spring loaded drive chain take-up idler (1). Make sure the driven sprocket on elevator headshaft and driving sprocket on elevator drive extension shaft are in correct alignment. Wrap drive chain (2) around sprockets, connect and tighten idler till no slack remains in the chain. Install drive chain guard as shown (3).

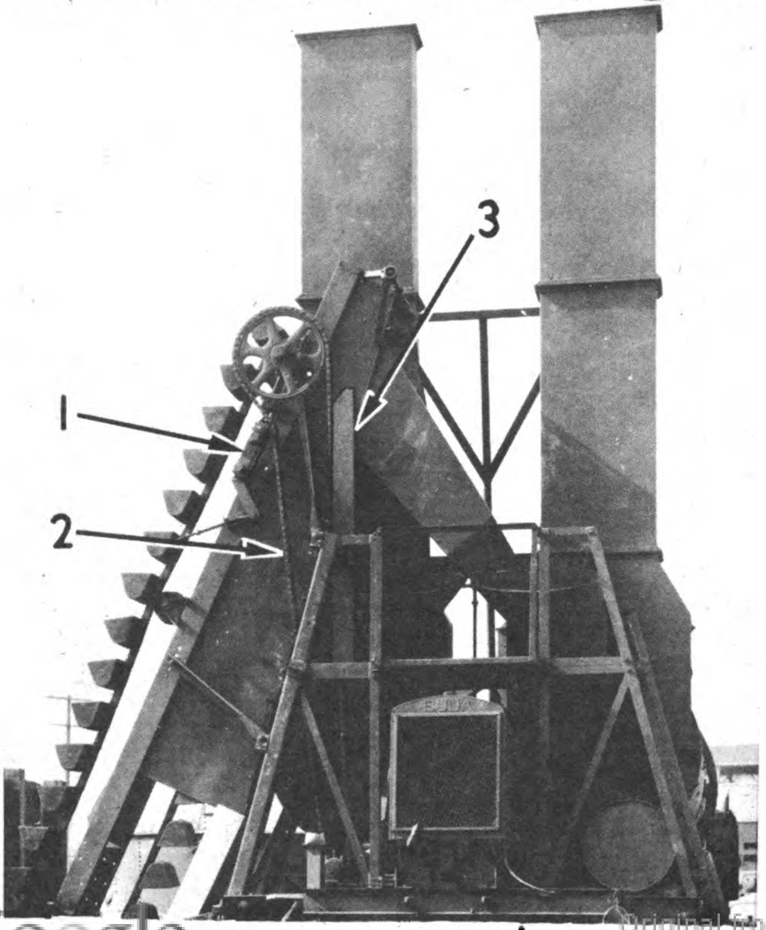


FIG. 46 - "DRYER CHARGING END SHOWING ERECTED POSITION OF COLD ELEVATOR WITH DRIVE CHAIN INSTALLED."

Dig pit for reciprocating feeder and for cold elevator foot end using dimensions as shown in Figure 46 A.

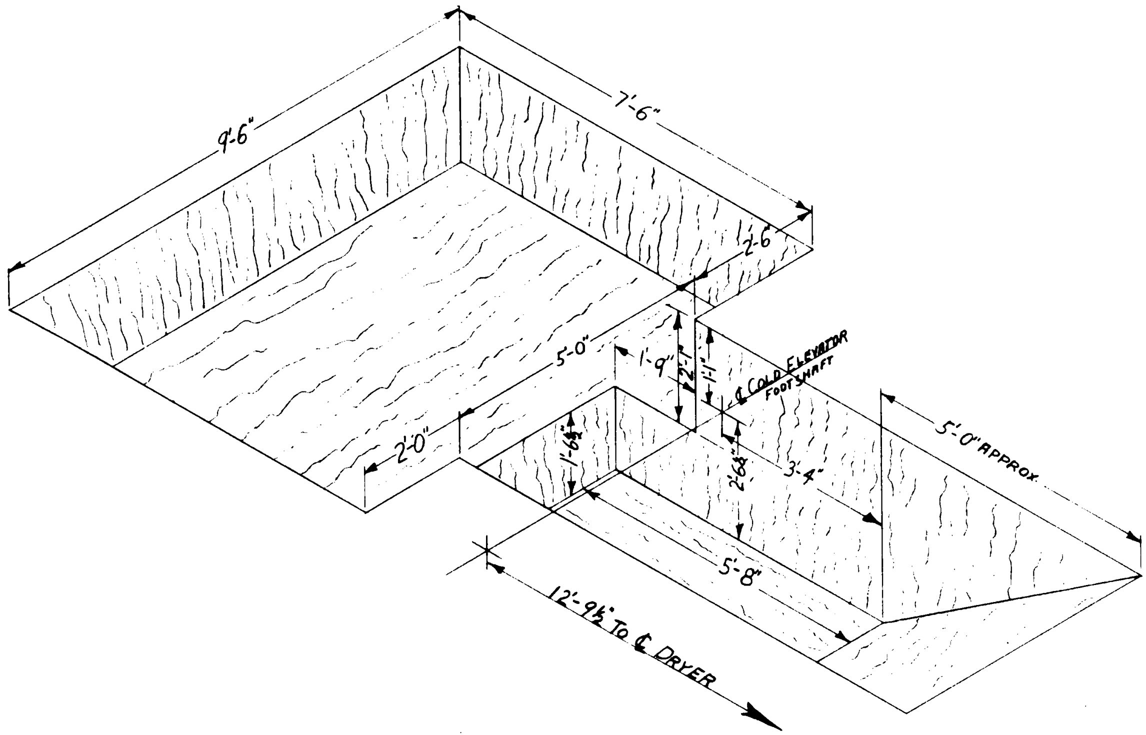


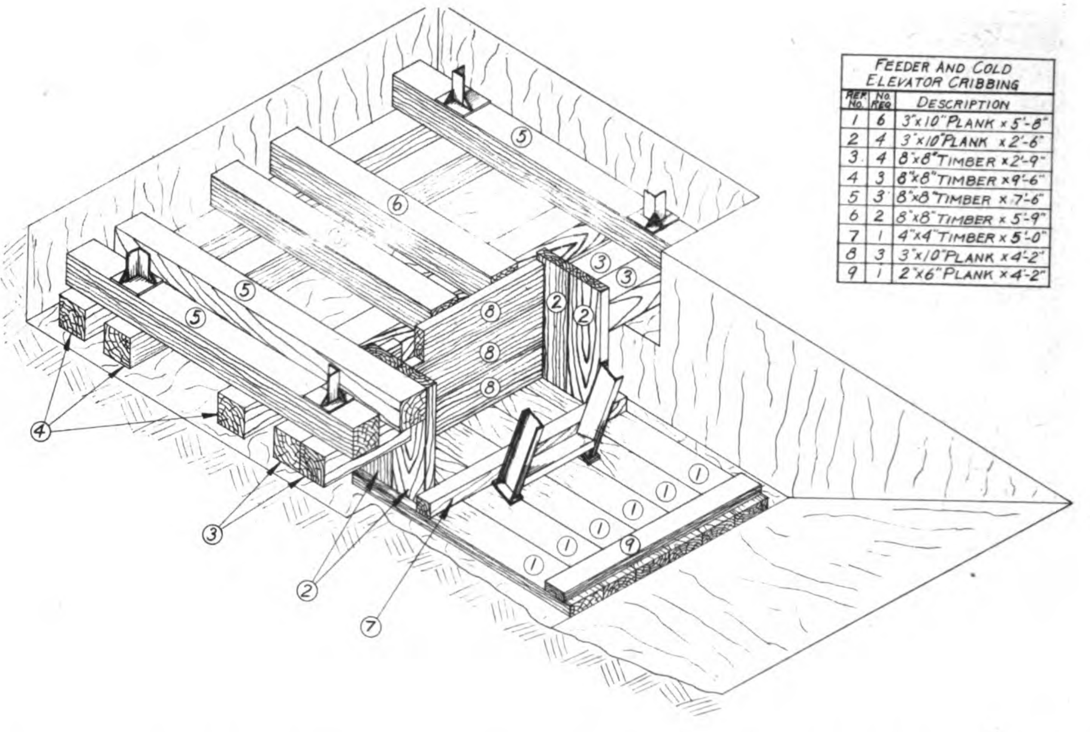
FIG. 46A - DIAGRAM WITH DIMENSIONS FOR USE IN DIGGING PIT FOR RECIPROCATING FEEDER AND COLD ELEVATOR. (This diagram to be used in conjunction with drawing Fig. 4 Asphalt Plant Erection and Operation Book.)

ERECTION OF RECIPROCATING FEEDER

The reciprocating feeder is erected as follows:

1. Building Feeder Cribbing

Refer to feeder cribbing diagram, Fig. 47. Construct the cribbing as shown using the timber members as shown in the bill of material. Nail all pieces together to form a rigid structure.



FEEDER AND COLD ELEVATOR CRIBBING

REF. No.	No. REQ.	DESCRIPTION
1	6	3"x10" PLANK x 5'-8"
2	4	3"x10" PLANK x 2'-6"
3	4	8"x8" TIMBER x 2'-9"
4	3	8"x8" TIMBER x 9'-6"
5	3	8"x8" TIMBER x 7'-6"
6	2	8"x8" TIMBER x 5'-9"
7	1	4"x4" TIMBER x 5'-0"
8	3	3"x10" PLANK x 4'-2"
9	1	2"x6" PLANK x 4'-2"

FIG. 47 - BLOCKING FOR RECIPROCATING FEEDER, COLD ELEVATOR AND FEEDER HOPPER.

2. Placing Feeder

Move the feeder into position so that feeder frame is supported by the two 8" x 8" timbers (6), and the inner of the two 8" x 8" timbers (5). Shift the feeder as necessary to line up the sprocket on the feeder crankshaft with the drive sprocket on the cold elevator footshaft. Move the feeder toward or away from the cold elevator until the distance from the centerlines of the elevator footshaft and the feeder crankshaft is approximately 3' x 1".

3. Connecting Push Arms

Connect the feeder push arms (1) and (2) as shown in Fig. 48. The feeder end of push arm (1) has a clevis type end and connects to the feeder frame by a pin that extends through the clevis and bracket on the feeder frame. The cold elevator end of push arm (1) straddles the footshaft bearing at the drive sprocket end of the footshaft. Extend or shorten the push arm as necessary until all slack is removed between the elevator and the feeder, then tighten lock nut. Push arm (2) is installed in the same manner except that the elevator end of this push arm is also of the pin and clevis type and connects to the elevator frame (3) below the footshaft bearing on that side of the elevator.

4. Installing Guard Plate (See Fig. 49)

The guard plate (1) and (2) consists of two sections, section (1) of which attaches to the feeder frame and section (2) of which attaches to the cold elevator frame. The two sections bolt together at the point of overlap. First bolt section (1) in place as shown, making sure that the crankshaft seal (3) is between the plate and the crankshaft sprocket. A large slot in the section allows the plate to fit over the crankshaft and extend to the feeder frame. Section (2) attaches to the cold eleva-

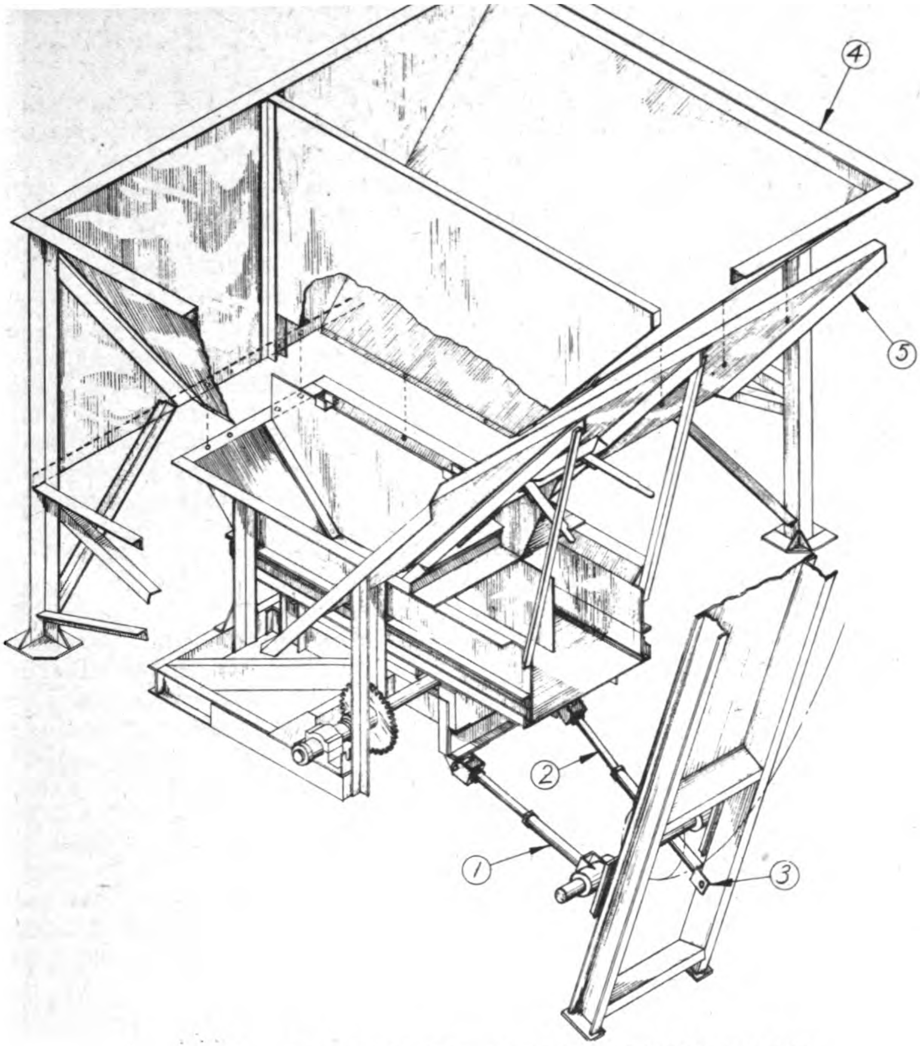


FIG. 48 - POSITION OF RECIPROCATING FEEDER AND HOPPER IN RELATION TO THE COLD ELEVATOR.

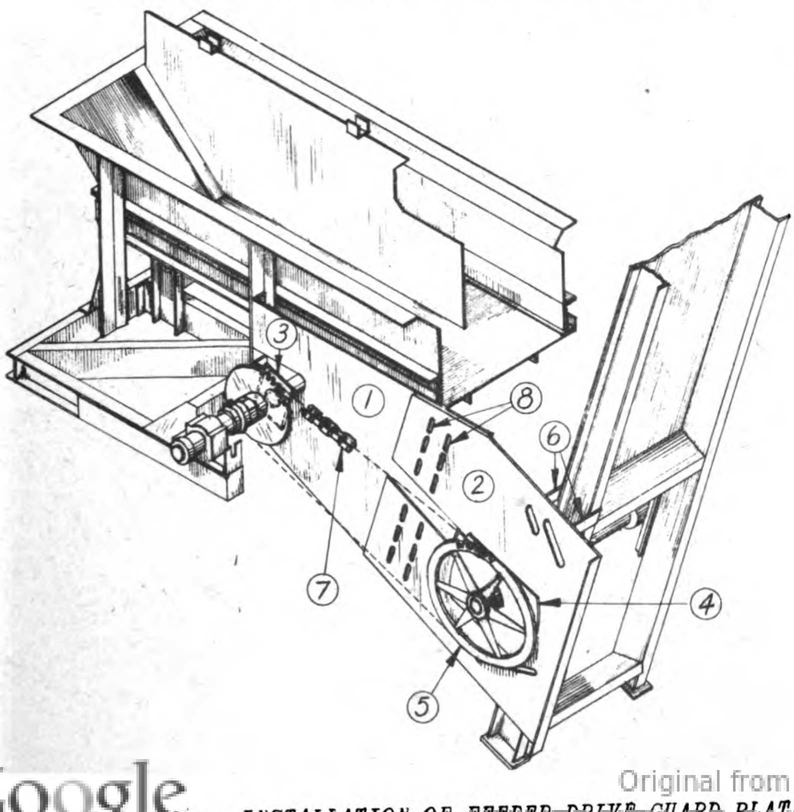


FIG. 49 - INSTALLATION OF FEEDER DRIVE GUARD PLATE.

tor frame by means of four angle clips (6). Slotted holes in the plate allow considerable leeway for adjustment vertically and longitudinally. Do not insert any bolts at the point of overlap (8) until after the chain guard is installed. Do not tighten the bolts that secure the two sections in place.

5. Installing Drive Chain (See Fig. 49)

Before installing drive sprocket (5) on elevator shaft, slip chain guard seal (4) on the shaft with the "pillbox" side of the seal toward the footshaft bearing. Slip sprocket (5) on shaft with longest part of the sprocket hub toward the footshaft bearing, insert key and tighten set screws. Wire set screws to prevent them from turning. Wrap drive chain (7) around driver and driven sprockets and connect. Leave $\frac{1}{4}$" to $\frac{1}{2}$" sag on the slack run of the chain. If chain is too loose, extend push arms an equal amount until chain is in proper tension.

6. Installing Chain Guard (See Fig. 50)

The chain guard that encloses the drive chain consists of two sections (1) and (2). Move section (1) up into position from the under side of the drive chain and sprockets. Make sure the seals (3) and (4) are inside the guard, and that the lower part of elevator footshaft seal (4) fits into the groove (5) in the guard. Lower section (2) of the guard down from above and bolt the two sections together at the flange extending around the guard. Bolt seal (3) in place by inserting 3/8" bolts through the guard from the outside. These bolts engage nuts welded to the seal. Make sure the guard is centered so that the sprockets and chain clear the inside of the guard at all points, then secure the guard at points (6) and (7). Bolts can now be inserted at the point of overlap (8) in the guard plate and all bolts securing the guard plate tightened.

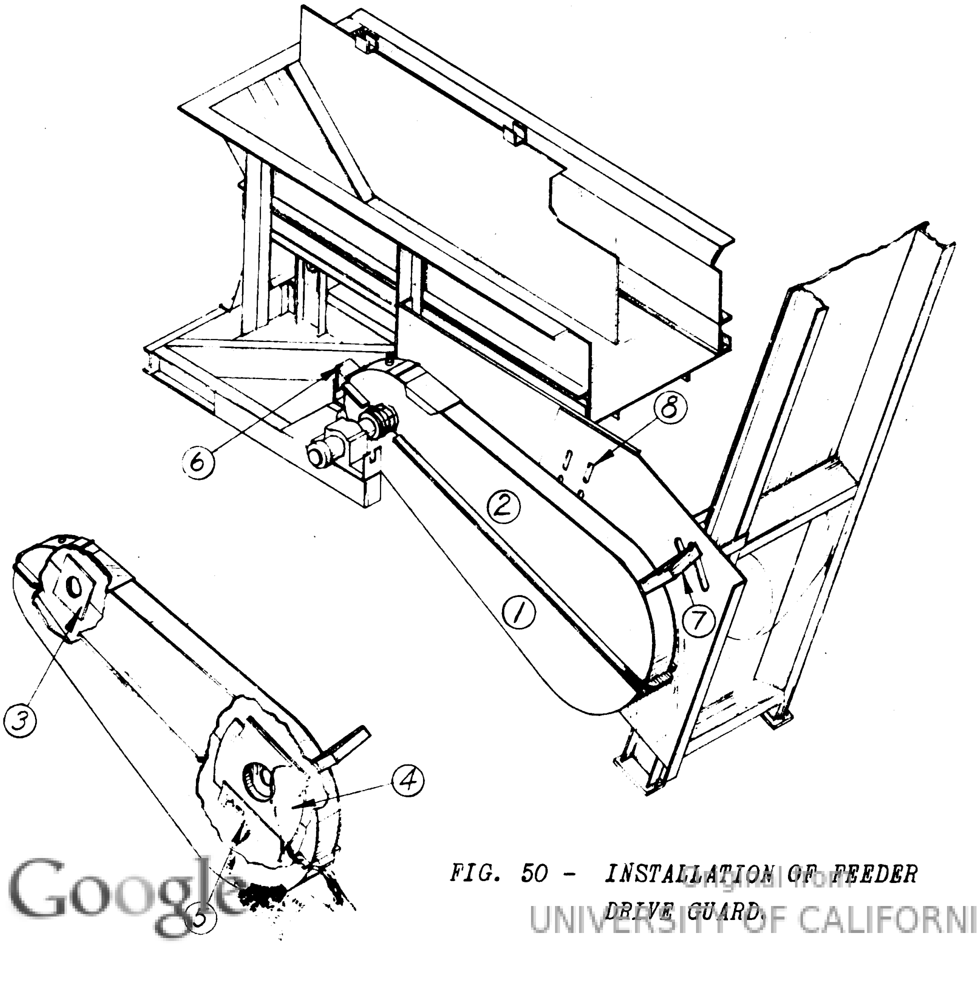


FIG. 50 - INSTALLATION OF FEEDER DRIVE GUARD.

HOPPER OR BULKHEAD?

Up to this point the erection instructions are standard, and apply to either the hopper or bulkhead setup. From this point on, however, the instructions will apply either to the bulkhead erection, or hopper erection, depending upon which setup is to be used.

Erection of Feeder Hopper

The gate section (5) Fig. 48, of the feeder is adaptable to either the bulkhead or hopper setup. It is mounted as shown, in all cases except when dismantled for transporting. The hopper base (4) consists of a welded unit including three hopper sides, divider plate, support legs and bracing. When moved in position over the feeder, the gate section constitutes the fourth side of the hopper and the bottom of the hopper bolts to the top flange of the reciprocating feeder. When in position on the cribbing support, see Fig. 47, the hopper legs are located in position as shown.

Caution: After locating the hopper in position, be sure that the entire weight of the hopper is borne by the four legs in contact with the cribbing, and that none of the weight of the hopper is borne by the feeder.

Installation of Hopper Extension Sections

The hopper extension sides and divider plate bolt to the top flange of feeder hopper after the hopper has been located in position. The extension sides and divider plate are shown in Fig. 51.

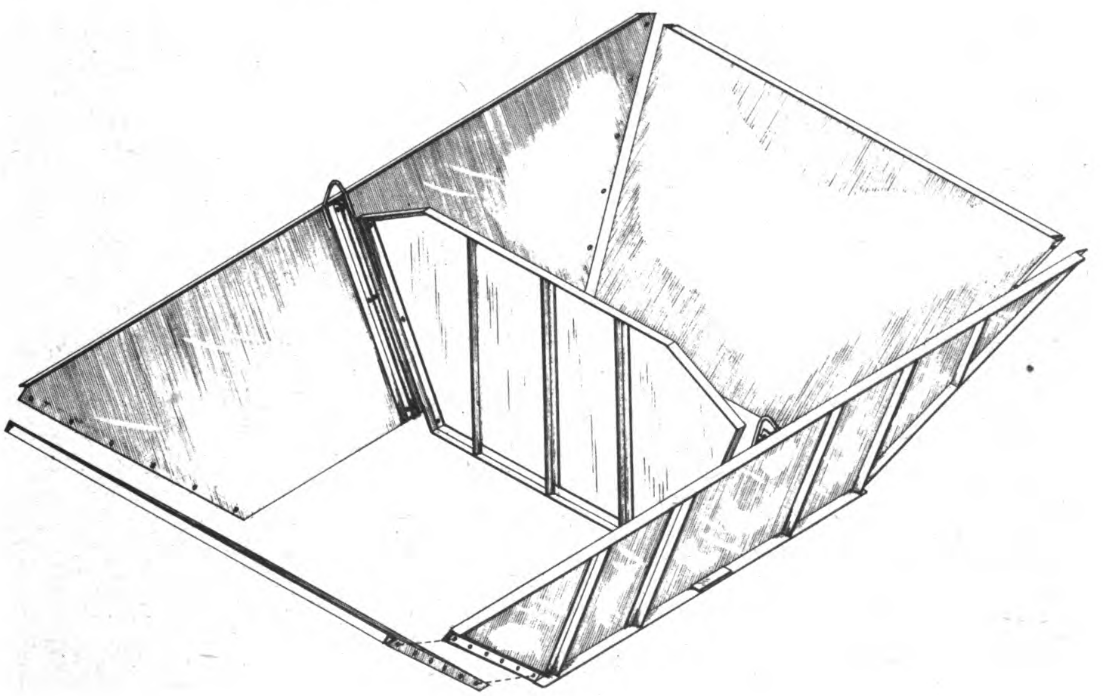


FIG. 51 - HOPPER EXTENSION SIDES AND DIVIDER PARTITION.

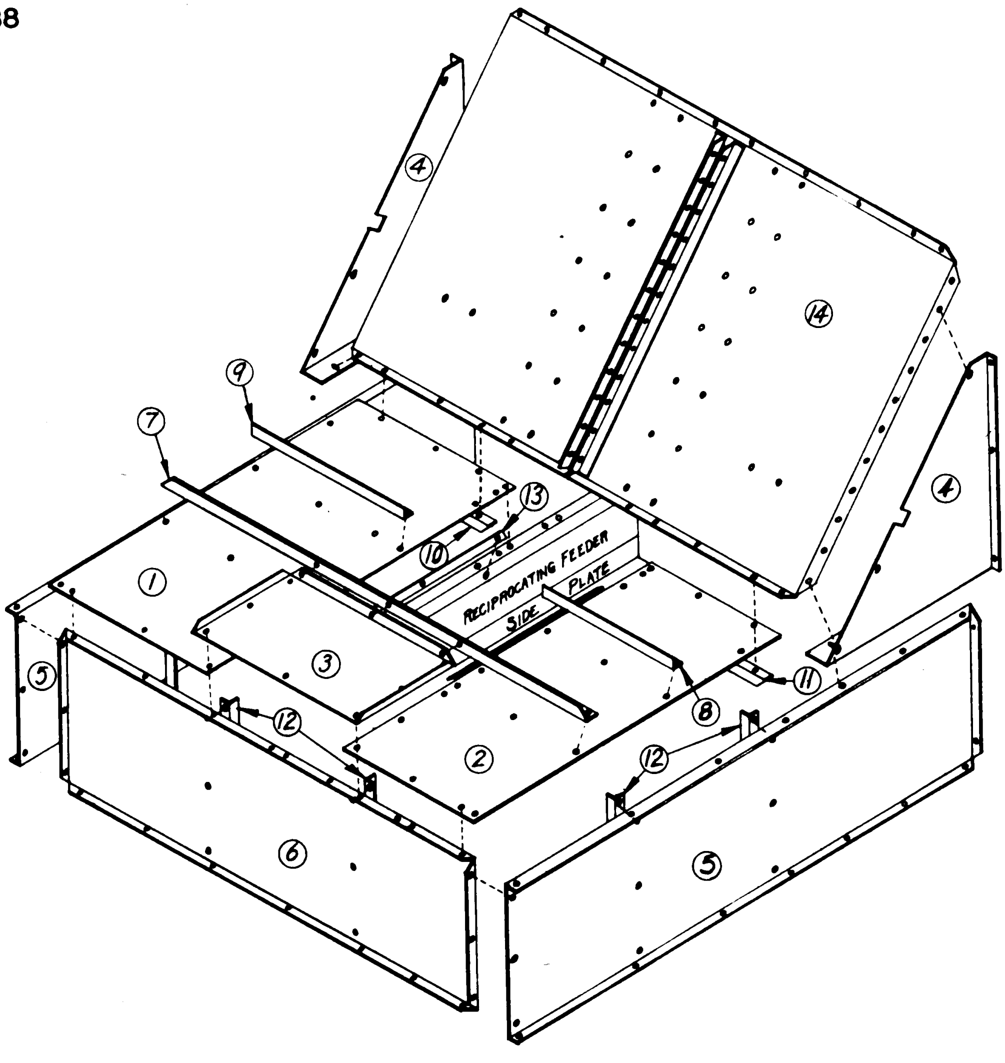


FIG. 52 - ASSEMBLY OF RECIPROCATING FEEDER HOUSING (FOR USE WITH BULKHEAD ONLY).

Erection of Feeder Housing and Bulkhead

. When the bulkhead setup is used for feeding the reciprocating feeder, a housing is first built around the feeder, Fig. 52, to prevent aggregate from getting into or around the feeder. This housing is erected from sections of steel plate and reinforcing angles bolted together to form a rigid housing. The bill of material for the complete housing is as follows:

Ref. No. On Fig. 52	No. Req.	Description
(1)	1	10 gauge plate, 2' 9-1/4" x 5' 6-7/8"
(2)	1	" " 2' 3-1/4" x 5' 6-7/8"
(3)	1	" " *1' 11-1/8" x 2' 11"
(4)	2	" " *3' 0" x 3' 8-9/16" Right & Left
(5)	2	" " 2' 7-3/4" x 8' 7-3/8"
	1	" " 2' 7-3/4" x 7' 5-1/2"

(7)	1	2 1/2" x 2" x 1/4"	Angle	7'6" lg.
(8)	1	2" x 2" x 1/4"	"	1'6" lg.
(9)	1	" "	"	2' 3-1/4" lg.
(10)	1	" "	"	2' 9-1/4" lg.
(11)	1	" "	"	2' 3" lg.
(12)	6	" "	"	2' 3-7/8" lg.
(13)	2	3/16" x 1"	Bar	2' 9-1/2" lg.

Sufficient ½" bolts, nuts and lock washers for erection

* Dimensions include flange bends.

By referring to dimensions of each piece shown above and to the illustrations in the erection diagram, Fig. 52, the pieces listed can be readily identified.

Assembly of Feeder Housing

The procedure for assembling the feeder housing is as follows:

1. Remove the two bolts that secure the lower flange of the sloping gate section (14) Fig. 52, to the top flange of the feeder sides.

2. Place the housing top plate (1) and (2) in position with the inner edge of each plate lapping the top flanges of the feeder sides. The ends of the top plates (toward the cold elevator) extend under the lower flange of the sloping gate section (14) with the row of holes in the end of each top plate matching holes in the lower flange of the sloping section. Insert bolts through the flanges from above, extending down through holes in ends of plates (1) and (2). Place angles (10) and (11) from below with the holes in the angles fitting over the bolts just inserted. Put nuts and lock washers on the bolts but do not tighten.

3. Place angles (7), (8) and (9) in position and insert all bolts except the last hole in each angle at the end extending toward the outer sides of the housing. These holes must be left free for installing the side plates.

4. Bolt top plate (3), with three flanged sides, in place as shown. The plate flange toward the cold elevator bolts to angle (7) already installed.

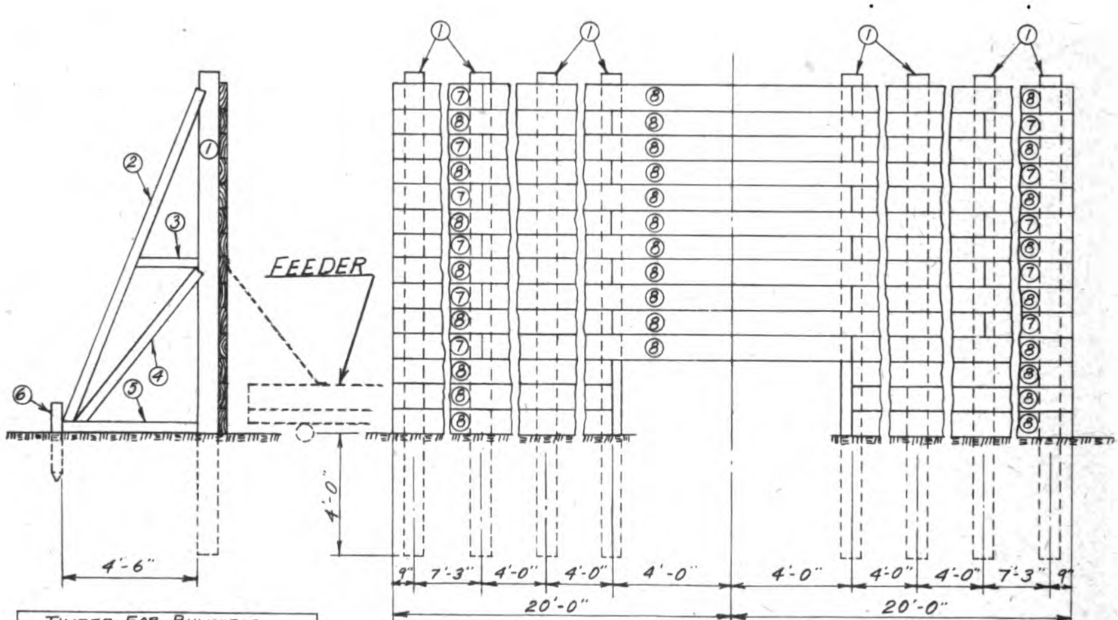
5. Bolt the triangular side plates (4) in position as shown by attaching the edge of the longest side of the plate to the flange at the end of the sloping gate section (14). These plates are right and left, with the 4 1/2" flange at the bottom of each plate extending in toward the feeder.

6. Bolt bars (13) to the beveled area of the top flanges of the feeder sides. These bars cover up rows of holes in the beveled portion of the flange preventing leakage of aggregate through the holes. Before bolting the side sections in place, bolt two angles (12) to the inner side of each plate as shown. These angles serve to strengthen the plates only and serve no purpose in bolting the housing together.

7. Bolt the side plates (6) and two side plates (5) in place as shown. The flanged edges of these plates extend outward. The bottom flanges of all three side sections should bear firmly on the feeder cribbing, or upon pieces of timber placed under each flange. Secure the bottom flanges to the timbers with spikes or lagscrews. It is important that the bottom flanges of the side sections be well supported to take the weight of aggregate over the housing.

Erection of Bulkhead

The construction of the bulkhead is shown in Fig. 53. The bulkhead uprights consist of 8" x 8" timbers extending 4' into the ground. The bracing for the uprights consist of 4" x 4" timbers as shown. The planking for the wall of the bulkhead consists of 3" x 10" members, but 2" planking can be substituted if no 3" plank is available. The bulkhead is laid out so that the bulkhead planking will come flush against the forward (cold elevator) end of the feeder housing. The flanged ends of the feeder housing are bolted to the bulkhead wall.



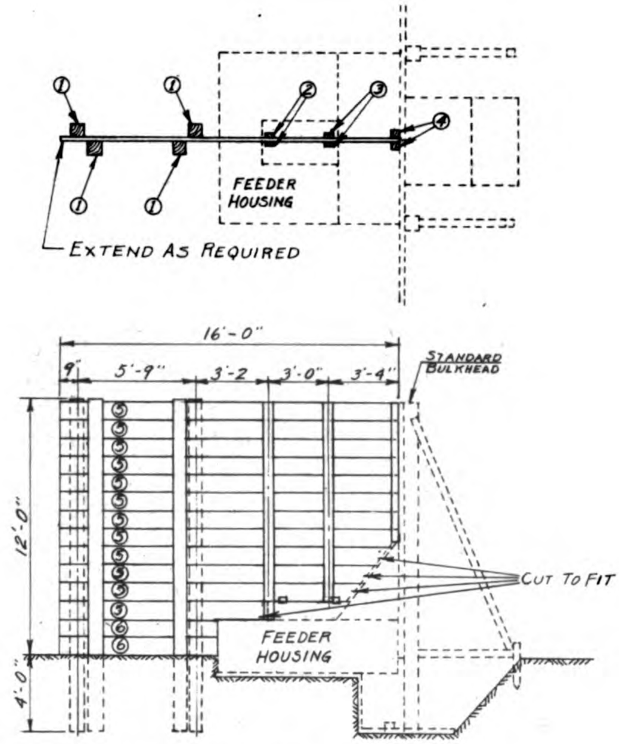
TIMBER FOR BULKHEAD			
REF. NO.	NO. REQ.	DESCRIPTION	
1	8	8"x8"	16'-0"
2	8	4"x4"	12'-0"
3	8	4"x4"	2'-0"
4	8	4"x4"	6'-6"
5	8	4"x4"	4'-6"
6	8	4"x4"	2'-6
7	11	3"x10"	8'-0"
8	28	3"x10"	16'-0"

STANDARD BULKHEAD

FIG. 53 - BULKHEAD ERECTION DIAGRAM.

Erection of Divider Partition

In the event that two sizes or types of aggregate are to be fed to the feeder, the divider partition must be installed in conjunction with the bulkhead to keep the two aggregates separate. The construction of the partition is shown in Fig. 54. The partition may be extended farther than the 16' 0" partition shown, if necessary, to keep the two aggregates apart.



TIMBERS FOR DIVIDER BULKHEAD			
1	4	6"x8"	16'-0"
2	2	2"x4"	10'-0"
3	2	2"x4	9'-2"
4	2	4"x4"	6'-6"
5	12	2"x10"	16'-0"
6	2	2"x10"	7'-6"

FIG. 54 - "BULKHEAD DIVIDER PARTITION ERECTION DIAGRAM."

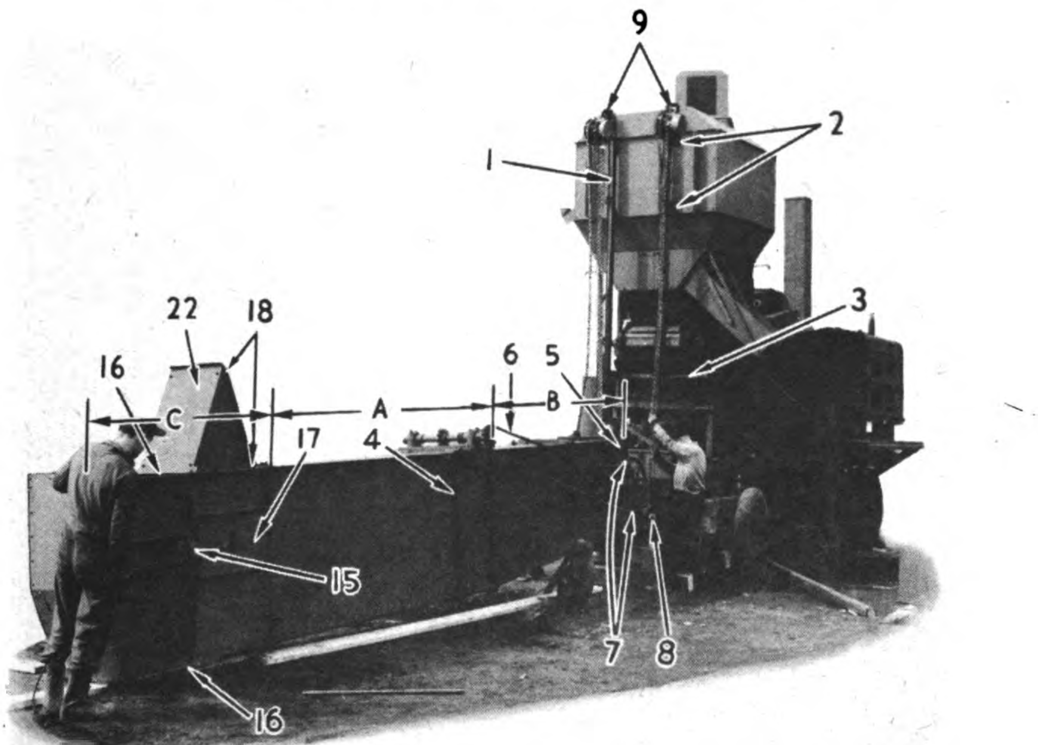
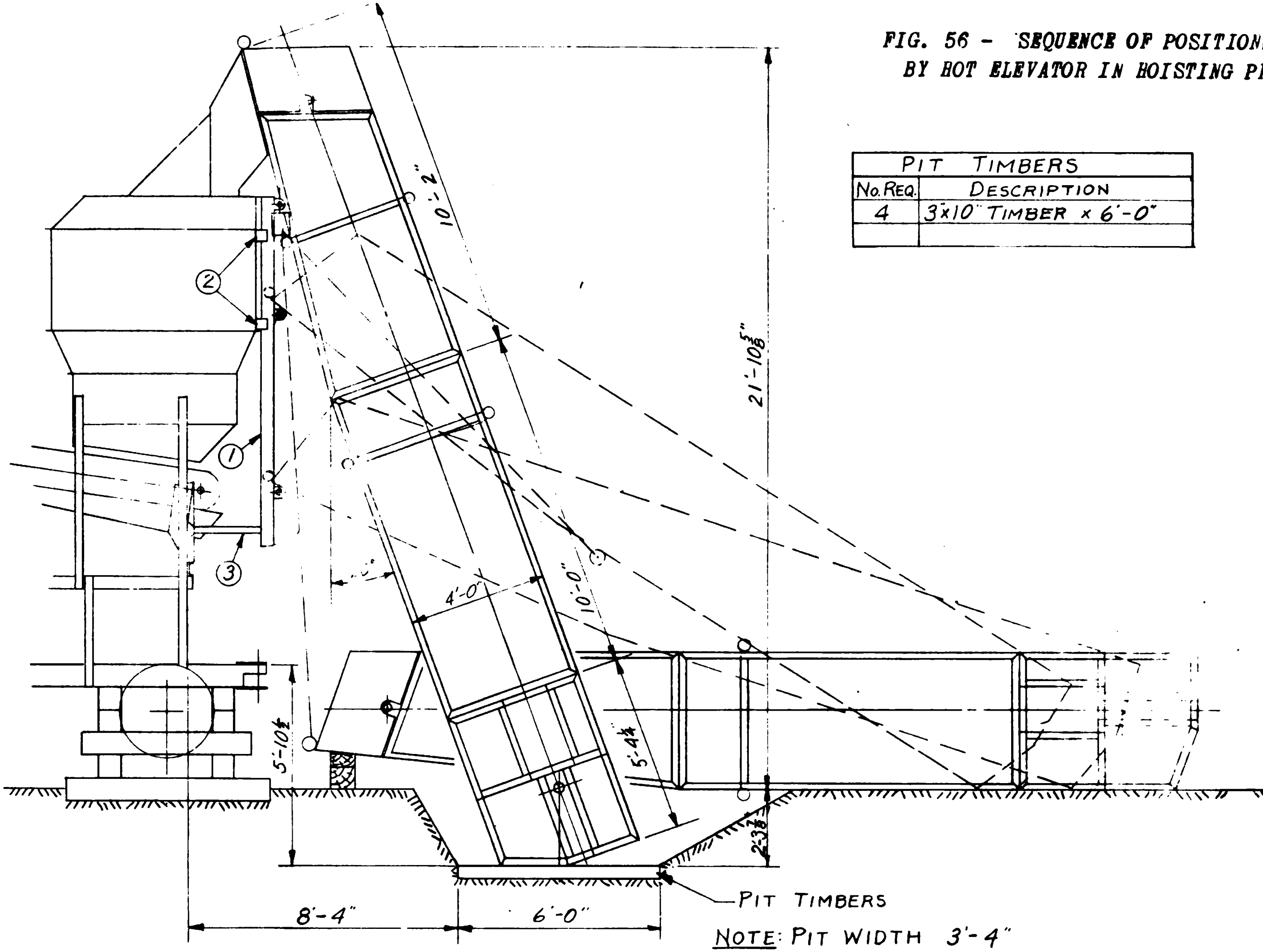


FIG. 55 - ASSEMBLED HOT ELEVATOR READY FOR HOISTING TO OPERATING POSITION

FIG. 56 - SEQUENCE OF POSITIONS ASSUMED BY HOT ELEVATOR IN HOISTING PROCESS.

PIT TIMBERS	
No. Req.	Description
4	3"x10" Timber x 6'-0"



ASSEMBLY AND ERECTION INSTRUCTIONS - HOT ELEVATOR

Pit for Boot

This unit cannot be assembled and erected until the Model 848 Mixer is located in its fixed operating position and the 2' deep pit for the Elevator Boot has been excavated. Locate this pit as per dimensions, Fig. 56, checking location and depth to the Mixer. Use planks for the bottom of pit, as indicated, to assure proper footing under the Boot.

Elevator Guides

Mount the two Guide Channels (1) Fig. 55, in position on the Mixer frame and hopper. These bolt to the hopper with clips (2) and structural angle iron frame (3). See Figures 55 and 56.

Intermediate Section A (Fig. 55)

Lay out planking on the ground and over the pit on which to assemble the elevator and to facilitate skidding into position when assembled.

Locate Section A in position in line with the Guide Channels on the Mixer, but about 4' farther away from the Mixer than indicated on Fig. 55, to allow room for working.

Couple the bucket line in two strands and lay one strand with buckets down, and bucket bottoms facing the Mixer, into Section A from the Section C end so that the end of the bucket line comes just to the end of Section A at the joint for Section B.

Head Section B (Fig. 55)

Remove the circular inspection door on Hood (5) on this section to expose the headshaft for completing installation of the bucket line. Tie a heavy rope, at least 50 foot length, to the end of the bucket line in Section A and run this rope under and over the headshaft as Section B is brought into position for bolting to Section A. Before bringing Sections A and B together for bolting run the rope over the bucket line idler at (4) and out the end of Section A. Bolt Section B securely to Section A.

Couple the other bucket line strand to the one partially installed. With the rope, pull the bucket line around the head sprocket and through Sections A and B until the two ends project equally from Section A. A truck may be used to pull the buckets into position. Operate the truck slowly and carefully.

Mount the drive chain (6) from the countershaft to the headshaft. Wire securely around the drive chain and drive sprocket rim at the two points (7) to prevent the bucket line from shifting during the process of raising the elevator.

Bolt inspection cover on Hood (5) securely in position on Head Section B.

Boot Section C (Fig. 55)

Bring this section into position as shown, and bolt to Section A. The chain and buckets are to be left free for coupling later.

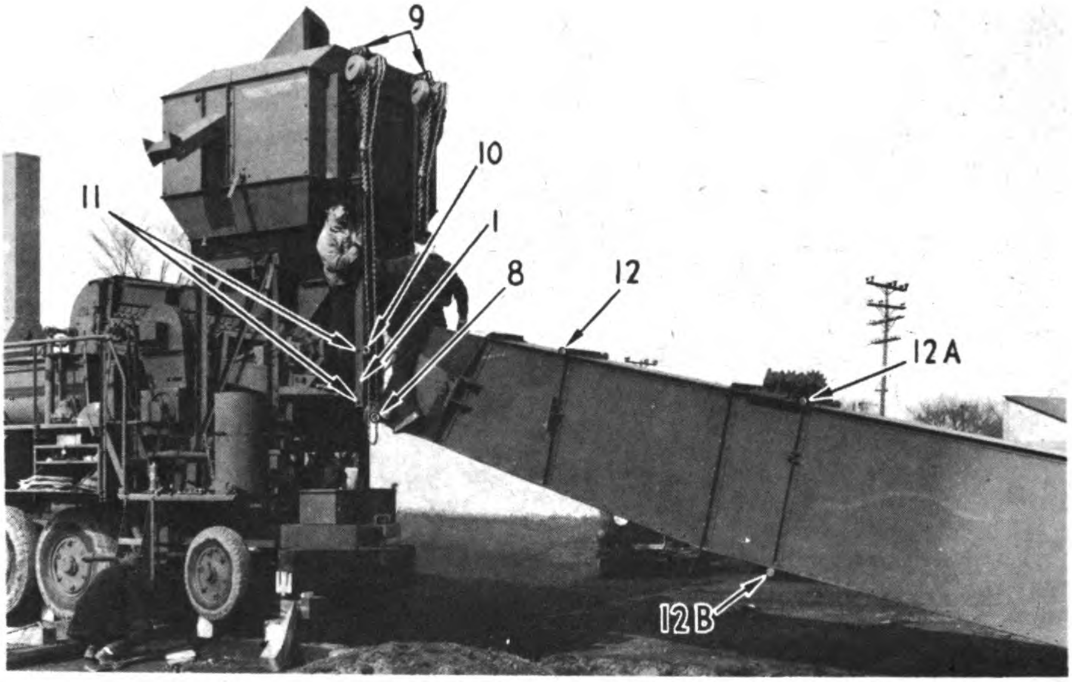


FIG. 57 - HOT ELEVATOR MIDWAY IN HOISTING PROCESS.

FIG. 58 - "HOT ELEVATOR IN OPERATING POSITION WITH PUSH ARMS AND DRIVE CHAINS INSTALLED.

HOISTING ELEVATOR TO OPERATING POSITION

With Crane

If a crane is on hand having adequate capacity to lift 5000 lbs. to the height necessary, the hoisting of the elevator will be greatly simplified. Use the roller (12) Fig. 57, for attaching chain slings for crane. It is not necessary to use the rollers (8) and guide channels (1) for this method of erection.

With Chain Hoists (If crane is not available)

a. Skid the elevator toward the Mixer so that rollers (8) Fig. 57, are directly under guide channels (1). Hook chain hoists into holes provided at (9).

b. Hook the extra chain slings available around the shaft, just back of rollers (8), on both sides. Extend chain on hoist far enough to hook into rings on end of chain slings.

c. Now raise the elevator so that rollers (8) go between flanges of guide channels (1). Raise the elevator to the maximum permitted by the chain hoists and place a bar through one set of holes (10) to carry weight of elevator while unhooking chain hoist, or place a bar through holes (11) in web of channels on which rollers may rest while chain hoists are being changed.

d. Extend hooks on chain hoist and use trunnions at (12) (12A) or (12B), as needed, to hook hoists for further raising. If necessary to carry weight of elevator while changing hoist hooks, follow instructions (C) above. When the elevator approaches its operating position, the rollers will come out of the channel guides (1) at their upper end.

e. Mount braces (13) and discharge chute (14) as indicated, Fig. 58. In locating elevator in final position it may be found necessary to use shim boards under the Boot Section in the pit.

FINAL ASSEMBLY

a. Couple the bucket line chain in the Boot Section C, Fig. 55, with takeups (15), all the way up. Tighten the chain with takeups, so that is is snug, and be sure that the takeups are adjusted down an equal distance on each side. Sliding cleanout doors at (16), and inspection door (17) are provided to facilitate work on this chain.

b. Bolt the Boot Hopper (22) to Boot Section C. Two angles are provided which bolt to holes in Boot Hopper at (18), to accomodate the sliding hopper cover which is furnished. The purpose of this cover is to prevent flooding of the Boot Section with material from Dryer, in the event the elevator stops due to an accident which breaks the bolt on the head drive sprocket. The angles for this cover may be extended to either side, to suit the conditions on any plant set-up.

DRIVE CHAIN FROM DRYER

Caution: Be sure that wires around chains and head drive sprocket rim are removed.

This drive chain is shown at (19) on Fig. 58. The Dryer must be carefully lined up with the Elevator for this drive from the sprocket with jaw clutch between Dryer Drums. The chain runs over idler sprockets at (20), on the Dryer, to the sprocket on elevator jackshaft (21).

General Towing Instructions

To tow the dryer, lower the exhaust stack and dismantle light brackets and any other parts necessary to reduce the height or width.

Set the parking brakes and jack up the front end, using the hydraulic jacks furnished with the machine, until the front axle with tongue attached can be rolled into position under the turntable support. Insert the pin through the turntable and secure the collars on each end. Then remove the jacks.

Back the towing truck into position and connect the dryer tongue to the pintle. Connect the service air brake line and emergency air brake line to their proper connection at the front of the machine. After brake connections are made, release the parking brake. It is generally good practice to try the air brakes before starting out for any distance to be absolutely sure they are functioning properly.

Air supplied by the tractor unit thru the emergency air line will fill the small tank on the side of the dryer. The cock on the bottom of this tank should be opened for an instant to test for air pressure and then closed. As long as the air lines are connected, the air in this tank will not function; but when the air lines are broken, either accidentally or in disconnecting, an automatic valve will release the air causing the brakes to set. To release the brakes, the cock in the bottom of the tank must be opened.

(See Accessory Section for adjusting brake with slack adjuster.)

Generally, after a period of time, each tire will require air to bring it up to proper inflation pressure. Before towing, the tires should be checked for air pressure, 75# in rear and 70# in front. As noted on the plate attached to each machine, they should not be towed over 10 miles per hour. Care should be taken in watching for road clearances, sharp turns, etc.

The Cold Elevator, Reciprocating Feeder, Feeder Hopper, Cribbing, Bulkhead and other miscellaneous parts are not carried with the Dryer proper and must be transported by trailer or truck.

MAINTENANCE MANUAL

CONTENTS

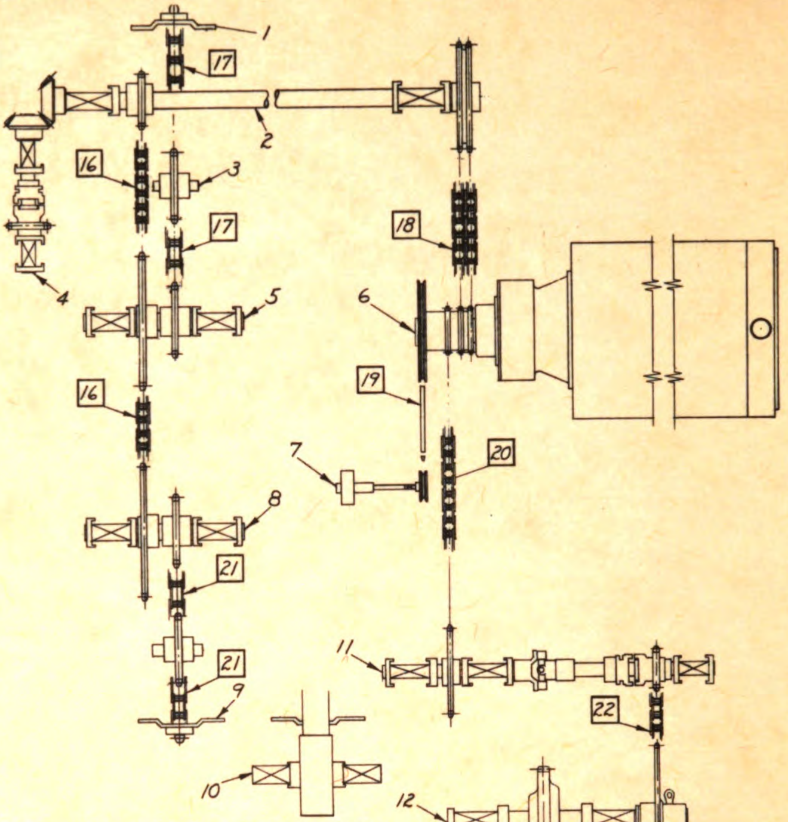


FIGURE 100

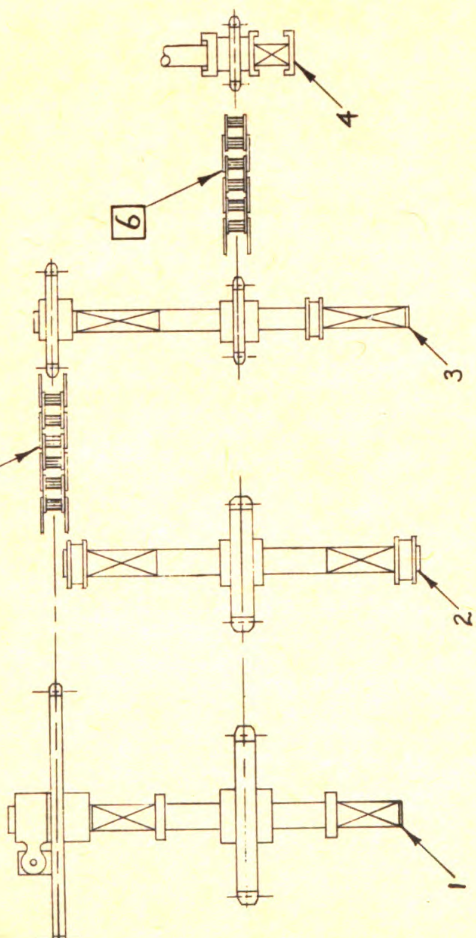


FIGURE 101

Power Transmission Charts (Dryer, Cold Elevator, Feeder)

Shafting Identification and Speeds

		R.P.M
1 & 9	Dryer Drums	9.94
2	Main Jack Shaft	140.0
3	Drum Drive T. U. Idler	56.0
4	Hot Elevator Drive Shaft	140.0
5 & 8	Drum Drive Counter Shaft	56.0
6	Reducer Shaft	350.0
7	Fuel Pump	1292.0
	Engine	1400.0
10	Trunnion Rollers	49.68
11	Cold Elevator Drive Shaft	169.70
12	Hot Elevator Head Shaft	40.58
13	Cold Elevator Bucket Line Idler	
14	Cold Elevator Foot Shaft	40.58
15	Reciprocating Feeder Crank Shaft	68.25

Drive Chain and Belt Identification

16	Drum Counter Shaft Drive Chain
17 &21	Drum Drive Chain
18	Main Jack Shaft Drive Chain
19	Fuel Pump Drive "V" Belt
20	Cold Elevator Drive Shaft Chain
22	Cold Elevator Drive Chain
23	Reciprocating Feeder Drive Chain

Hot Elevator Power Transmission Chart

Shafting Identification and Speed

		R.P.M.
1.	Head Shaft	43.78
2.	Foot Shaft	
3.	Counter Shaft	118.46
4.	Dryer Hot Elevator Drive Shaft	140.0
	Bucket Line Speed 176.52 FPM	

Drive Chain Identification

5.	Head Shaft Drive Chain
6.	Hot Elevator Drive Chain

Main Dryer Units

HOW TO REMOVE ENGINE

1. The oil tight guard (1) Fig. 102 should be removed to facilitate removal of engine. To remove guard proceed as follows: Drain lubricant from oil tight chain guard. Remove section of guard that encloses the pulley (2), which drives burner fuel pump (3). Remove bolts (10), that secure seals (4), to guard. Remove bolts (5), that secure the main section of guard to the guard extension (6), over the cold elevator drive shaft. Remove all guard holddown bolts (7), and lower guard between main frame channels (8).

2. Break chain between speed reducer and jack shaft and chain between speed reducer and cold elevator drive shaft.

3. Remove exhaust pipe (1) (Fig. 103) that extends through top of engine housing.

4. Remove both adjusting bolts (2).

5. Remove all sill hold-down bolts and remove engine.

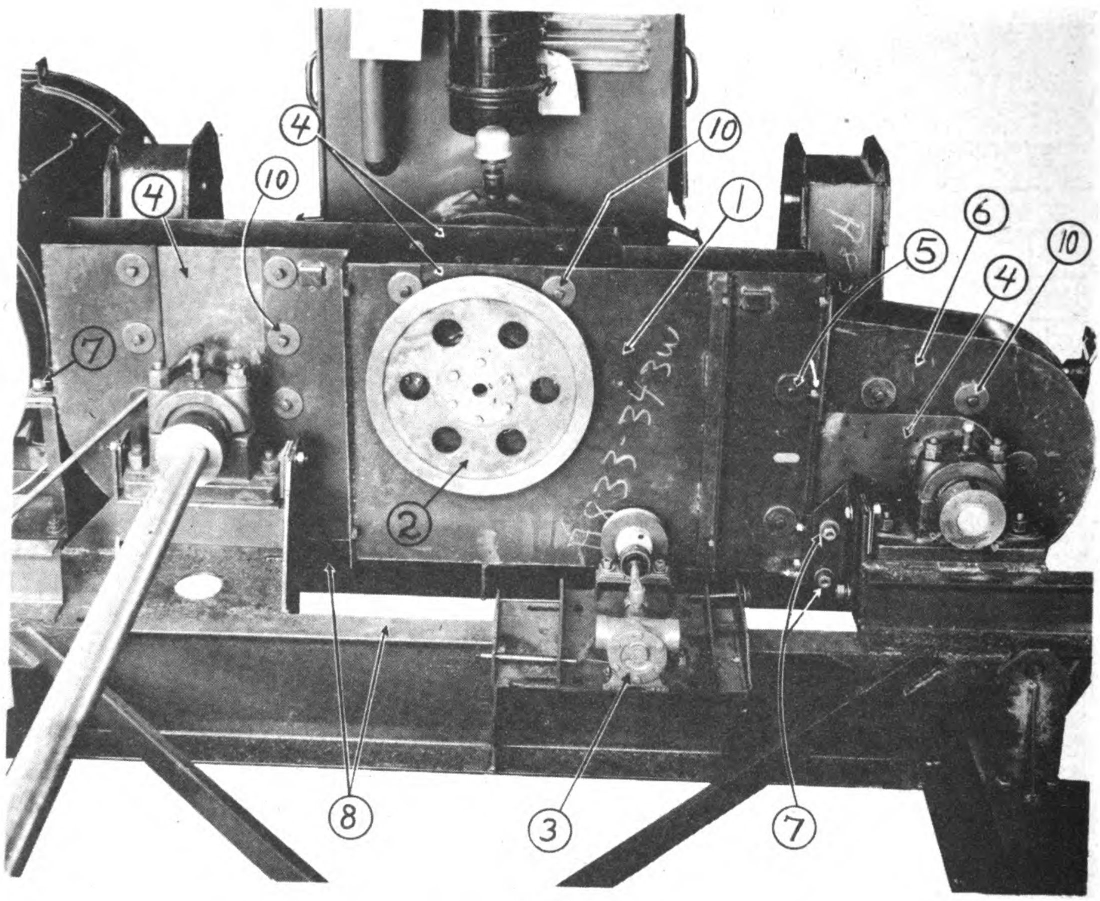


FIGURE 102

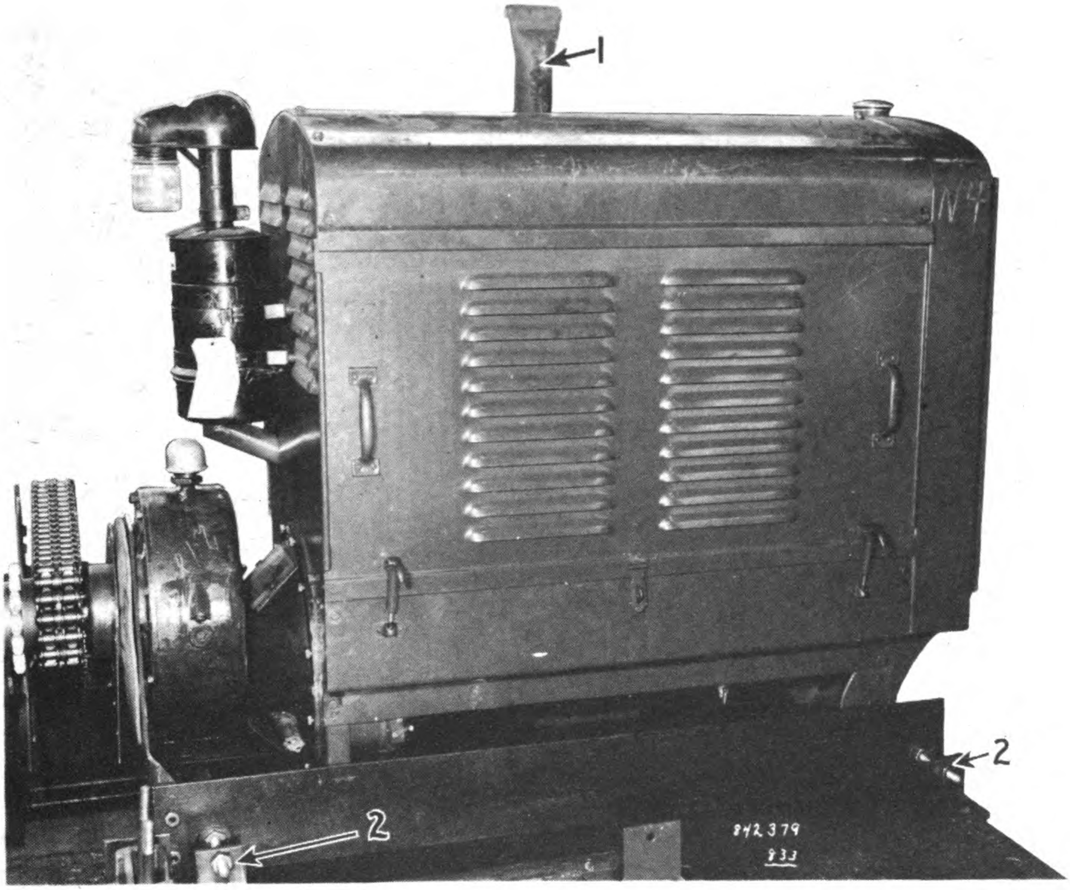


FIGURE 103

HOW TO REMOVE MAIN JACK SHAFT

The main jack shaft should be removed to facilitate stripping. However, the bevel gear end can be stripped without removing the shaft. To strip bevel gear end, remove bolts from bevel gear box (1) Fig. 104 and lower box out of position. Break counter shaft drive chain (2). Remove bearing caps (3) from both ends of the shaft and raise bevel gear (4) end up high enough to permit stripping.

To Remove Entire Shaft Proceed As Follows.

1. The oil tight guard (1) Fig. 102 should be removed first. To remove guard proceed as follows: Drain lubricant from oil tight chain guard. Remove section of guard that encloses the pulley (2), which drives burner fuel pump (3). Remove bolts (10), that secure seals (4), to guard. Remove bolts (5), that secure the main section of guard to the guard extension (6), over the cold elevator drive shaft. Remove all guard holddown bolts (7), and lower guard between main frame channels (8).

2. Remove bevel gear case (1) Fig. 104 at opposite end of jack shaft. This is done by removing gear case hold-down bolts and lowering gear case out of position.

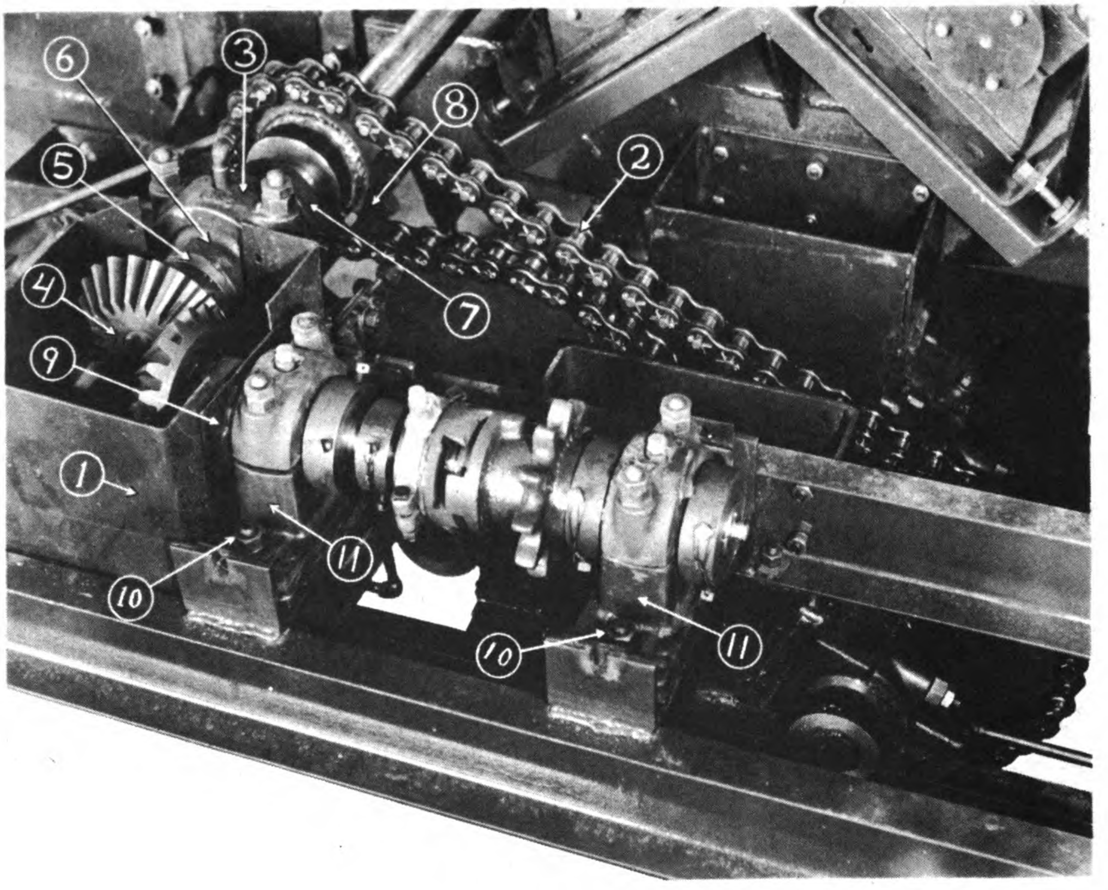


FIGURE 104

3. Break the drive chain (2) between sprocket on jack shaft and drum drive counter shafts.

4. Break drive chain between speed reducer (6) Fig.100 and sprocket on jack shaft (2).

5. Remove caps from bearings on both ends of shaft.

6. Raise the bevel gear end of shaft and remove following parts; bevel gear (4), Fig. 104, bronze washer (5), bearing (6), collar (7), and sprocket (8).

7. Raise opposite end of shaft high enough for sprocket to clear guard and jockey shaft back toward discharge end of Dryer far enough so it can be pulled out of position from side of Dryer. The sprocket can be removed before the shaft is jockeyed out of position to simplify removing shaft.

NOTE: The jack shaft can be removed without stripping any parts from shaft if the drum has been removed for any reason.

How to Strip Jack Shaft

1. Parts(1)(Fig.105),(2),(6),(7)are removed before the shaft is removed.

2. Loosen set screws in sprocket hub (10), remove sprocket.

3. Loosen set screws in collar (9), remove collar.

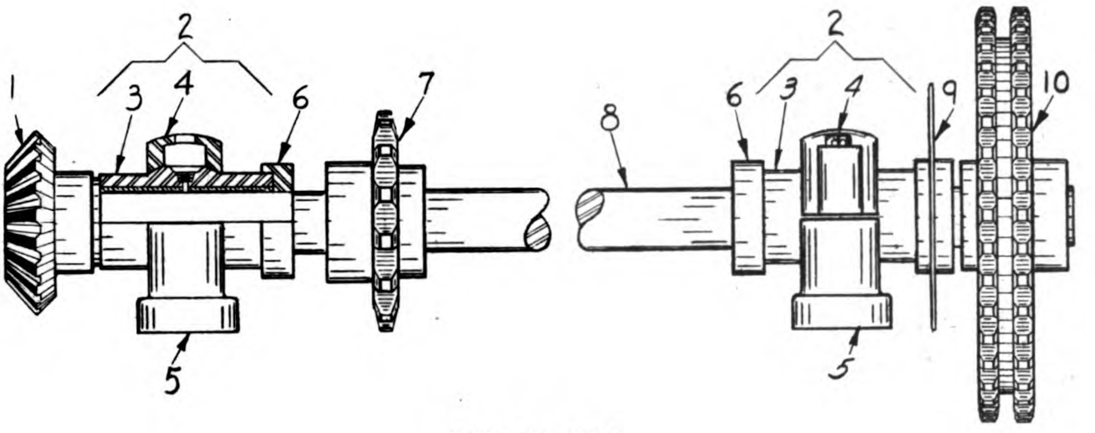


FIGURE 105

4. Bearing (2), is loose on shaft.

5. Loosen set screws in collar (6), remove collar.

NOTE: Operations requiring special attention when reassembling and replacing shaft are as follows:

1. The bevel gear end of shaft must not be assembled until after the jack shaft has been replaced in position. This is due to the limited amount of clearance between the drum and main frame through which the bevel gear end of shaft must pass to permit the opposite end of shaft to be installed.

2. The double sprocket end of shaft should also be in position before installing the sprocket. This is not positively necessary but will simplify maneuvering of shaft when installing.

3. Check the bevel gear for proper alignment before installing bevel gear case.

4. Connect the double drive chain before raising the main drive gear case in position.

. Replace all guard seal gaskets.

HOW TO REMOVE TRUNNIONS

1. The weight of the drum must be supported by a jack to permit removal of a trunnion. This is done by placing a jack on the main frame near the trunnion to be removed. Jack up the drum high enough to remove the weight from trunnion. A clearance of 1/16" between drum tire and trunnion roller is sufficient.

2. Remove four bolts (1), Fig. 106 from pivot plate (2).

3. Remove bearing stop locks.

4. Remove two hold-down bolts (3), from both bearing bases and remove both bearings.

5. Remove roller guard plate (4).

6. Slide roller uphill through hole provided in the trunnion support (5).

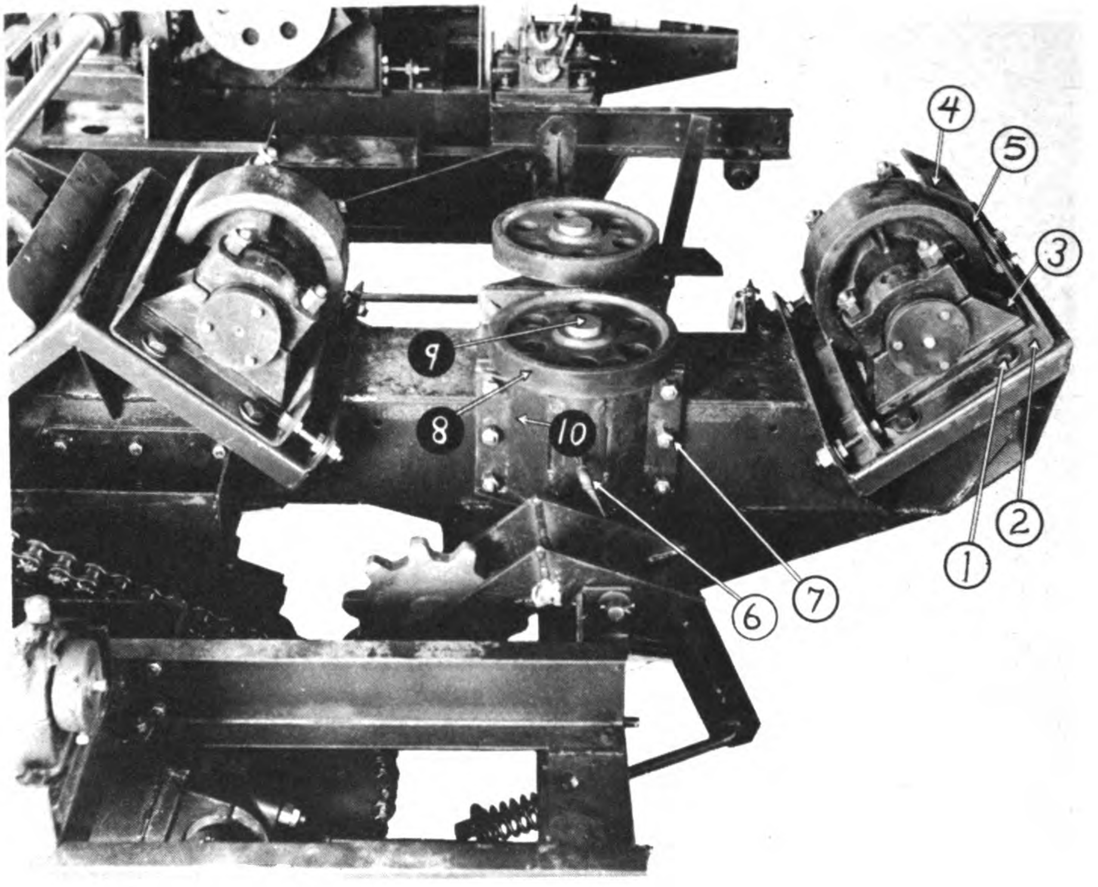


FIGURE 106

HOW TO REMOVE THRUST ROLLERS

The thrust rollers must be removed to permit stripping. This is done by removing the alemite piping (6) Fig. 106 and the six hold-down bolts (7). To strip shaft, loosen set screws that secure the roller (8) to the shaft (9), remove roller and pull shaft out of bearing (10).

HOW TO REMOVE HOT ELEVATOR DRIVE SHAFT

1. Remove dust seals (9), Fig. 104 from bevel gear box (1). Remove the bolts that secure the gear box to the main frame and lower gear box out of position.

2. Break the hot elevator drive chain.

3. Remove two bearing hold-down bolts (10) from each bearing (11) and remove shaft.

NOTE: When replacing the shaft be sure to align bevel gears correctly.

HOW TO STRIP HOT ELEVATOR DRIVE SHAFT

Starting at bevel gear end of shaft.

1. Loosen set screws in bevel gear hub (13), Fig. 107 remove gear.

2. Bearing (3) is loose on shaft.

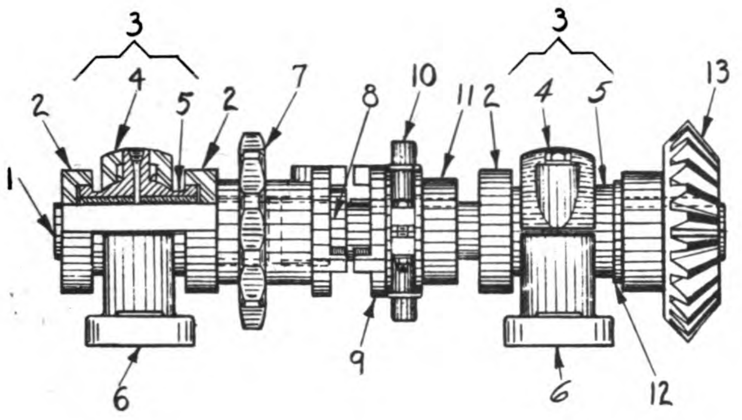


FIGURE 107

3. Loosen set screws in collar (2), remove collar.

4. Loosen set screws in collar (11), remove collar.

5. Clutch jaw (9) is loose on shaft and will slide off key. Remove key.

6. Loosen set screws in collar (8), remove collar.

7. Drive sprocket (7) is loose on shaft.

8. Loosen set screws in collar (2) on both sides of bearing (3) and slide off shaft.

NOTE: Reverse the stripping procedure to assemble

MAINTENANCE OF COUNTER SHAFT ASSEMBLIES

Removal of Bearing, Shafts, etc.

There are two bearings on each counter shaft and there are two counter shafts. Any of these bearings can be removed and replaced without removing the shafts.

This is done as follows:

1. Support the shaft with timbers or secure the shaft to the main frame with heavy wire so it will remain in its approximate position while removing the bearings.

2. Remove the alemite piping that extends through the bearing cap.

3. Remove nuts from bolts that secure the cap and bearing base and remove cap.

4. Remove the collar from end of shaft and work bearing off.

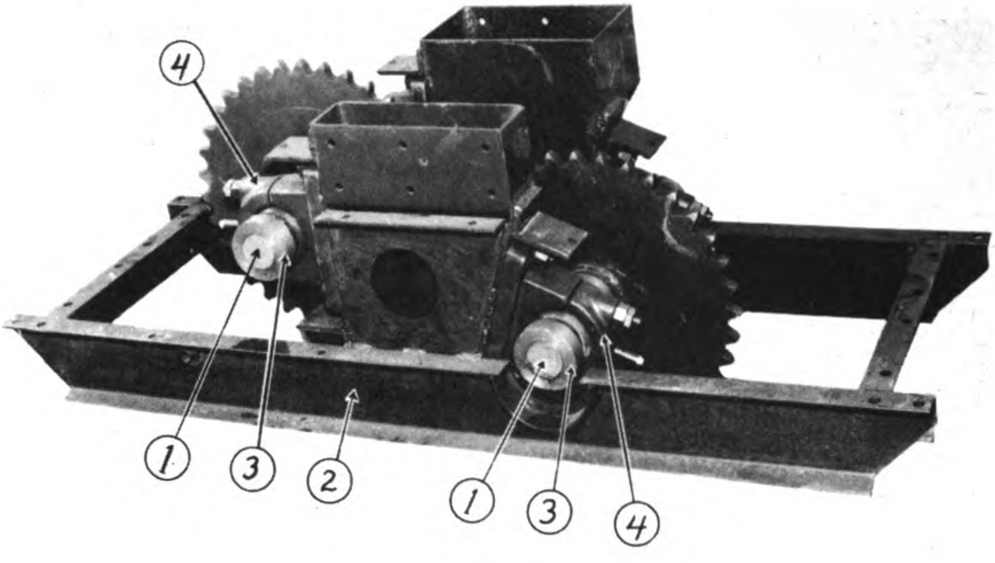


FIGURE 108

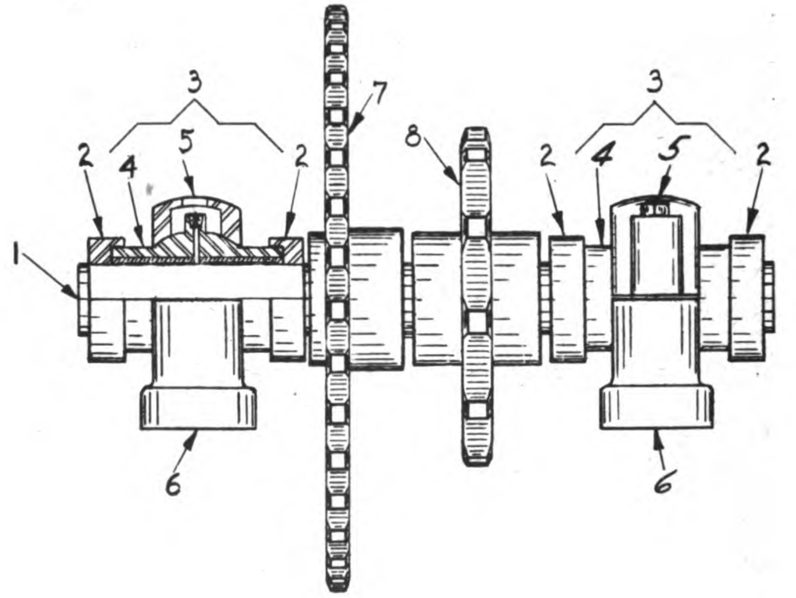


FIGURE 109

It is necessary to remove the entire shaft assembly to remove the sprockets. The sprockets of both shafts are of the same design and their function is identical. If the sprocket on one shaft requires replacement it is very possible that the sprocket on the other shaft would also require replacement.

To simplify the removal of these sprockets, we suggest the removal of the frame supporting the counter shafts as shown in Fig. 108. This is done as follows:

1. Break both drum drive chains. Also break the chain driving both counter shafts (1).

2. Remove alemite piping that extends from each counter shaft bearing.

3. Erect cribbing under the counter shaft support frame (2) capable of supporting the weight of support frame.

4. Remove all the bolts that secure the support frame to the Dryer main frame. Gradually lower the support frame to the ground by using two jacks to support the frame as each section of cribbing is being removed.

5. With frame on the ground the counter shafts are removed by removing collars (3) and bearing caps (4).

How to Strip Counter Shafts

Starting at 35-tooth sprocket end of shaft.

1. Loosen set screws in collar (2) Fig. 109, remove collar.

2. Bearing (3) is loose on shaft.

3. Loosen set screws in collar (2), remove collar.

4. Loosen set screws in hub of sprocket (7), remove sprocket.

5. Loosen set screws in hub of sprocket (8), remove sprocket.

6. Loosen set screws in both collars (2), and remove collars and bearings (3).

HOW TO REMOVE COLD ELEVATOR DRIVE SHAFT

The jaw clutch end of shaft is removed for stripping by removing the hub of universal joint (10) Fig. 110 from the end of other half of shaft assembly. In other words the shaft assembly consists of two sections which are interlocked by a universal joint. To remove the jaw clutch end of shaft proceed as as follows:

1. Break the cold elevator drive chain.

2. Remove guard housing, the universal joint, and jaw clutch.

3. Loosen set screws in the hub of universal fitted on end of other half of shaft.

4. Remove bearing hold-down bolts, and work shaft out of position. To remove the remaining half of cold elevator drive shaft proceed as follows:

Remove all bolts that secure seals to the guard.

Remove all bolts that secure the portion of guard over the sprocket elevator drive shaft to the main section of the gear case. Also remove bolts that secure the end section of guard to Dryer main frame and remove guard.

Break the drive chain between speed reducer and elevator drive shaft.

Remove bearing hold-down bolts and remove shaft.

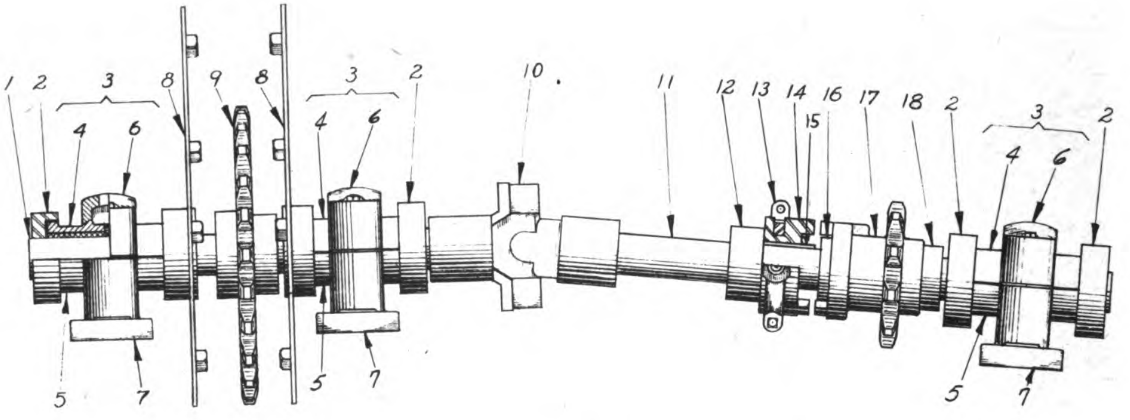


FIGURE 110

HOW TO STRIP COLD ELEVATOR DRIVE SHAFT

Starting at clutch end of shaft:

1. Loosen set screws in collar (2) Fig. 110 remove collar.
2. Bearing (3) is loose on shaft.
3. Loosen set screws in collar (2), remove collar.
4. Loosen set screws in collar (18), remove collar.
5. Sprocket (17), is loose on shaft.
6. Loosen set screws in collar (16), remove collar.
7. Jaw Clutch, (14), is loose on shaft, remove jaw clutch and key.
8. Loosen set screws in collar (12), remove collar.
9. Loosen set screws in hub of universal (10), remove universal.
10. Loosen set screws in collar (2), remove collar.
11. Bearing (3), is loose on shaft.
12. Remove guard seal (8).
13. Loosen set screws in hub of sprocket (9) remove sprocket.
14. Loosen set screws in collar (2), remove collar guard seal, and bearing (3).

ADJUSTABLE STACK BASES

The charging end of drum extends into the base of stack. The stack bases fit around the end of the drum and have a clearance of approximately 5/16" between the drum and stack. Due to the function and size of the drum, it is possible that the drum may warp slightly after a reasonable amount of service, causing contact of the revolving drum and edge of stack base. If this should occur, the stack base must be adjusted to maintain a clearance between the drum and stack to prevent serious damage to them.

The stack bases can be moved in six directions namely; up and down, sideways and forward and back. Assume the drum is contacting the stack base near top of stack base opening, it would be necessary to raise the stack base to correct this condition. Further, if drum was contacting the stack at base of opening it would be necessary to lower stack base. All adjustments of stack bases are made possible by means of slotted bolt holes in the members that support the stack bases. Figure 111 shows the various angles (1) to which the stack bases are secured. Note the slotted bolt holes in the angles. These stack base support members are secured to the Dryer super structure (2) which also has slotted bolt holes. This combination of slotted holes make possible the adjustments mentioned above.

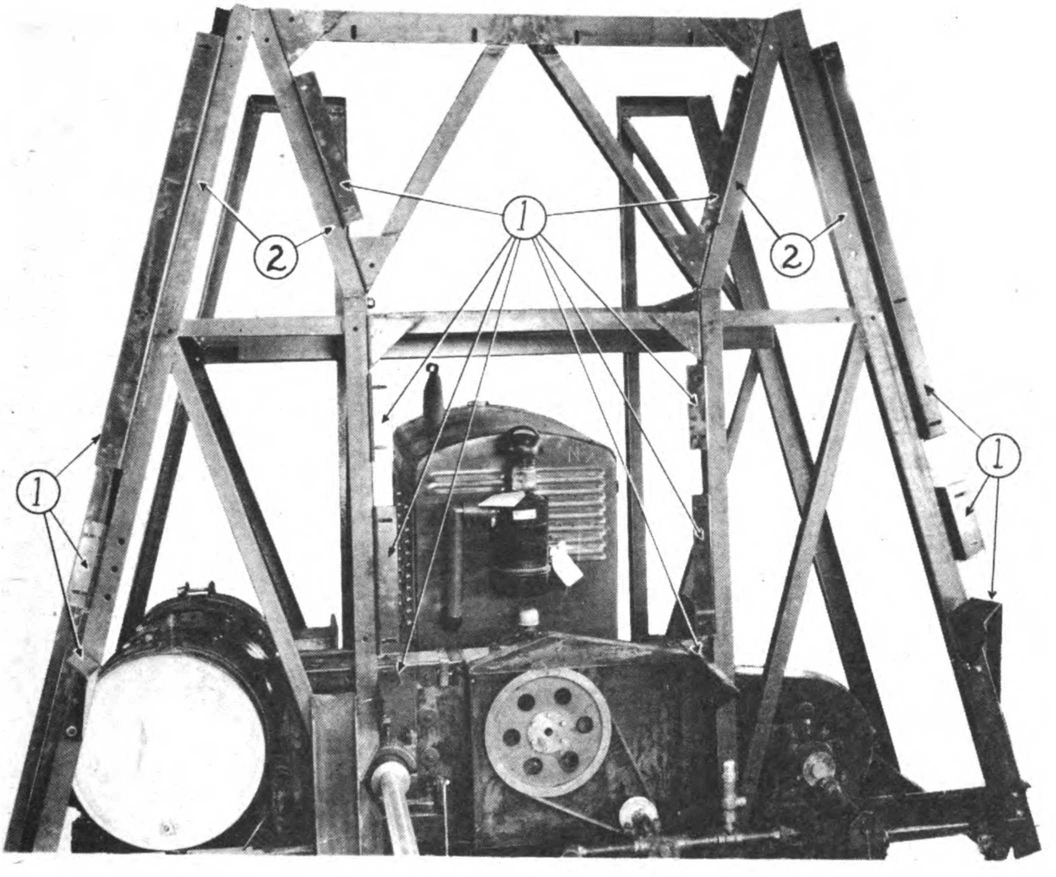


FIGURE 111

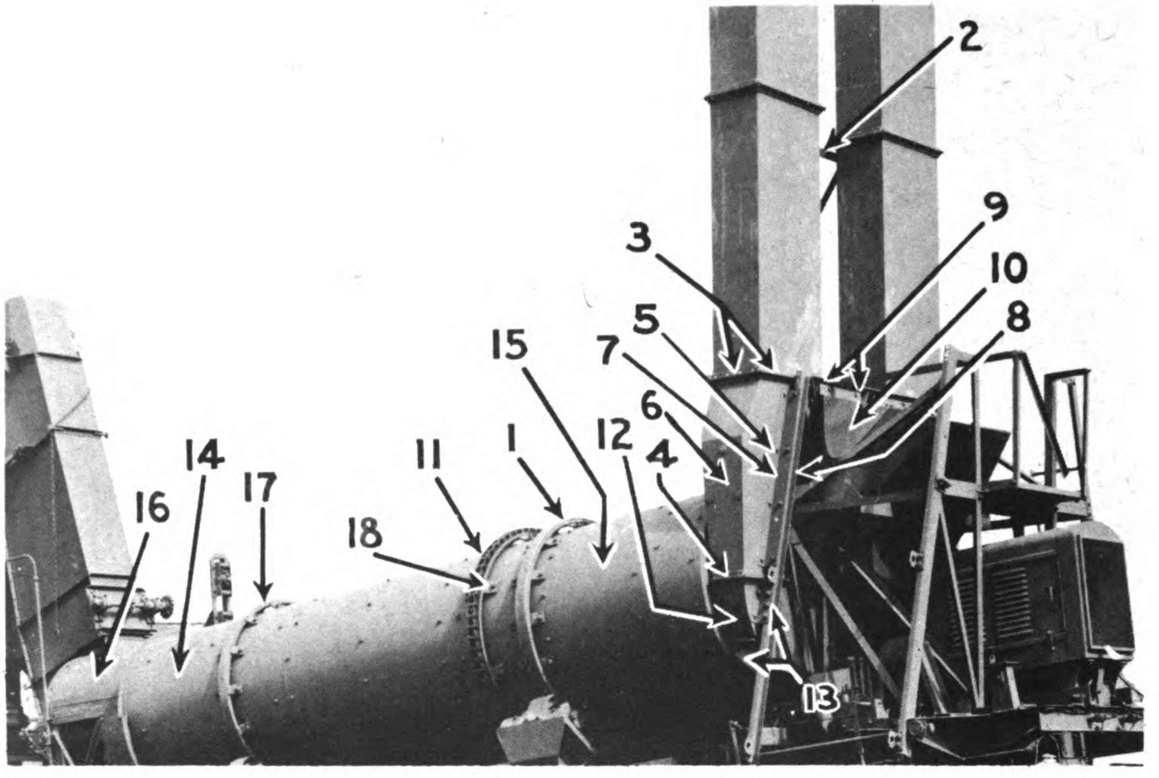


FIGURE 112

HOW TO REMOVE AND INSTALL DRUM TIRE

Assuming the Dryer is set up for operation, the drum tire (1) Fig. 112 is removed as follows:

1. Shut steam valve in main steam line between dryer and boller.

2. Break the union in the stack draft steam line.

3. Remove stack support mast (2) from stacks.

4. Remove bolts (3), that secure sections of stack. Do not remove hinge bolts.

5. Lower the two upper sections of stack. With stack layed back on drum, remove hinge bolts that interlocks stack sections.

6. Remove all bolts (4) that secure the two sections of stack bases. Also remove all bolts (5) that secure upper half of stack base (6) to the the angles (7) bolted to super-structure (8) and remove the upper section of stack base.

7. Remove bolts (9) that secure receiving hopper (10) to super structure and remove conical shaped receiving hopper.

8. Break the drum drive chain (11).

9. Remove the bottom section of stack base (12). This is done by removing the stack base support brackets (13) and turning stack base on the rim of drum until stack base can be removed from the side of Dryer.

10. Support the discharge end (14) of drum on timbers so that when charging end (15) of drum is raised the discharge end will not rest on top of combustion chamber, (16).

11. Raise the charging end of drum with a jack or crane.

12. Remove tire hold-down bolts and shims and slide tire off charging end of drum.

When installing a new tire, the operation of major importance is to insert a proper thickness of shims between the tire support brackets and the drum to eliminate whipping of the end of drum. This is done by sliding tire in position and securing it to drum at four points, namely; top, bottom and sides. When inserting the hold-down bolts, also insert 1/4" shims between the four brackets and drum. After the nuts have been tightened, lower drum to operating position. The drum is then slowly revolved manually. While drum is being revolved check the charging end of drum to determine if the end is whipping. Excessive eccentric motion of the drum end is corrected by changing the thickness of the shims inserted between the tire brackets and drum. With drum running true as possible insert the bolts and shims to complete the tire installation. The correct thickness of shims to insert between the remaining brackets and drum is determined by measuring the distance between the bracket and the drum.

The method of removal and installation of the rear tire is practically the same operation. However, to remove the rear drum tire (17) it is necessary to first remove the drum drive sprocket (18) and the front tire because the rear tire must be taken off at charging end of drum. When removing the front tire and the sprocket to permit removal of rear tire, mark the position of front tire and sprocket on drum and also mark the thickness of shims under each support bracket. This will simplify replacement of tire and sprocket after the rear tire has been installed.

Cold Elevator

HOW TO REMOVE COLD ELEVATOR HEAD SHAFT

Assuming the cold elevator is in operating position, the head shaft is removed as follows:

1. Break the cold elevator drive chain (1) Fig. 113.

2. Break the bucket line (2) near foot shaft of cold elevator.

3. With the aid of a crane raise the bucket line from head shaft far enough to provide room for removal of head shaft.

4. Remove lock nuts (3) Fig. 114 from the end of both adjusting bolts (4) and raise the head shaft (5) until bearings (6) are free of bearing guide plates (7).

HOW TO STRIP COLD ELEVATOR HEAD SHAFT

Starting at sprocket end of shaft.

1. Remove safety breaker bolt (8) Fig. 115 that interlocks the sprocket and the stationary hub on end of shaft.

2. Loosen set screws in hub (9), remove hub.

3. Sprocket (7) is loose on shaft.

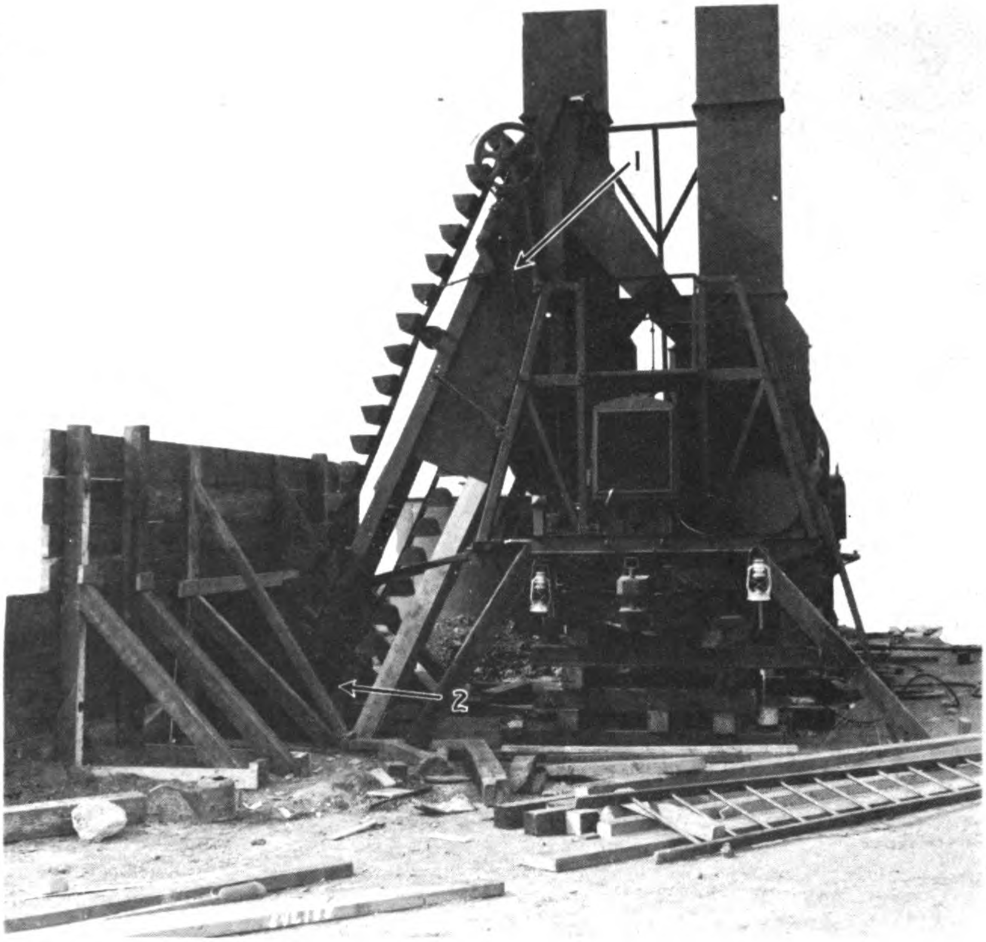


FIGURE 113

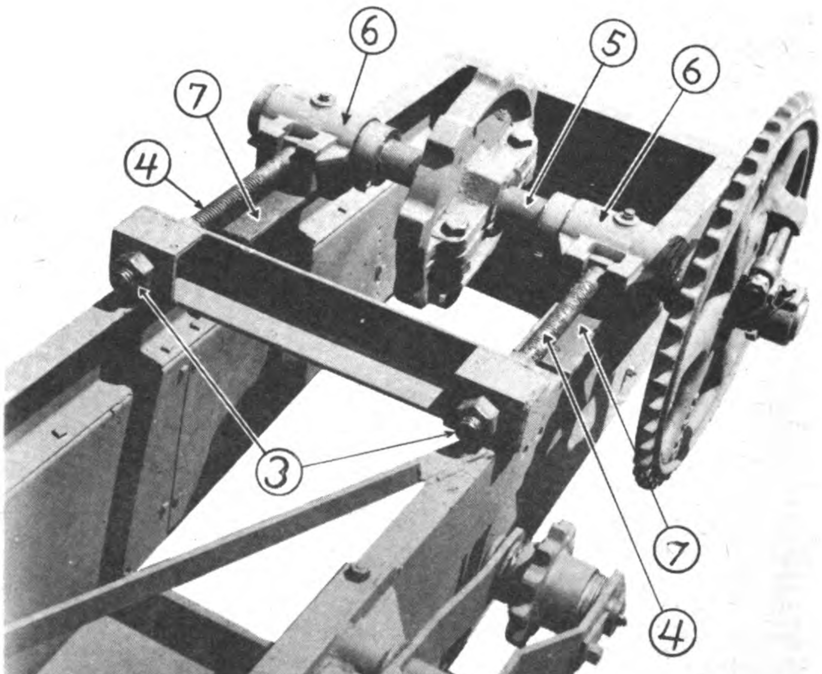


FIGURE 114

4. Washers (6), are loose on shaft.

5. Bearing (2), is loose on shaft.

6. Loosen set screws in collar (3), remove collar.

7. Loosen set screws in the hub of sprocket (4), and remove bolts that secure halves of sprocket, remove sprocket.

8. Loosen set screws in collar (3), remove collar.

9. Bearing (2), is loose on shaft.

10. Loosen set screws in collar (1), remove collar.

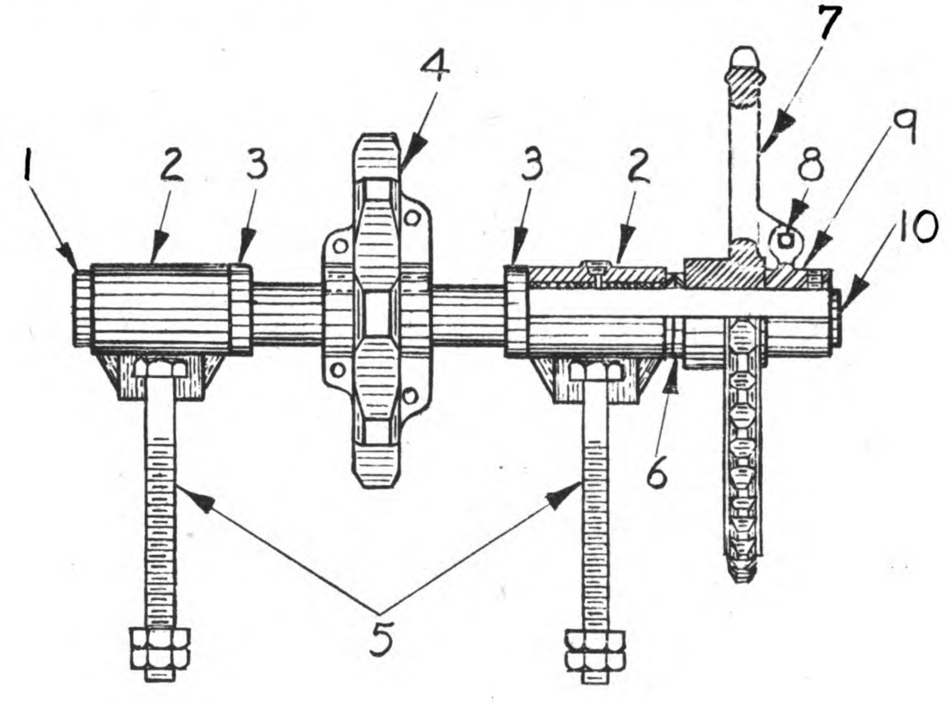


FIGURE 115

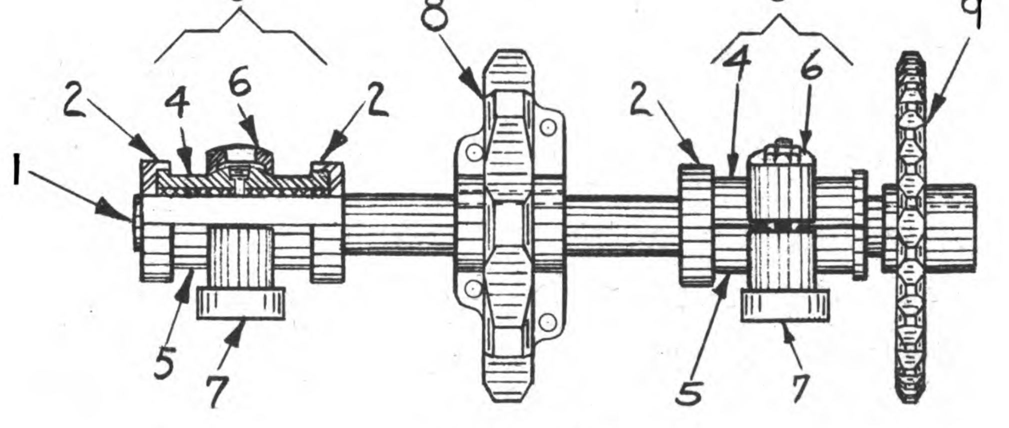


FIGURE 116

HOW TO REMOVE COLD ELEVATOR FOOT SHAFT

Assuming the cold elevator is in operation position, the foot shaft is removed as follows:

1. Break the bucket line at foot shaft.
2. Remove top section of the reciprocating feeder drive chain guard and the section of the guard assembly through which the foot shaft extends.
3. Turn back the bolt in adjustable strut far enough so that the end of strut will not interfere with removal of shaft.
4. Remove bearing hold-down bolts, remove shaft.

HOW TO STRIP COLD ELEVATOR FOOT SHAFT

Starting at the sprocket end of shaft.

1. Loosen set screws in hub of sprocket (9) Fig. 116, remove sprocket.
2. Bearing (3) is loose on shaft.
3. Loosen set screws in collar (2), and remove collar.
4. Loosen set screws in hub of sprocket (8), and remove bolts that secure halves of sprocket, remove sprocket.
5. Loosen set screws in collars (2), and remove collars and bearing (3).

Reciprocating Feeder

HOW TO REMOVE RECIPROCATING FEEDER CRANK SHAFT

Assuming the reciprocating feeder is in operating position, the crank shaft is removed as follows:

1. Remove top section of reciprocating feeder drive chain guard.
2. Remove the anchor plate (1) Fig. 117 used to maintain position of the shifter yoke (2).
3. Remove bearing caps (3) from bearings (4).
4. Remove half nut (5) located on end of crank pin. Loosen set screw (6) in BAR welded on end of crank shaft. Remove crank pin (7).
5. Remove crank shaft from drive side of feeder.
6. The connecting rod (8) can also be removed if necessary by removing the pin (9) that secures the connecting rod to the reciprocating plate (10) of feeder. This pin is held in place by set screws (11).

HOW TO STRIP RECIPROCATING FEEDER CRANK SHAFT

1. Loosen set screws in collar (7), Fig. 118, remove collar.
2. Bearing (2), is loose on shaft.
3. Jaw clutch (15), is loose on shaft, remove clutch and key.
4. Loosen set screws in collar (9), remove collar.

5. Sprocket (12), is loose on shaft.
6. Loosen set screws in collar (9), remove collar.
7. Guard seal is loose on shaft.
8. Loosen set screws in collar (7), remove collar.
9. Bearing (2), is loose on shaft.
10. Washers (1) are loose on shaft.

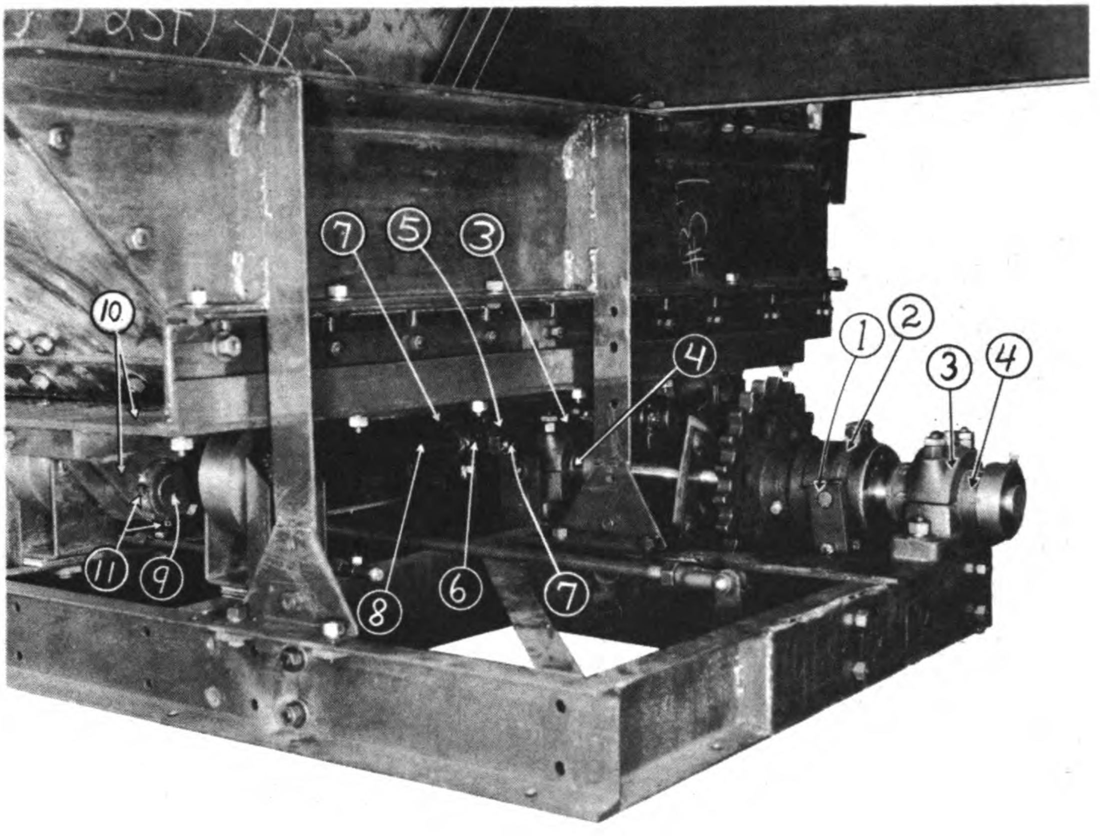


FIGURE 117

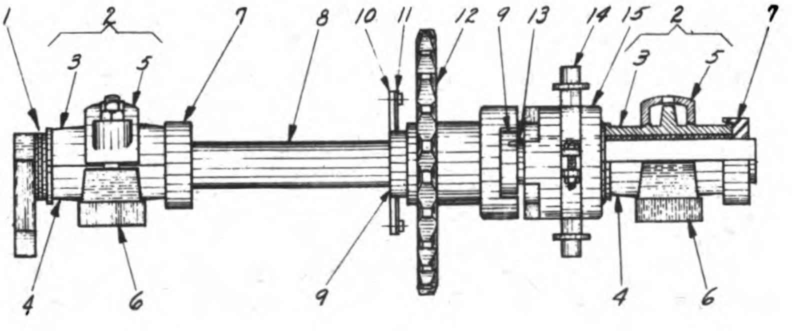


FIGURE 118

Hot Elevator

The maintenance of this unit involves a minimum of working parts whicn are mounted in a manner to provide easy access for replacement of any worn parts. Inspection doors are provided in Head and Boot Sections to determine condition of chain and buckets and bucket line sprockets. The photograph shows the primary parts concerned and covered by the discussions which follow.

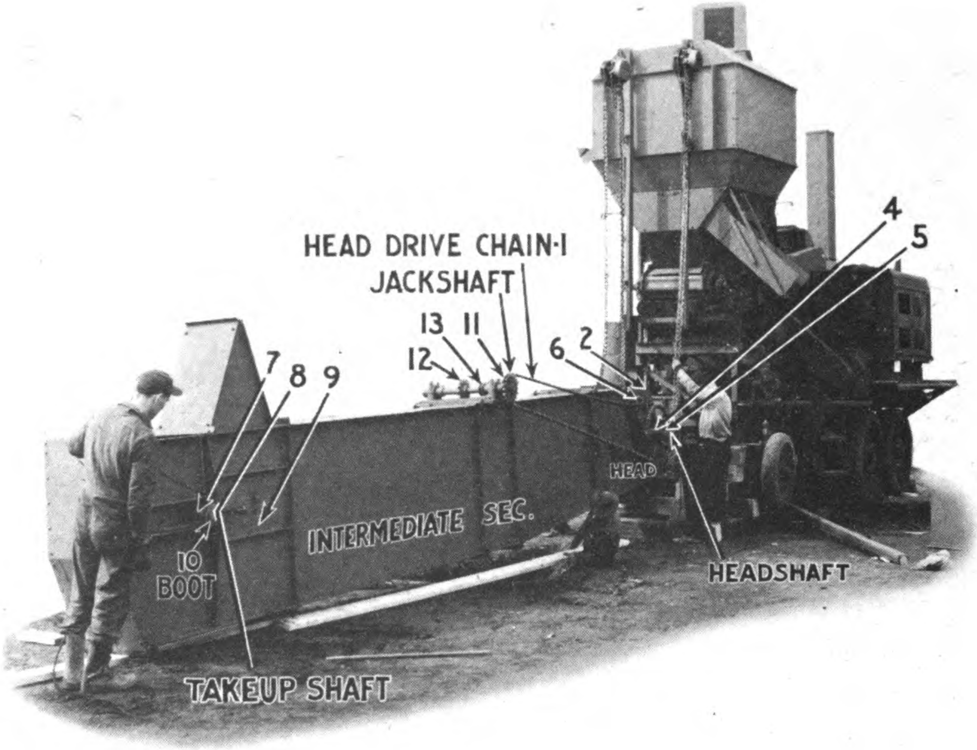


FIGURE 119

HEADSHAFT

This item is mounted on two angle iron flanges on the Head Section by means of bolts through bronze-bushed bearings. To remove this shaft, uncouple drive chain (1) Fig. 119 and remove hood (2).

Drive sprocket (3) is free on the shaft and couples to the shaft with breaking bolt (4) to collar (5) which is keyed and set screwed to the end of shaft.

The bucket chain sprocket is the split type, bolted together and keyed and set screwed to the shaft. It is not necessary to remove the shaft to replace this sprocket.

Set collars are located against the inside hubs of the bearings on this shaft.

The counterweighted idler sprocket (6) is accessible for replacement. Care should be taken to assure alignment between this idler and sprocket (3).

BOOT TAKEUP SHAFT

This is mounted in bronze-bushed bearings (7) which slide on guides and are controlled by the takeup screws (8). Inspection doors (9) may be removed to work on this shaft.

Set Collars (10) are mounted on each end of the shaft. The bucket chain traction wheel inside the boot is set screwed to the shaft.

CHAIN AND BUCKETS

The 16" by 8" Style "A" malleable iron buckets are bolted to K-2 attachments, on every other link of the bucket chain, by means of four bolts.

COUNTERSHAFT

This bolts to the outside flange on the Intermediate Section of the casing by means of bolts through the bronze bushed bearings.

Drive sprocket (11) and driven sprocket (12) are keyed and set screwed to the shaft. Collar (13) mounts against the inside bearing hub on the drive sprocket side.

HEAD DRIVE CHAIN

This should be kept in alignment over sprockets (3), (6), and (11). Idler sprocket (6) is counterweighted to maintain chain tension. Remove one or two links of chain when it has stretched too much for tension idler sprocket to be effective.

DRYER DRIVE CHAIN

This should be maintained in alignment over sprocket (12) and drive sprocket and idler sprockets on the Model 833 Dryer. The idler sprockets on the dryer are adjustable to maintain proper chain tension. Remove one or two links of chain when it has stretched beyond adjustment limits.

PARTS LIST

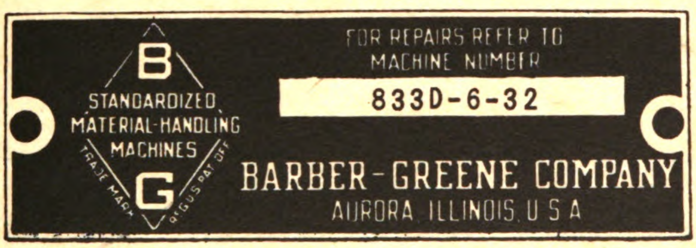
BARBER-GREENE
Model 833
(Dual Drum)

AGGREGATE DRYER
including
HOT ELEVATOR
COLD ELEVATOR
RECIPROCATING FEEDER

Ordering Parts

The Serial Number, shown and described below, is the means by which Barber-Greene identifies the bills of materials used in manufacturing any particular machine and must be given when ordering parts. This Serial Number provides an accurate method of indicating in the sequence of serial numbers any design changes that have been made.

Sample Serial Number Plate



The Serial Number Plate appears on the stack support frame on the elevator drive side. Always give the serial number of your machine, part number and description when ordering parts.

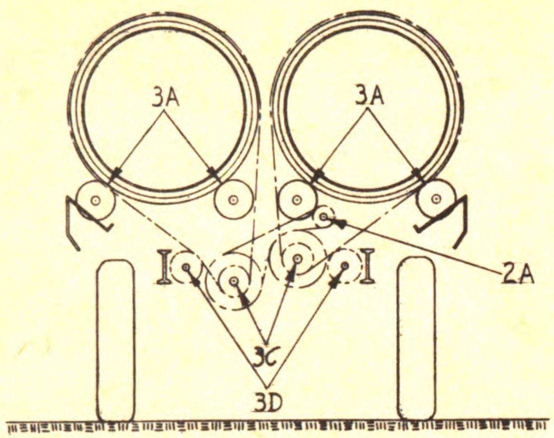
Key to Serial Number System

833D-6-32

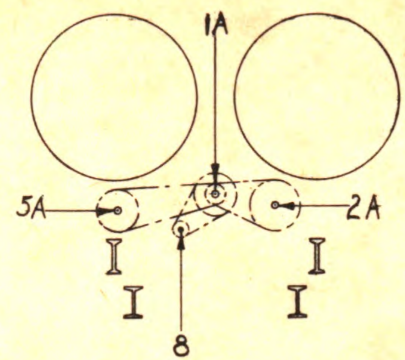
The first number (833D) indicates the machine model. The last number (32) indicates the schedule of manufacture in which the machine was built. The middle number (6) indicates the number or place of the machine in that schedule of manufacture. The machine above is Model 833D and is the 6th machine manufactured in the 32nd schedule. The next machine built will have serial number 833D-7-32. The next schedule will be 33 and the serial number of the first machine will be 833D-1-33.

PARTS LIST GRAPHIC INDEX

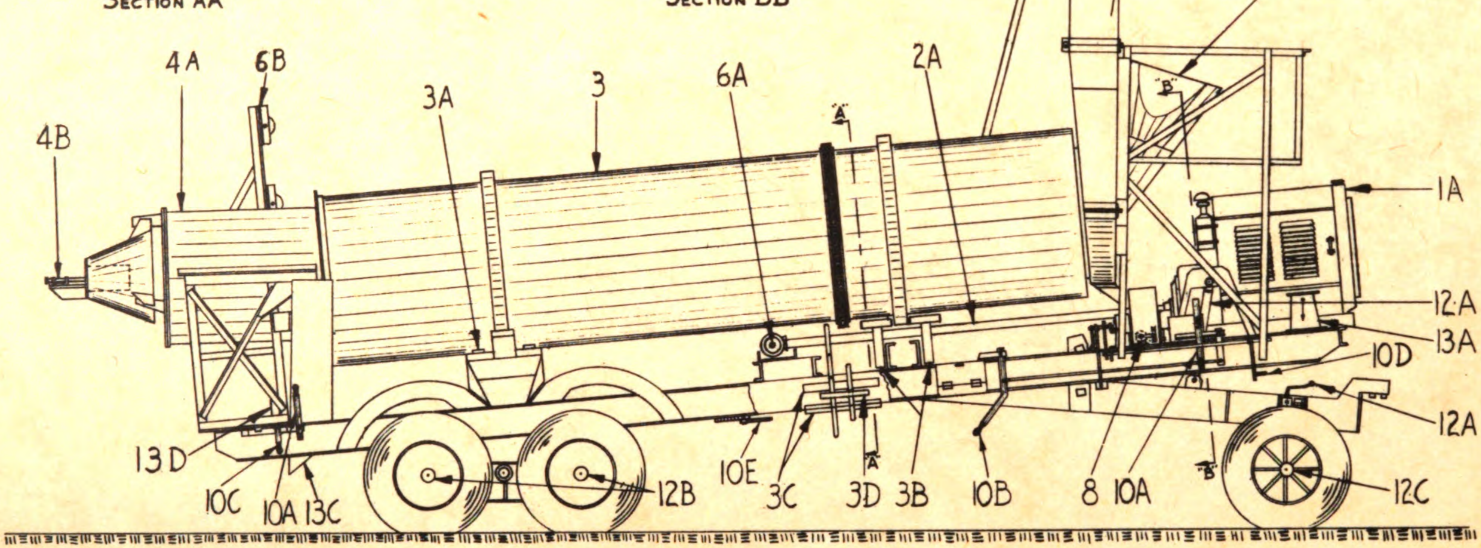
References below correspond to references in index page



SECTION "AA"



SECTION "BB"

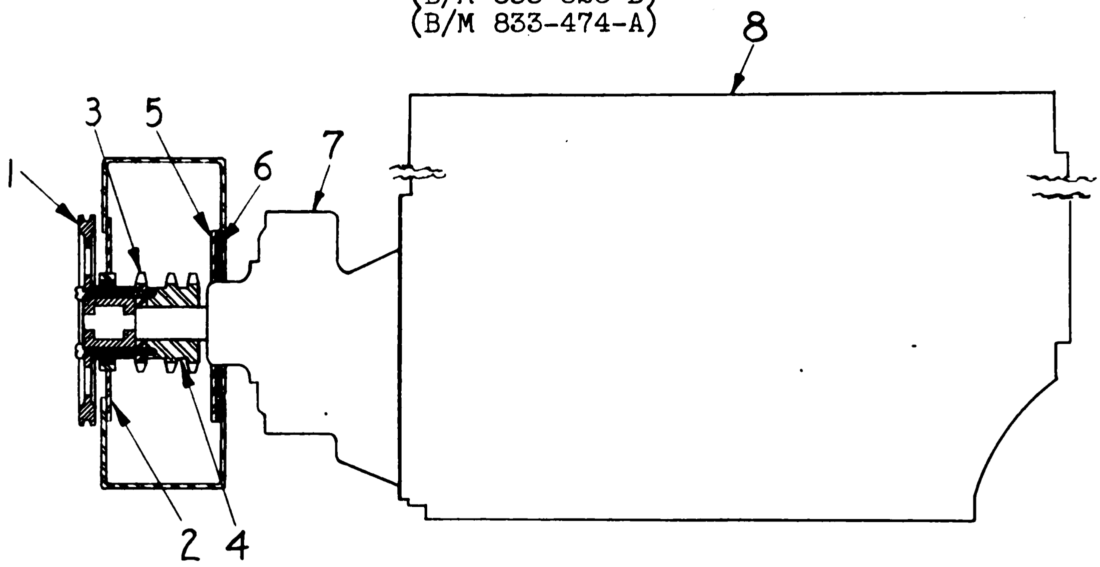


CONTENTS

Dual Drum Dryer Model 833

POWER UNIT

(B/M 833-346-A)
(B/M 833-323-B)
(B/M 833-474-A)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	3770	Pulley
2.	1	G-833-343 WB	Seal
	1	F-833-343	Gasket
	5		Machine Bolt, Lock Washer, 3/8" x 1"
3.	1	B-19-759	Sprocket, 16-Tooth
	6		Hex Head Cap Screw, & Lock Washer, 3/8" x 5-1/4"
4.	1	A-19-759	Double Sprocket, 16-Tooth
	1		Allen Cup Point Safety Set Screw, 5/8" x 1-1/4"
	1		Allen Cup Point Safety Set Screw, 5/8" x 1"
	1	MM-17-34	Key, 5/8" x 5/8" x 3-5/16" .
5.	1	O-833-343	Seal
	5		Machine Bolt, Nut, & Lock Washer, 3/8" x 1"
	1	U-833-343	Filler
	2		Machine Bolt, Nut, & Lock Washer, 3/8" x 1"
6.	1	P-833-343	Felt, 1/4"
7.	1	SR-TD-D4	Twin Disc Reduction Unit, X-8368 (For Details See Engine Section)
8.	1	EN-B-N9	Power Unit, Buda Model HP 351 (For Details See Engine Section)
	1	B-833-322	Transmission Support Plate
	2		Flat Head Cap Screw Nut, & Lock Washer, 1/2" x 1-1/2"
	4		Machine Bolt, Nut & Lock Washer, 1/2" x 1-1/4"
	6		Hex Head Cap Screw, & Lock Washer, 1/2" x 1"
	2	BG-17-24	Special Take-Up Bolt, 3/4" x 6"
	4		Hex Nut, 3/4"
	4		Machine Bolt, Nut, Lock Washer, & Cut Washer, 5/8" x 2"
	4		Bevel Washer, 5/8"

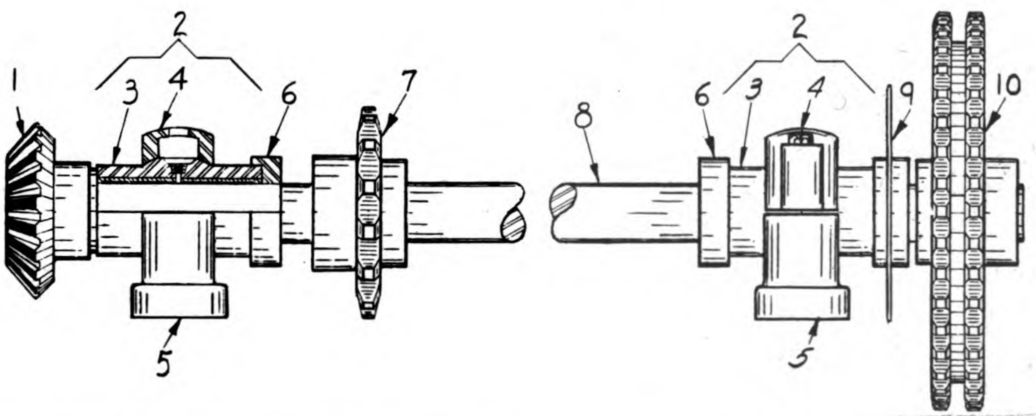
Buda Power Unit HP 351 (Continued)

(B/M 833-346-A)
(B/M 833-323-B)
(B/M 833-474-A)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	1	A (R) 833-322	Engine Sill (Operator Side)
	1	A (L) 833-322	Engine Sill (Opposite Operator Side)
	1	EL-BA-C1	6V-19-Plate Battery (Dry Charge)
	1		EL-CN-A1 Galvanized Flexible Conduit, 1/2" x 4'-2"
	1		EL-CA-CO #0 Starting Cable x 7'-0"
	2	EL-WT-C6	Battery Cable Terminal, Closed Barrel
	2	EL-WT-BO	Copper Cable Lug #0

MAIN JACK SHAFT

(B/M 833-82-A3)
(B/M 833-92-A2)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	A-18-238	Bevel Gear, 21-Tooth
	1		Allen Cup Point Safety Set Screw, 5/8" x 3/4"
	1		Allen Cup Point Safety Set Screw, 5/8" x 1"
	1	D-17-33	Key, 1/2" x 1/2" x 3-3/8"
	1	D-17-92	Washer
2.	2	13-220-C	Ball & Socket Bearing, Complete
3.	2	3401	Bearing
	4	DD-8-95	Bronze Bushing
	2	AF-17-43	Pipe, 1/4" x 2-1/4"
	2		Pipe Coupling, 1/4"
	2		1/4" Button Head Alemite, Male
4.	2	1365	Bearing Cap
	4		Machine Bolt, Nut, & Jam Nut, 3/4" x 7"

Main Jack Shaft (Continued)

(B/M 833-82-A3)
(B/M 833-92-A2)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
5.	2	1363	Bearing Base
	4		Machine Bolt, Nut, & Lock Washer, 3/4" x 3-1/2"
	6	BX-17-109	Shim, 16 Ga.
	2	QQ-17-111	Stop Shim, 1/4"
	6	SS-17-111	Stop Shim, 12 Ga.
	4	TT-17-111	Stop Shim, 16 Ga.
	2		Machine Bolt, Nut, & Lock Washer, 3/8" x 1-1/2"
6.	2	E-3-1200	Dust Seal
	4		Set Screw, 1/2" x 1-1/2"
7.	1	19-632-B	Sprocket, 14-Tooth
	2		Set Screw, 5/8" x 1-1/4"
	1	Y-17-34	Key, 5/8" x 5/8" x 4"
8.	1	A1-833-92	Shaft, 2-7/16" x 9' 11-15/16" S.A.E. 4140
9.	1	D-833-343 WB	Dust Seal
10.	1	3619 B	Double Sprocket, 40-Tooth
	2		Set Screw, 5/8" x 1"
	1	GG-17-34	Key, 5/8" x 5/8" x 4-1/4"

DOUBLE DRUM DRYER SHAFTING & DRIVE CHAIN CHART

Shafting

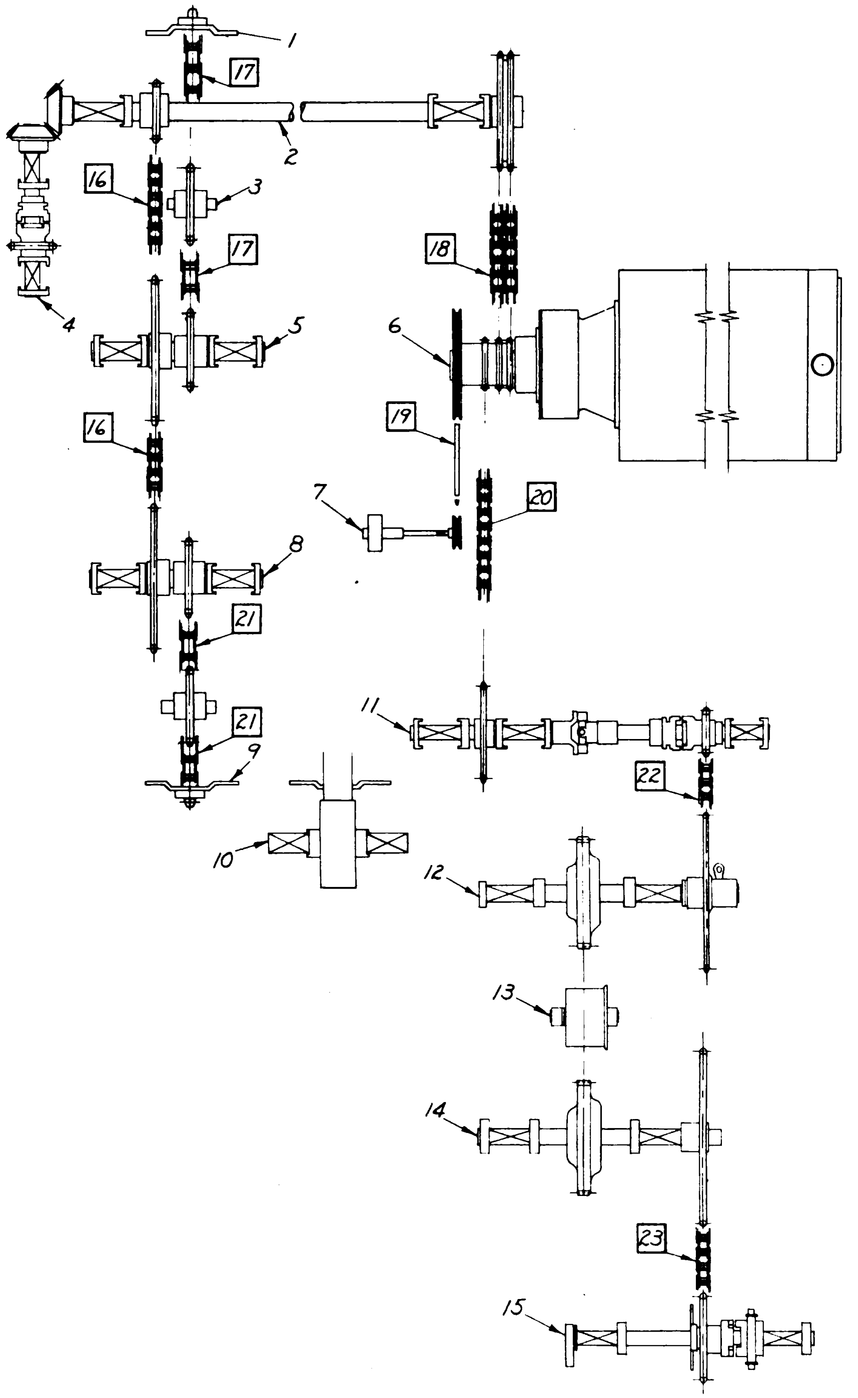
1. Drum Drive Sprocket (Opposite Operator Side)
2. Main Jack Shaft
3. Drum Drive Take-Up Idler
4. Hot Elevator Drive Shaft
5. Drum Drive Countershaft (Opposite Operator Side)
6. Power Unit
7. Fuel Pump
8. Drum Drive Countershaft (Operators Side)
9. Drum Drive Sprocket (Operator Side)
10. Trunnion Shaft
11. Cold Elevator Drive Shaft
12. Cold Elevator Head Shaft
13. Cold Elevator Bucket Line Roller
14. Cold Elevator Foot Shaft
15. Reciprocating Feed Crank Shaft

Drive Chains

(B/M 833-109-A2)

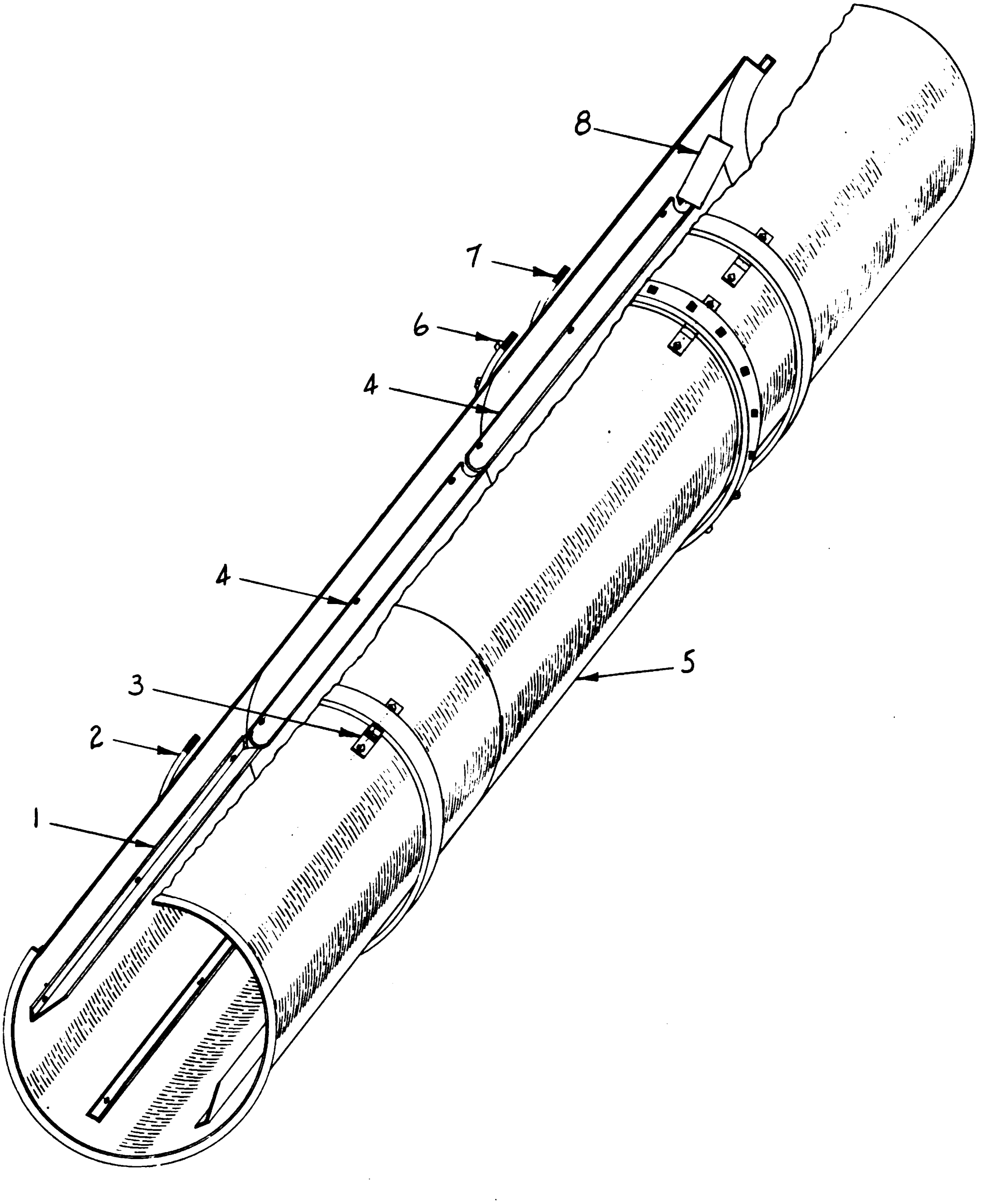
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
16	1	AT-6-86C	Strand of Diamond #474, 1-3/4" P. 68 links & 1 offset
17	1	AZ-6-120R	Strand of Chain belt #1030, 3.075" P., 75 links
18	1	AJ-6-65C	Strand of Diamond #D470, 1-1/4" P., 58 links & 1 offset
19	1	BE-DR-J1	Dayton V-Belt #6B3
20	1	AZ-6-64C	Strand of Diamond #470, 1-1/4" P., 74 links & 1 offset
21	1	BD-6-120R	Strand of Chain Belt #1030, 3.075" P., 78 links
22	1	FT-6-82C	Strand of Baldwin #0362, 1.654" P., 194 links
23	1	BE-6-82C	Strand of Baldwin #0362, 1.654" P., 78 links & 1 offset
		A-6-120	Roller Link Chain Belt #1030
		A-6-86	Roller Link Diamond #474
		B-6-86	Connecting Link Diamond #474
		C-6-86	Offset Link Diamond #474
		A-6-82	Roller Link Baldwin #0362
		B-6-82	Connecting Link Baldwin #0362
		C-6-82	Offset Link Baldwin #0362
		A-6-65	Roller Link Diamond #D470
		B-6-65	Connecting Link Diamond #D470
		C-6-65	Offset Link Diamond #D470
		A-6-64	Roller Link Diamond #470
		B-6-64	Connecting Link Diamond #470
		C-6-64	Offset Link Diamond #470

DOUBLE DRUM DRYER SHAFTING & DRIVE CHAIN CHART



DRYER DRUM

(B/M 833-77-A2)
(B/M 833-77-B2)



Dryer Drum (Continued)

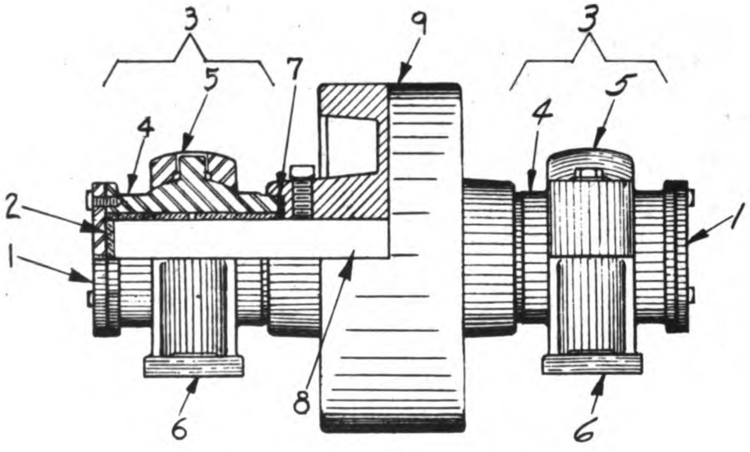
(B/M 833-77-A2)
(B/M 833-77-B2)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	7	B (L) 833-77	Angle Flight (As Shown) **(Left)**
	21		Machine Bolt, & Anco Nut, 5/8" x 1-1/2"
	21		Cut Washer, 5/8"
2.	2	A-833-285 W	Rear Drum Tire
3.	28	C-833-285 W	Rear Drum Tire Bracket
	56		Machine Bolt, & Anco Nut, 3/4" x 2"
	56		Cut Washer, 3/4"
	112	E1-833-88	Shim, 12 Ga.
	56	F1-833-88	Shim, 16 Ga.
	56	G1-833-88	Shim, 20 Ga.
4.	56	A-833-77	Flight
	168		Machine Bolt, & Anco Nut, 5/8" x 1-1/2"
	168		Cut Washer, 5/8"
5.	2	B1-833-76 W	Drum
6.	2	A1-833-88 W	Drum Sprocket, With Welded Brackets
	28		Machine Bolt, & Anco Nut, 3/4" x 2"
	28		Cut Washer, 3/4"
	56	E1-833-88	Shim, 12 Ga.
	28	F1-833-88	Shim, 16 Ga.
	28	G1-833-88	Shim, 20 Ga.
7.	2	B1-833-89 W	Front Drum Tire With Welded Brackets
	56		Machine Bolt, & Anco Nut, 3/4" x 2"
	56		Cut Washer, 3/4"
	112	E1-833-89	Shim, 12 Ga.
	56	F1-833-89	Shim, 16 Ga.
	56	G1-833-89	Shim, 20 Ga.
8.	28	C1-833-77	Deflector
	56		Machine Bolt, & Anco Nut, 5/8" x 1-1/2"
	56	KE-17-9	Cut Washer, 5/8"
	7	B (R) 833-77)	Angle Flight (Opposite) **(Right)**
	21		Machine Bolt, & Anco Nut, 5/8" x 1-1/2"
	21		Cut Washer, 5/8"

Always give Serial Number of Machine, Part Number and Description.

TRUNNION ROLLER

(B/M 833-321-A)

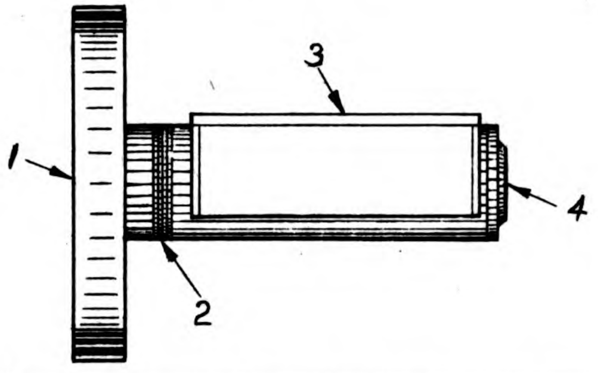


REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	16	B-833-321	Bearing End Plate
	48		Hex Head, Cap Screw, & Lock Washer, 3/8" x 1"
	16		1/4" Button Head Alemite, Male
	16	C-833-321	Victorite Gasket
2.	16	A-17-202	Bronze Washer
3.	16	13-222-F	Ball & Socket Bearing, Complete
4.	16	3554 A	Bearing
	16	E-8-115	Bronze Bushing (Closed End Oil Groove)
	16	A-8-126	Bronze Bushing (Open End Oil Groove)
5.	16	3105	Bearing Cap
	32		Machine Bolt, Nut, & Jam Nut, 3/4" x 7"
6.	16	3104	Bearing Base
	32		Machine Bolt, Nut, Lock Washer, & Cut Washer, 3/4" x 2-3/4"
	48	D-17-139	Stop Shim, 12 Ga.
	32	E-17-139	Stop Shim, 16 Ga.
	64	TT-17-111	Shim, 16 Ga.
	32	SS-17-111	Shim, 12 Ga.
	16	QQ-17-111	Shim, 1/4"
	32		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/2"
7.	16	V-17-105	Felt Washer
8.	8	A-833-321	Shaft, 2-11/16" x 1' 7-1/2" S.A.E. 1045
9.	8	3771	Trunnion Roller
	32		Set Screw, 5/8" x 1-3/4"

For Grease Piping See Page 214

THRUST ROLLER ASSEMBLY

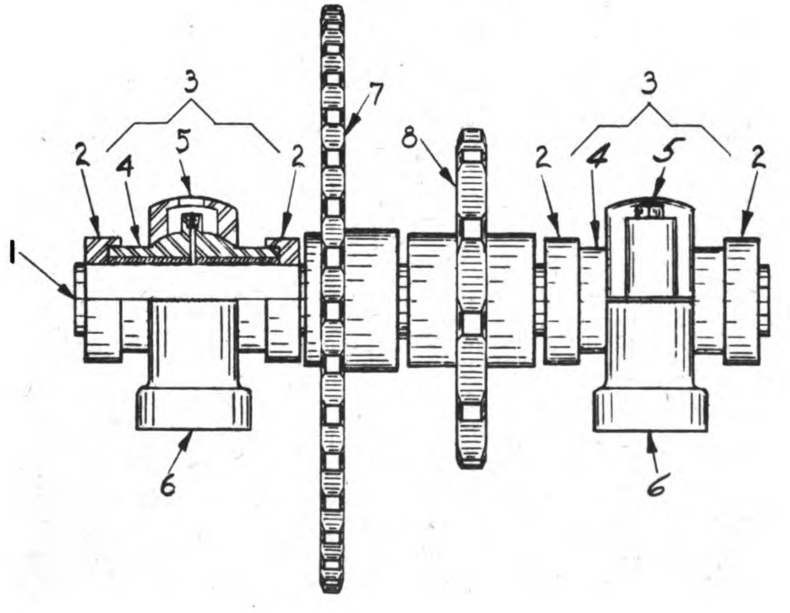
(B/M 833-28-A2)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	4	3526	Thrust Wheel
	8		Set Screw, 5/8" x 1-1/4"
2.	16	JN-17-9	Washers
3.	4	G2-833-28 WB	Bearing Bracket
	24		Machine Bolt, Nut, & Lock Washer, 5/8" x 2-1/4"
	4		1/4" Button Head Alemite, Male
	4	H1-833-28	Shim, 1/4"
	4	J1-833-28	Shim, 10 Ga.
	4	K1-833-28	Shim, 16 Ga.
4.	4	C1-833-28 W	Shaft, 2-7/16" x 1' 2-7/8" S.A.E. 1020

DRUM DRIVE COUNTER SHAFT

(B/M 833-333-A)



See Parts List on following page.

Drum Drive Counter Shaft (Continued)

(B/M 833-333-A)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2	A-833-333	Shaft, 2-7/16" x 2' 0" S.A.E. 4140
2.	8	D-3-1200	Dust Seal
	16		Set Screw, 1/4" x 1-1/4"
3.	4	13-220-A	2-7/16" Ball & Socket Bearing, Complete
4.	4	2220 A	Bearing
	8	BB-8-94	Bronze Bushing
	4	HH-17-43	Pipe, 1/4" x 1-3/4"
	4		Pipe Coupling, 1/4"
	4		1/4" Button Head Alemite, Male
5.	4	1365	Bearing Cap
	8		Machine Bolt, Nut, & Jam Nut, 3/4" x 7"
6.	4	1363	Bearing Base
	8		Machine Bolt, Nut, Lock Washer, & Cut Washer, 3/4" x 3"
	16	BX-17-109	Shim, 16 Ga.
	12	AD-17-111	Stop Shim, 1/4"
	16	AE-17-111	Stop Shim, 10 Ga.
	8	AF-17-111	Stop Shim, 16 Ga.
7.	2	19-632-A	Sprocket, 35-Tooth
	2		Set Screw, 5/8" x 1"
	2		Set Screw, 5/8" x 1-1/2"
8.	2	E-19-742	Sprocket, 11-Tooth
	2		Set Screw, 5/8" x 1-1/4"
	2		Set Screw, 5/8" x 1-1/2"
	2	XX-17-34	Key, 5/8" x 5/8" x 8-1/4"

DRUM DRIVE TAKE-UP IDLER

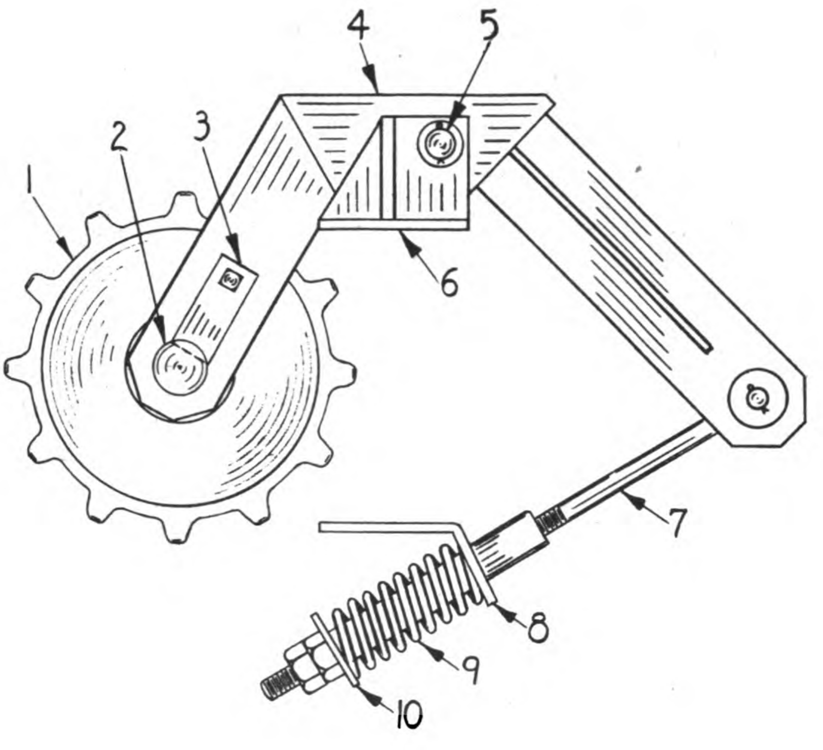
(B/M 833-336-A)

See Illustration on following page.

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2	D-19-742	Sprocket, 11-Tooth
2.	2	D-833-93 W	Shaft, 1-11/16" x 7-3/8" S.A.E. 1020
	2		1/8" Button Head Alemite, Male
3.	2	F-833-41	Keeper Bar
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/2"
4.	2	A-833-337 W	Pivot Arm
5.	2	E-833-41	Shaft, 1" x 9-3/8" S.A.E. 1020
	2	TT-17-13	Pipe Spacer
	4	YY-17-9	Washers
	4		Cotter, 1/4" x 1-1/2"

Drum Drive Take-Up Idler (Continued)

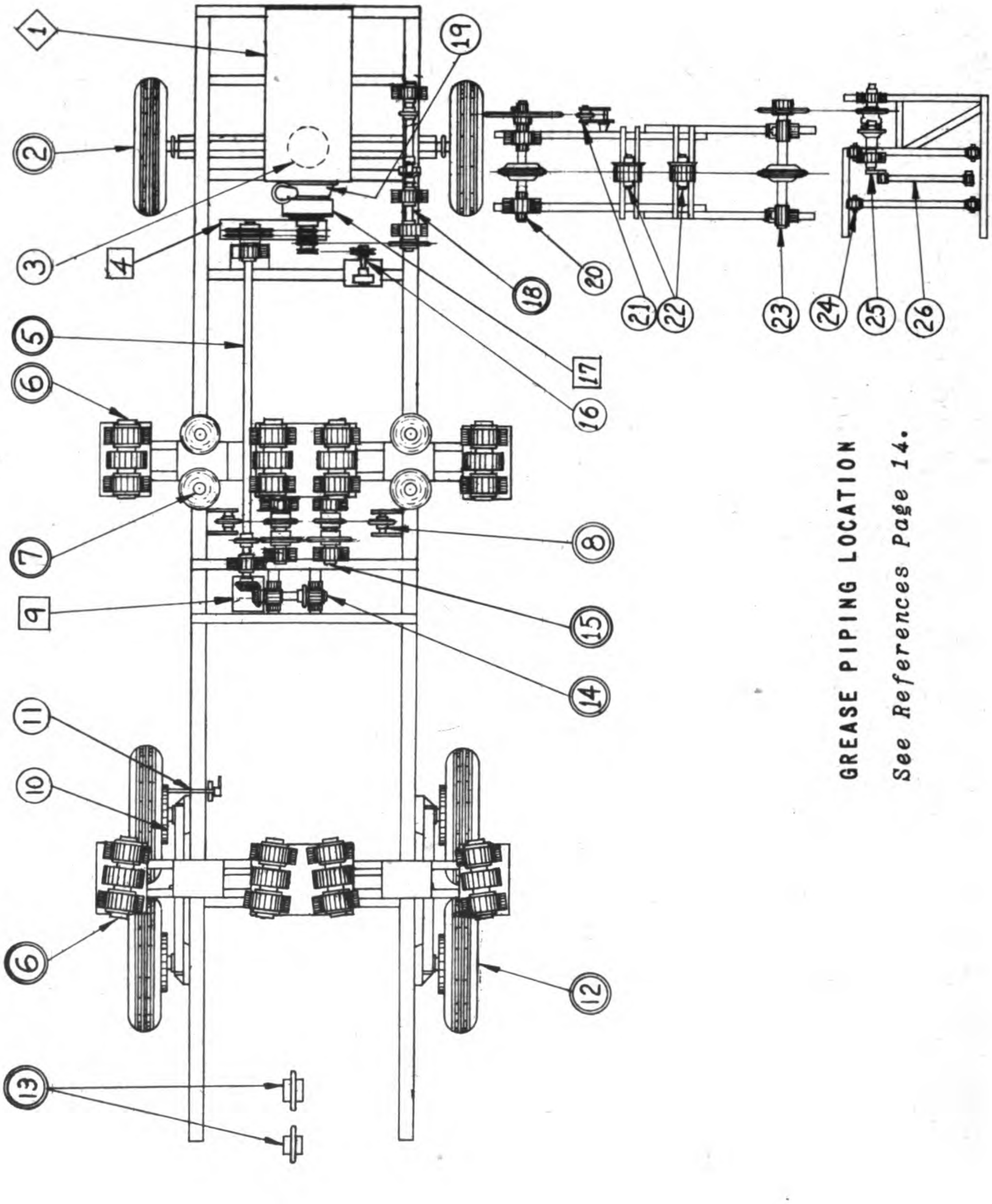
(B/M 833-336-A)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
6.	2	G (R) 833-337 W	Bracket (As Shown)
	4		Machine Bolt, Nut, & Lock Washer, 5/8" x 2-1/4"
	4		Bevel Washer, 5/8"
	2	G (L) 833-337 W	Bracket (Opposite)
	4		Machine Bolt, Nut, & Lock Washer, 5/8" x 2-1/4"
	4		Bevel Washer, 5/8"
7.	2	M-833-337 W	Adjusting Rod
	2		Cut Washer, 3/4"
	2		Cotter, 1/4" x 1-1/2"
8.	2	K-833-337	Support
	4		Machine Bolt, Nut, & Lock Washer, 5/8" x 2-1/4"
	4		Bevel Washer, 5/8"
	2	O-833-337	Spacer
9.	2	B-46-63	Spring
10.	2	P-833-337 W	Spring Seat
	4		Nuts, 3/4"

DOUBLE DRUM GREASE PIPING

(B/M 833-336-A)

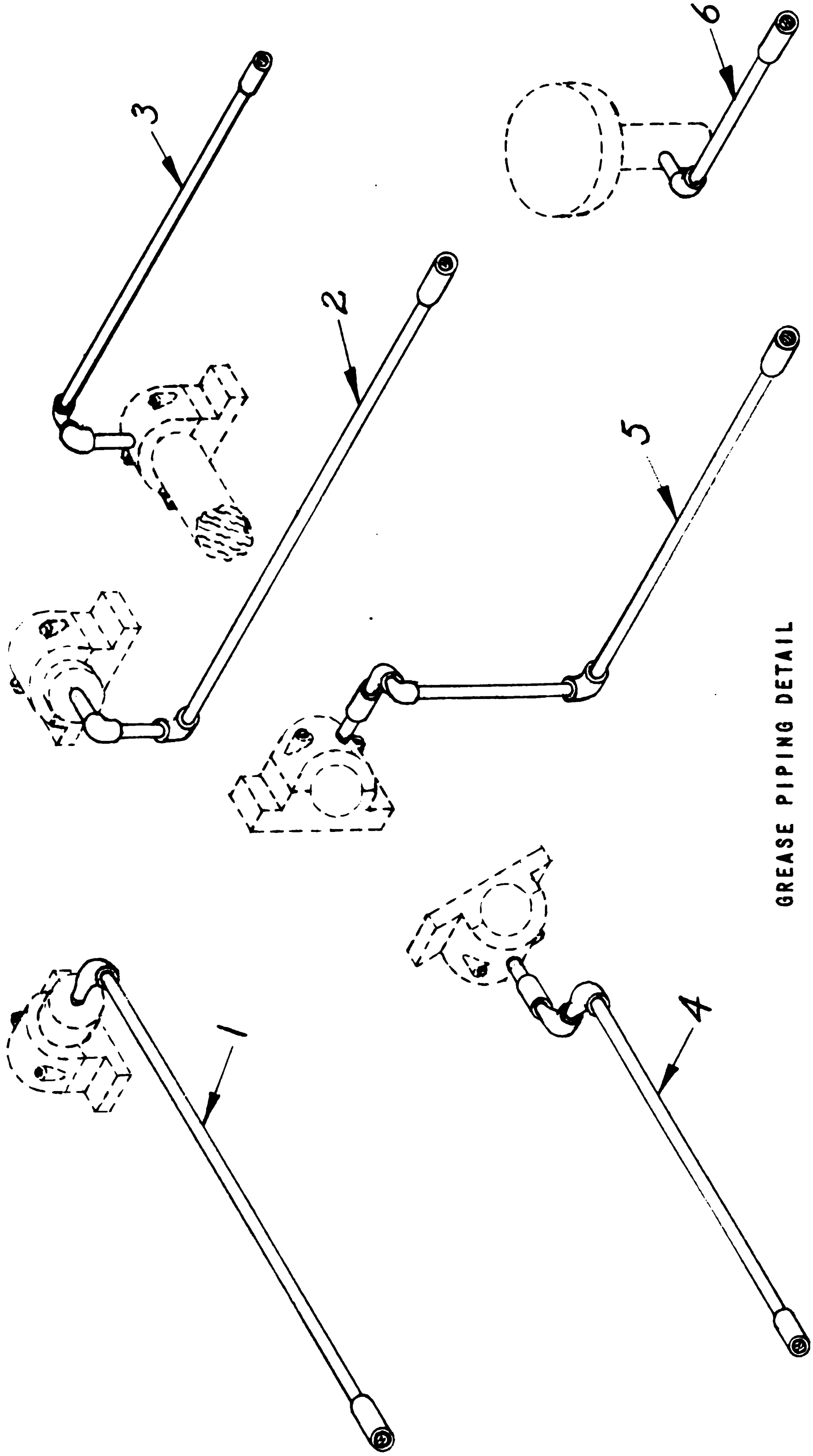


GREASE PIPING LOCATION

See References Page 14.

Double Drum Grease Piping (Continued)

(B/M 833-445-A)



GREASE PIPING DETAIL

See References Page 216

Double Drum Grease Piping (Continued)

(B/M 833-445-A)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.			Trunnion Shaft Piping
	6	AE-17-43	Pipe, 1/4" x 2' 6"
	6		Street Elbow, 1/4" x 90°
	6		Pipe Coupling, 1/4"
2.			Trunnion Shaft Piping
	4	AF-17-43	Pipe, 1/4" x 2-1/2"
	4		Elbow, 1/4" x 90°
	2	AE-17-43	Pipe, 1/4" x 2' 6"
	2		Pipe Coupling, 1/4"
3.			Main Jack Shaft Piping
	2	AF-17-43	Pipe, 1/4" x 2-1/2"
	2		Elbow, 1/4" x 90°
	2		Street Elbow, 1/4" x 90°
	1	GG-17-43	Pipe, 1/4" x 1' 8"
	1	M-17-43	Pipe, 1/4" x 1' 11"
	2		Pipe Coupling, 1/4"
4.			Counter-Shaft Piping
	2		Pipe Coupling, 1/4"
	4		Street Elbow, 1/4" x 90°
	2	GG-17-43	Pipe, 1/4" x 1' 8"
5.			Counter-Shaft Piping
	2		Pipe Coupling, 1/4"
	4		Street Elbow, 1/4" x 90°
	2	T-17-43	Pipe, 1/4" x 8-1/2"
	2		Elbow, 1/4" x 90°
	2	GG-17-43	Pipe, 1/4" x 1' 8"
6.			Thrust Roller Piping
	2	AF-17-43	Pipe, 1/4" x 2-1/2"
	2		Elbow, 1/4" x 90°
	2	X-17-43	Pipe, 1/4" x 7-1/2"
	2		Pipe Coupling, 1/4"

COMBUSTION CHAMBER LINING

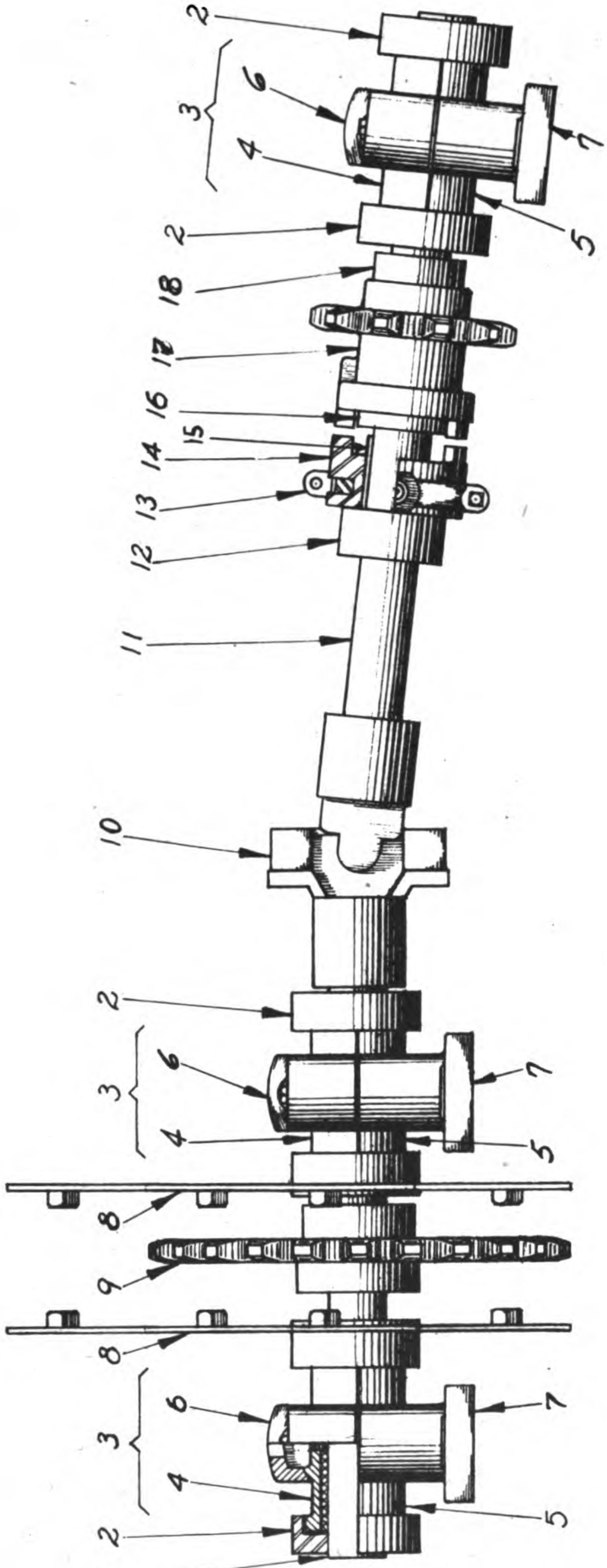
FROM (B/M 833-330-A)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	2	BO-WM-A1	Set 168 General Refractory Co. No 6-30 Cupola Blocks (Western Materials Co., Chicago, Ill.)
	2	CE-WM-A1	250 Lb. High Temperature Cement (Western Materials Co., Chicago, Ill.)

Always give Serial Number of Machine, Part Number and Description.

COLD ELEVATOR DRIVE SHAFT

(B/M 833-239-A2)



See Parts List on following page.

Cold Elevator Drive Shaft (Continued)

(B/M 833-239-A2)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	A1-833-239	Shaft, 1 15/16" x 1' 10-3/8" S.A.E. 1045
2.	4	C-3-1200	Dust Seal
	8		Set Screw, 1/2" x 1-1/2"
3.	3	13-213-K	Ball & Socket Bearing, Complete
	4		Machine Bolt, Nut, Lock Washer, & Cut Washer, 5/8" x 2-3/4"
	2		Machine Bolt, Nut, Lock Washer, & Cut Washer, 5/8" x 3-1/2"
	6		Machine Bolt, Nut & Jam Nut, 5/8" x 6"
4.	3	1462 D	Bearing, Upper Half
	3	AF-17-43	Pipe, 1/4" x 2-1/2"
	3		Pipe Coupling, 1/4"
	3		1/4" Button Head Alemite, Male
5.	3	1462 A	Bearing, Lower Half
6.	3	822 B	Bearing Cap
7.	3	823	Bearing Base
	6	AX-17-109	Shim, #12 Ga.
	7	AY-17-109	Shim, #16 Ga.
	9	TT-17-111	Stop Shim, #16 Ga.
	6	SS-17-111	Stop Shim, #12 Ga.
	30	QQ-17-111	Stop Shim, 1/4"
	6		Machine Bolt, Nut, & Lock Washer, 3/8" x 3"
8.	2	M-833-343 WB	Seal
9.	1	19-601-D	Sprocket, 33-Tooth
	1	U-17-33	Key, 1/2" x 1/2" x 2-3/4"
	1		Set Screw, 1/2" x 7/8"
	1		Set Screw, 1/2" x 1-1/4"
10.	1	UJ-BW-A1	Universal Joint
	2	Z-17-33	Key, 1/2" x 1/2" x 2-5/8"
	1	WW-17-43	Pipe, 1/8" x 1-1/2"
	1		1/8" Button Head Alemite, Female
	2		Allen Cup Point Safety Set Screw, 3/8" x 3/8"
11.	1	B2-833-239	Shaft, 1-15/16" x 2' 0-1/2", S.A.E. 1045
12.	1	136	Collar
	1		Low Head, Set Screw, 5/8" x 7/8"
13.	1	2427	Shifter Yoke
	2		Machine Bolt, Nut, & Lock Washer, 3/8" x 2-1/4"
	1		1/4" Button Head Alemite, Male
14.	1	2864 B	Jaw Clutch
15.	1	G-17-106	Feather Key, 1/2" x 1/2" x 3-3/4"
16.	1	E-3-941	Collar
	2		Allen Cup Point Safety Set Screw, 3/8" x 1/2"

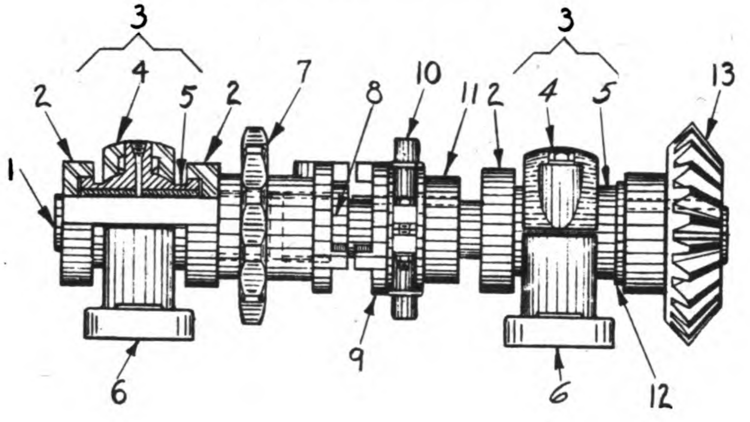
Cold Elevator Drive Shaft (Continued)

(B/M 833-239-A2)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
17.	1	3632 A	Sprocket, 11-Tooth
	2	P-8-75	Bronze Bushing
	1		1/4" Button Head Alemite, Male
18.	1	0-3-941	Collar
	2		Set Screw, 1/2" x 3/4"

HOT ELEVATOR DRIVE SHAFT

(B/M 833-82-A3)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	A3-833-82	Shaft, 1 15/16" x 1' 11-5/8" S.A.E. 4140
	1		1/4" Button Head Alemite, Male
2.	3	G-3-1200	Dust Seal
	6		Set Screw, 1/2" x 1-1/2"
3.	2	13-213-Q	1-15/16" Ball & Socket Bearing, Complete
4.	2	3488	Bearing Cap
	4		Machine Bolt, Nut, & Jam Nut, 5/8" x 5-3/4"
5.	2	2419 B	Bearing
	4	S-8-75	Bronze Bushing
	2		1/8" Button Head Alemite, Male
6.	2	823	Bearing Base
	4		Machine Bolt, Nut, Lock Washer, & Cut Washer, 5/8" x 3-3/4"
	4		Bevel Washer, 5/8"
	6	AX-17-109	Shims, 1/8"
	4	QQ-17-111	Stop Shim, 1/4"
	6	SS-17-111	Stop Shim, 12 Ga.
	4	TT-17-111	Stop Shim, 16 Ga.
	2		Machine Bolt, Nut, & Lock Washer 3/8" x 1-1/2"

Hot Elevator Drive Shaft (Continued)

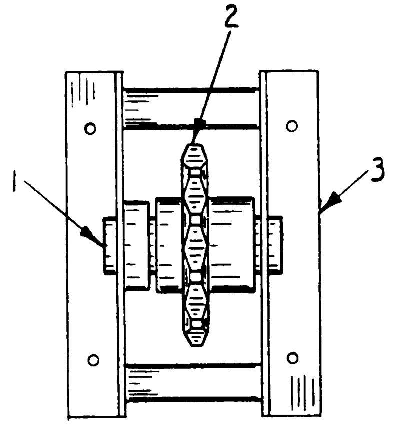
(B/M 833-82-A3)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
7.	1	3632	Sprocket, 11-Tooth
	2	P-8-75	Bronze Bushing
	1	G-17-106	Feather Key, 1/2" x 1/2" x 3-3/4"
8.	1	E-3-941	Collar
	2		Allen Cup Point Safety Set Screw, 3/8" x 1/2"
9.	1	2864 B	Jaw Clutch
10.	1	2427	Shifter Yoke
	2		Machine Bolt, Nut, & Lock Washer, 3/8" x 2-1/4"
	1		1/4" Button Head Alemite, Male
11.	1	W-3-941	Collar
	2		Set Screw, 3/8" x 1-1/4"
12.	1	D-17-92	Bronze Washer
13.	1	A-18-238	Bevel Gear
	1	D-17-33	Key, 1/2" x 1/2" x 3-3/8"
	1		Allen Cup Point Safety Set Screw, 5/8" x 3/4"
	1		Allen Cup Point Safety Set Screw, 5/8" x 1"

on)

HOT ELEVATOR DRIVE SUPPORT IDLER

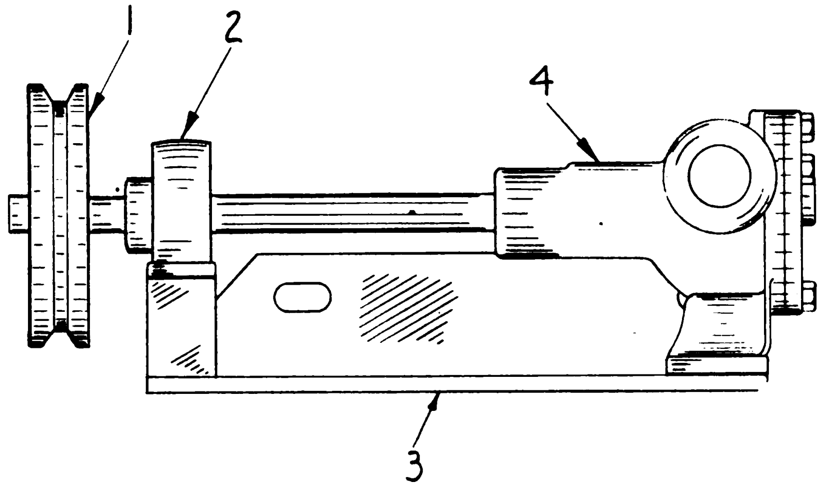
From (B/M 833-307-A)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2	M-833-307	Shaft, 1 15/16" x 6-1/4" S.A.E. 1020
	2		1/4" Button Head Alemites, Male
2.	2	2161 D	Sprocket, 11-Tooth
	4	C-8-123	Graphite Bushing
3.	2	K-833-307 W	Bracket
	4		Set Screw, 1/2" x 3/4"
	8		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/4"

FUEL PUMP

(B/M 833-79-A2)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	PL-DR-G1	Pulley, V Type
	1	W-17-41	Key, 3/16" x 3/16" x 1-3/16"
	2		Set Screw, 1/4" x 1/4"
2.	1	BR-F-Q1	5/8" Bearing, Fafnir Model LAK
	2		Machine Bolt, Nut, & Lock Washer, 3/8" x 1-1/4"
	4	DM-17-139	Shim, .010"
3.	1	C1-833-79 W	Pump Support
	2		Flat Head Cap Screw, Nut, & Lock Washer, 5/16" x 1"
	4		Machine Bolt, Nut, Lock Washer, & Cut Washer, 1/2" x 1-1/4"
	1	BK-17-24	Take Up Bolt, 1/2" x 3-3/4"
	1	CT-17-24	Take Up Bolt, 1/2" x 6"
	6		Hex Nut, 1/2"
4.	1	PU-VK-B	Pump, Viking Model EG X 2 (For Details See Accessory Section)

MASTER CLUTCH REMOTE CONTROL LEVER

(B/M 833-280-B)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	F-3-1058 W	Lever
	1		Set Screw, 3/8" x 5/8"
	1		Set Screw, 3/8" x 3/4"
	1	BB-17-30	Key, 1/4" x 1/4" x 1-1/8"
2.	1	A-833-280	Bracket
	4		Machine Bolt, Nut, Lock Washer, & Cut Washer, 1/2" x 1-1/2"
3.	1	E1-833-279 W	Shaft
4.	2		Cable, 1/4" x 25' 0" (8 x 19)
	4		Cable Thimble, 1/4"
	4		Cable Clamp, 1/4"
	4		U-Bolt & 4 Nuts, 5/16"
	4		Fast Eye Block, No. 9
5.	1	J-833-279 W	Bracket
	1		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/4"
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/2"
	3		Bevel Washer, 1/2"
6.	1	B-3-1205 W	Lever
	1		Set Screw, 3/8" x 5/8"
	1	BB-17-30	Key, 1/4" x 1/4" x 1-1/8"
7.	1	F1-833-279 W	Rod

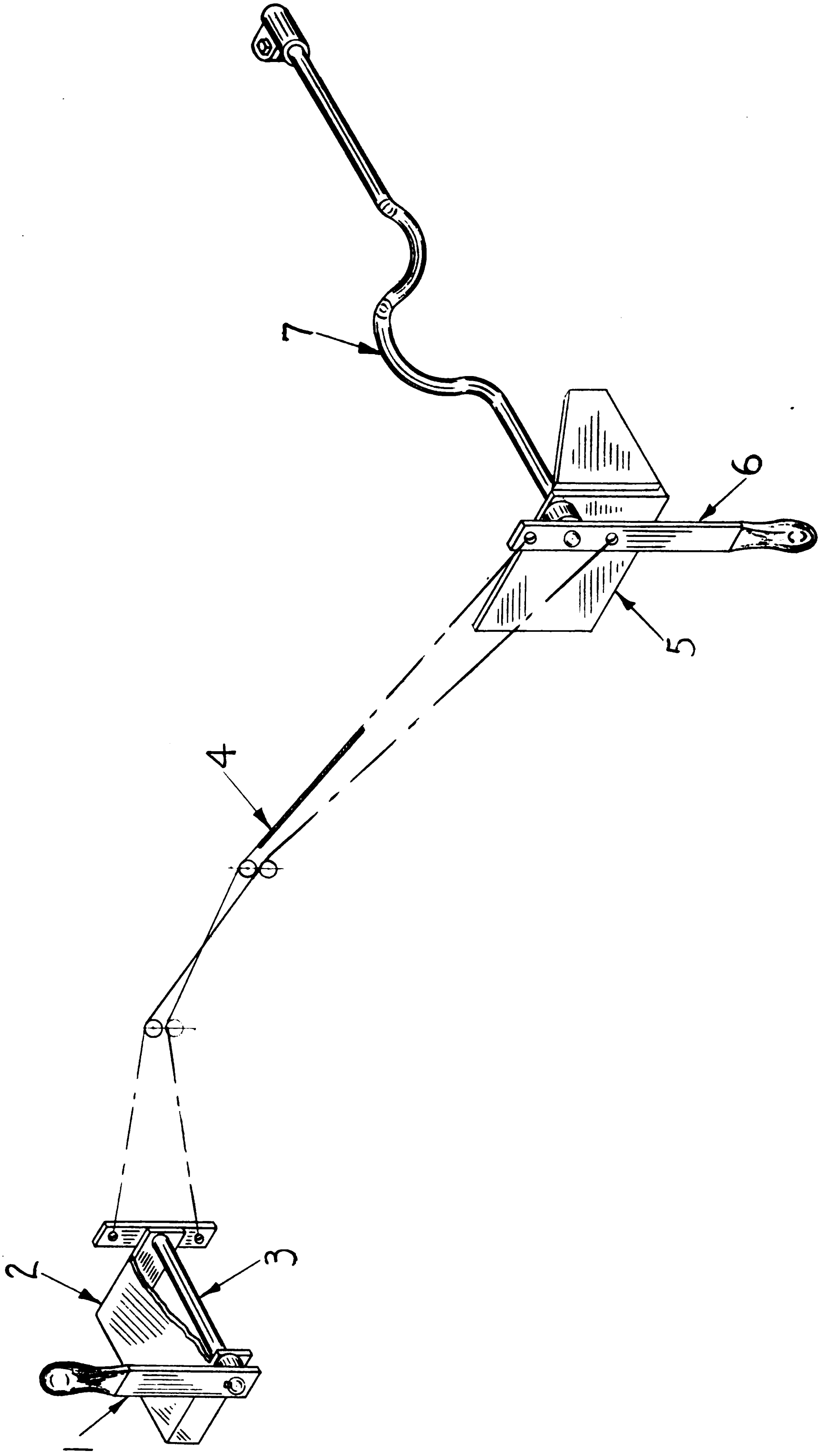
TOOLS

(B/M 833-135-A)
(B/M 833-272-B)
(B/M 848-106-B)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	1	B-46-20	Engineer's Wrench, 3/8" x 1/2"
	1	WW-46-20	Engineer's Wrench, 5/8" x 3/4"
	1	F-46-20	Construction Wrench, 1-1/4"
	1	MM-46-20	Adjustable Wrench, 12"
	1	BB-46-20	Oil Can
	1	AN-46-20	Alemite Gat Gun
	1	AH-46-20	Heavy Duty Hose For Gun
	2	HT-PD-B1	Chain Hoist, 1 Ton McCullum Spur Gear, Standard 8'-0" Lift (For Details See Accessory Section)
	2	CH-PD-A1	3/8" Chain Sling, 7'-0"
	1	HJ-BL-A1	Blackhawk Jack, 8 Ton, 10-1/2" High, 7-3/4" Lift, Two Piece Handle (For Details See Accessory Section)

Master Clutch Remote Control Lever (Continued)

(B/M 833-280-B)



G A S O L I N E   T A N K

(B/M 833-268-A1)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	1	A-46-240W	Gasoline Tank
	2	H-46-240	Saddle Block, Wood
	4	F-46-240	Strap
	4	D-46-240	Strap Flashing
	2	Y-17-24	Machine Bolt, & Two Nuts, 1/2" x 5"
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 5-1/4"
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 4-3/4"
	2		Bevel Washer, 1/2"
	1	53-54-A	Breather
	1		Elbow, 1/4" x 90°
	1	I-17-43	Pipe, 1/4" x 3"
	1		Cock, Imperial #57 EF
	1		Elbow, 1/4" x 90°
	1	C-17-43	Pipe, 1/4" x 7/8"
	1		Copper Tube, 3/8" x 4'-6"
	1		Elbow, Imperial #69F, 3/8" OD x 1/8" IPT
	1		Pipe Plug, 1/4"

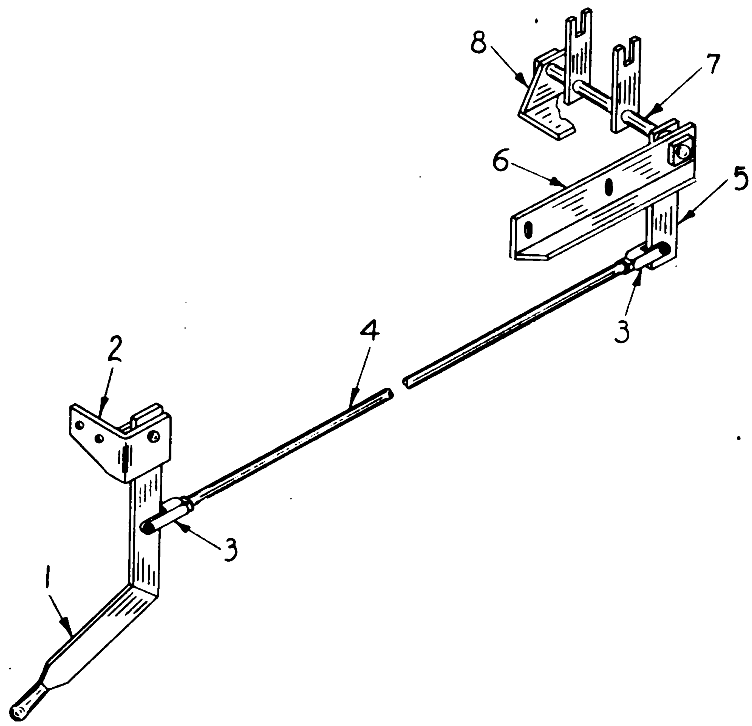
T H E R M O M E T E R

(B/M 833-105-A1)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	4	F-38-144	Clamp
	2	TH-EA-A1	Motoco Dial Thermometer 50° to 550°F.
	2	E-833-105W	Housing
	4		Machine Bolt, Nut, & Lock Washer, 3/8" x 1"
	4		Shakeproof Right Hand, Thread Cutting Screw, #10-24 x 1/4"
	2	FF-46-20	Padlock
	2	G-833-105	Thermometer Support
	4		Machine Bolt, Nut, Lock Washer, & Cut Washer, 3/8" x 1-1/4"

COLD ELEVATOR CONTROL LEVER

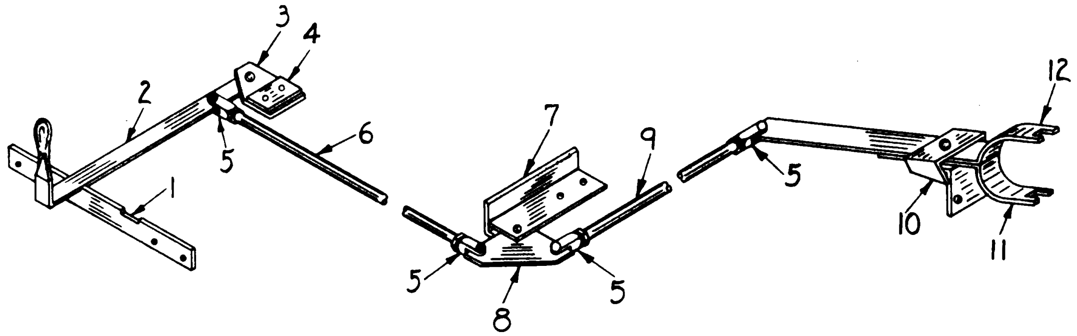
(B/M 833-366-A)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	V-833-367 W	Lever
	1	Q-17-23	Rivet
	1		Cotter, 1/8" x 1"
2.	1	S-833-367 W	Bracket
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/4"
3.	2	B-3-149	Yoke End
	2		Hex Nut, 3/4"
	2	C-17-23	Rivet
	2		Cotter, 1/8" x 1"
4.	1	J-833-367	Rod, 3/4" x 4' 7-3/4"
5.	1	M-833-367 W	Lever
	1	BB-17-30	Key, 1/4" x 1/4" x 1-1/8"
	1		Set Screw, 3/8" x 5/8"
	1		Set Screw, 3/8" x 3/4"
6.	1	A-833-367 W	Bracket
	2		Machine Bolt, Nut, Lock Washer, & Cut Washer, 1/2" x 1-1/4"
7.	1	F-833-367 W	Shifter
8.	1	D-833-367 W	Bracket
	2		Machine Bolt, Nut, Lock Washer, & Cut Washer, 1/2" x 2-1/2"
	2		Bevel Washer, 1/2"
	2	N-833-367	Shim, 12 Ga.
	2	O-833-367	Shim, 1/4"

H O 1 ELEVATOR CONTROL LEVER

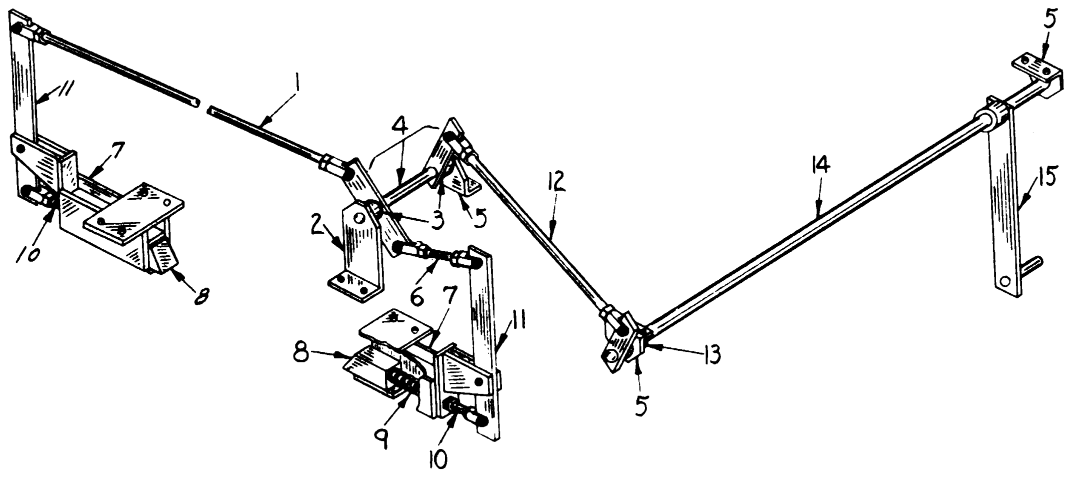
(B/M 833-351-A)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	A-833-352	Lever Stop
	3		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/4"
2.	1	C-833-352	Lever
	1		Machine Bolt, Nut, Lock Washer, & Cut Washer, 1/2" x 2"
	1	C-17-10	Pipe Spacer
3.	1	D-833-352	Support
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/2"
4.	1	E-833-352	Spacer Bar
5.	4	B-3-149	Yoke End
	4	C-17-23	Rivet
	4		Cotter, 1/8" x 1"
	4		Hex Nut, 3/4"
	2	HH-17-9	Washer
6.	1	BZ-17-144	Rod, 3/4" x 11' 1"
	1	Q-833-352	Support
	2	E-17-11	Pipe Spacer
	2		Machine Bolt, Nut, Lock Washer, 1/2" x 2-1/2"
	2		Bevel Washer, 1/2"
7.	1	P-833-352 W	Bracket
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/2"
	1	Z-17-23	Rivet
	1		Cotter, 1/8" x 1"
	2		Bevel Washer, 1/2"
8.	1	H-833-352	Lever Plate
9.	1	CP-17-144	Rod, 3/4" x 3' 4"
10.	1	O-833-352 W	Bracket
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/4"
11.	1	K-833-352	Shifter Fork Half
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/2"
	1	BG-17-23	Rivet
	1		Cotter, 1/8" x 1"
[illegible]	1	J-833-352	Shifter Fork Half

SAFETY LATCH LEVER

(B/M 833-452-A)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	B-833-451	Rod, 3/4" x 5' 9-3/4"
	2	B-3-149	Yoke Ends
	2	C-17-23	Rivet
	2		Cotter, 1/8" x 1"
	2		Hex Nut, 3/4"
2.	1	M-833-452 W	Bracket
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-3/4"
	2		Bevel Washer, 1/2"
3.	3	B-17-9	Washer
4.	1	P-833-452 W	Lever
5.	3	J-833-452 W	Bracket
	1	BB-833-452	Shim, 1/4"
	4		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/4"
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/2"
6.	1	T-17-144	Rod, 3/4" x 6"
	2	B-3-149	Yoke Ends
	2		Hex Nut, 3/4"
	2	C-17-23	Rivet
	2		Cotter, 1/8" x 1"
7.	2	A-833-452 W	Ratchet Frame
	8		Machine Bolt, Nut, & Lock Washer, 3/4" x 2-1/2"
	8		Bevel Washer, 3/4"
8.	2	A-833-451	Latch
9.	2	B-46-64	Spring
10.	2	BC-17-144	Rod, 3/4" x 9"
	2	B-3-149	Yoke End
	4		Half Nut, 3/4"
	2	C-17-23	Rivet
	2		Cotter, 1/8" x 1"

Safety Latch Lever (Continued)
(B/M 833-452-A)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
11.	2	U-833-452	Lever Link
	2	Z-17-23	Rivet
	2		Cotter, 1/8" x 1"
12.	1	A-17-144	Rod, 3/4" x 1' 6-3/4"
	2	B-3-149	Yoke End
	2		Hex Nut, 3/4"
	2	C-17-23	Rivet
	2		Cotter, 1/8" x 1"
13.	1	B-3-932	Collar
	2		Set Screw, 3/8" x 3/4"
14.	1	AA-833-452 W	Shaft, 1-3/16" x 4' 6-5/16" S.A.E. 1020
15.	1	V-833-452 W	Lever
	2		Set Screw, 3/8" x 3/4"
	1	C-17-30	Key, 1/4" x 1/4" x 1-1/2"

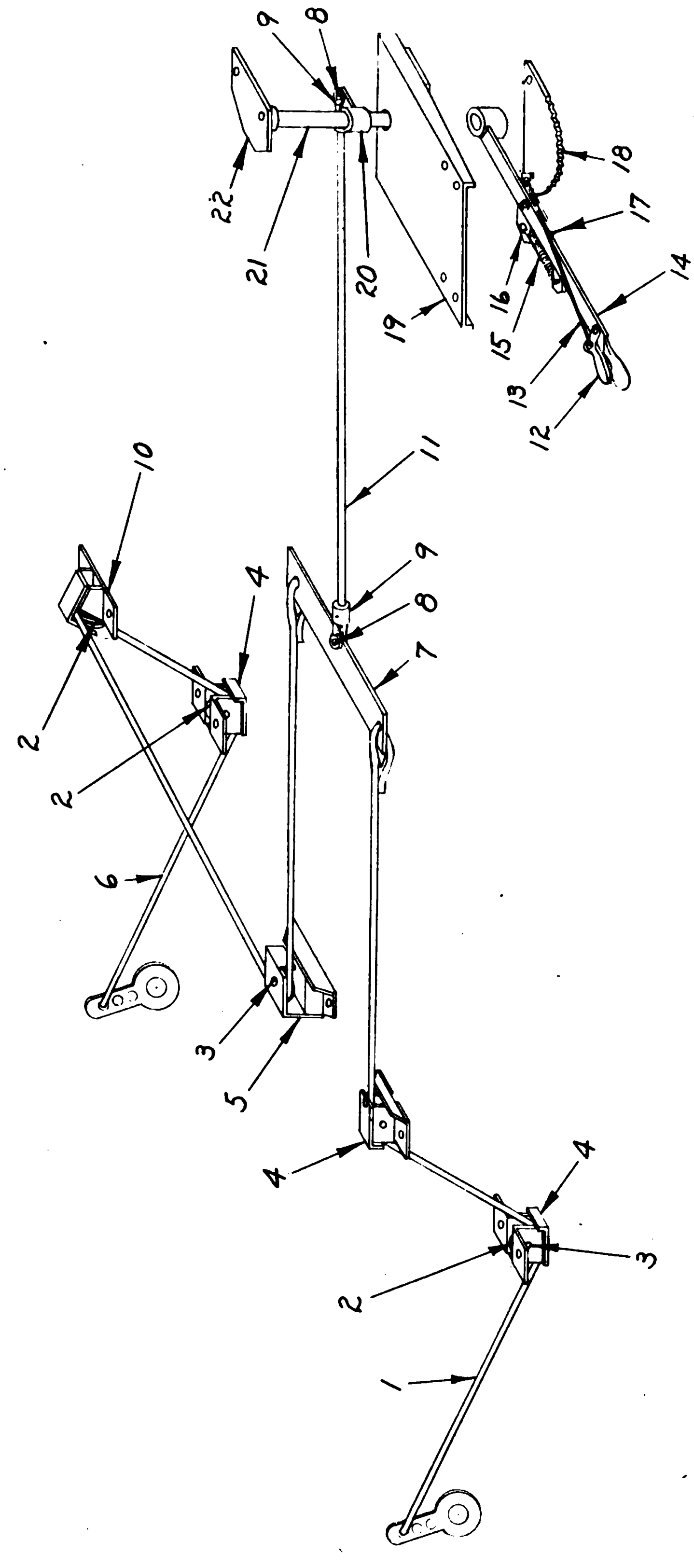
MECHANICAL BRAKE LEVER
(B/M 833-458-A)

See Illustration on following page.

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1		Cable, 5/16" x 6' 6" (6 x 19)
	2		Cable Clamps, 5/16"
	2		Cable Thimbles, 5/16"
2.	5	3513	Sheave
3.	5	WW-17-23	Rivet
	5		Cotter, 1/8" x 1"
4.	3	V-833-459 W	Bracket
	6		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-3/4"
	6		Bevel Washer, 1/2"
5.	1	Z-833-459 W	Bracket
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-3/4"
	2		Bevel Washer, 1/2"
6.	1		Cable, 5/16" x 9' 6" (6 x 19)
	2		Cable Clamps, 5/16"
	2		Cable Thimbles, 5/16"
7.	1	F-58-10	Evener
8.	2	CP-17-23	Rivet
	2		Cotter, 1/8" x 1"
9.	2	A-3-604	Yoke End, 1/2"
	2		Hex Nut, 1/2"
10.	1	D-833-459 W	Bracket
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-3/4"
	2		Bevel Washer, 1/2"

Mechanical Brake Lever (Continued)

(B/M 833-458-A)



See Parts Lists on Pages 26 and 28.

Mechanical Brake Lever (Continued)

(B/M 833-458-A)

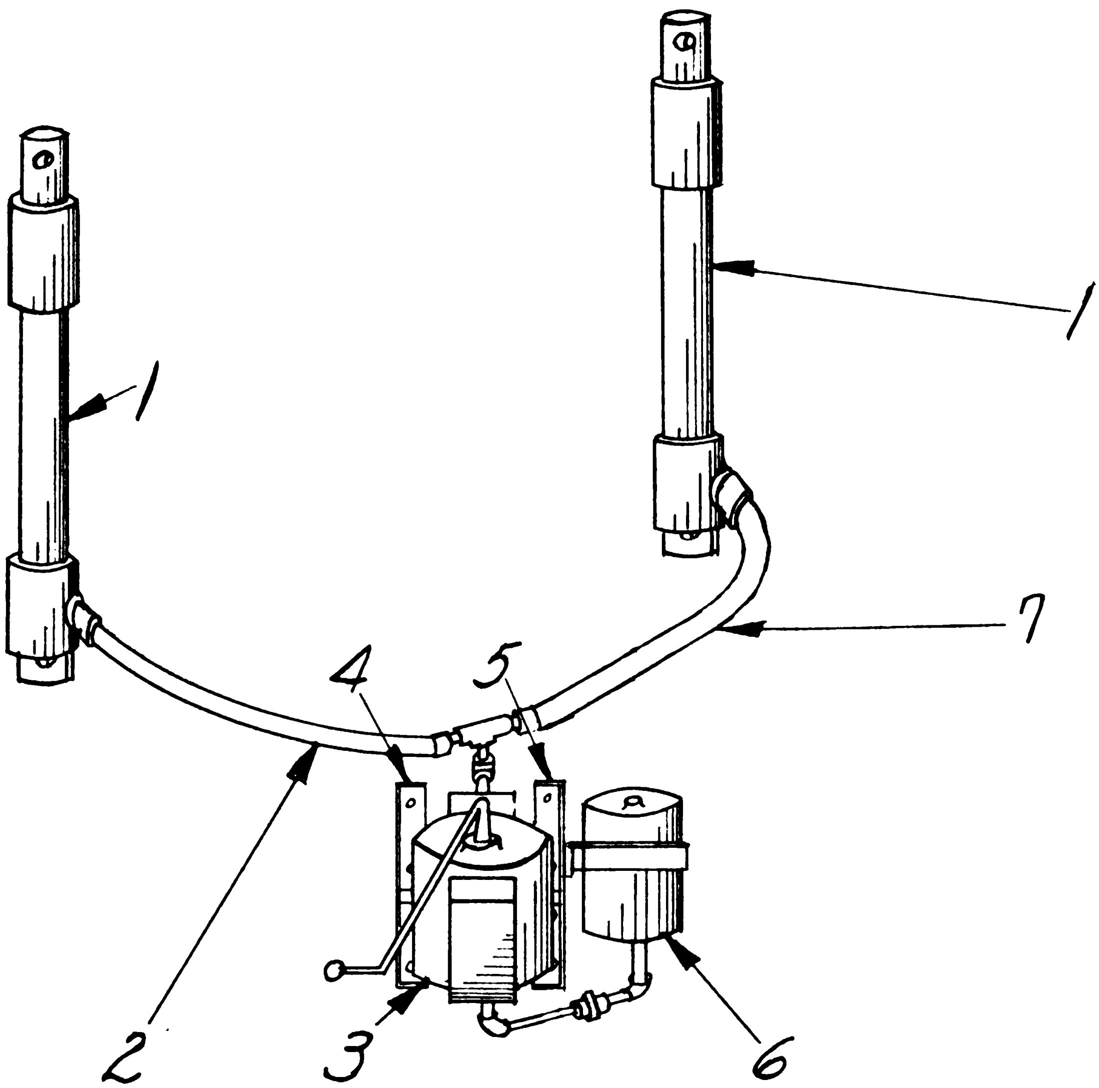
See Illustration on page 27.

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
11.	1	AZ-17-144	Rod, 1/2" x 3' 3"
12.	1	G-62-33	Grip Latch
	1	DC-17-23	Rivet
	1		Cotter, 3/32" x 1"
13.	1	P-3-1197	Rod, 1/4" x 1' 10-3/16"
14.	1	O-3-1197 W	Lever Arm
	1	E-17-30	Key, 1/4" x 1/4" x 2"
	1		Set Screw, 3/8" x 1/2"
	1		Set Screw, 3/8" x 7/8"
15.	1	D-46-154	Spring
	2		Round Head Stove Bolt, Nut, & Lock Washer, 1/4" x 3/4"
16.	1	F-3-1197	Latch
	1	B-17-10	Spacer
	1		Machine Bolt, Nut, & Lock Washer, 1/2" x 2"
17.	1	H-3-1197	Bar
	1		Machine Bolt, Nut, & Lock Washer, 1/2" x 2"
18.	1	M-3-1197	Ratchet
	4	DM-17-9	Washer
	2		Machine Bolt, Nut, & Lock Washer, 5/8" x 2"
19.	1	Q-833-459 W	Bracket
	1		1/4" Button Head Alemite, Male
	4		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-3/4"
	4		Bevel Washer, 1/2"
20.	1	G-3-1032 W	Lever Arm
	1	C-17-30	Key, 1/4" x 1/4" x 1-1/2"
	1		Set Screw, 3/8" x 3/8"
	1		Set Screw, 3/8" x 7/8"
21.	1	J-833-459	Shaft, 1-1/4" x 1' 1-7/8" S.A.E. 1020
22.	1	N-833-459 W	Bearing Bracket
	1		1/4" Button Head Alemite, Male
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-3/4"
	2		Bevel Washer, 1/2"

Always give Serial Number of Machine, Part Number and Description.

HYDRAULIC PUMP & RAMS

(B/M 833-453-A)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2	HR-BL-A6	Ram, Blackhawk #R340 24" Stroke (For Details See Accessory Section)
2.	1	HO-BL-A4	Hose, 1' 3" Blackhawk High Pressure
3.	1	HP-BL-B2	Hydraulic Pump, Blackhawk P-112 (For Details See Accessory Section)
	4		Machine Bolt, Nut, & Lock Washer, 3/8" x 1-1/4"
	1	U-17-178	Seamless Steel Pipe, 1/4" x 2"
	1		Elbow, 1/4" x 90°, 3000# Pressure
	1	T-17-178	Seamless Steel Pipe, 1/4" x 3-1/2"
	1		Tee 1/4" x 1/4" x 1/4", 3000# Pressure
	3		Pipe Strap, 3/8"
	6		Round Head Stove Bolt, Nut, & Lock Washer, 3/16" x 3/4"
	3 Qt.		Blackhawk Hydraulic Fluid

Hydraulic Pump & Rams (Continued)

(B/M 833-453-A)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
4.	1	A (R) 833-453	Hydraulic Pump Support
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/2"
5.	1	A (L) 833-453	Hydraulic Pump Support
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/2"
6.	1	B-833-453 W	Tank
	2		Machine Bolt, Nut, & Lock Washer, 3/8" x 3/4"
	1	F-17-149	Plug
	1		Reducing Bushing, 3/8" x 1/4"
	1	HH-17-43	Pipe, 1/4" x 1-3/4"
	1		Elbow, 1/4" x 90°
	1	T-17-43	Pipe, 1/4" x 4"
	1		Gem Union, 1/4"
	1	D-17-43	Pipe, 1/4" x 1-1/4"
	1		Elbow, 1/4" x 90°
	1	E-17-43	Pipe, 1/4" x 1-1/2"
7.	1	HO-BL-A5	Hose, 5' 0" Blackhawk High Pressure

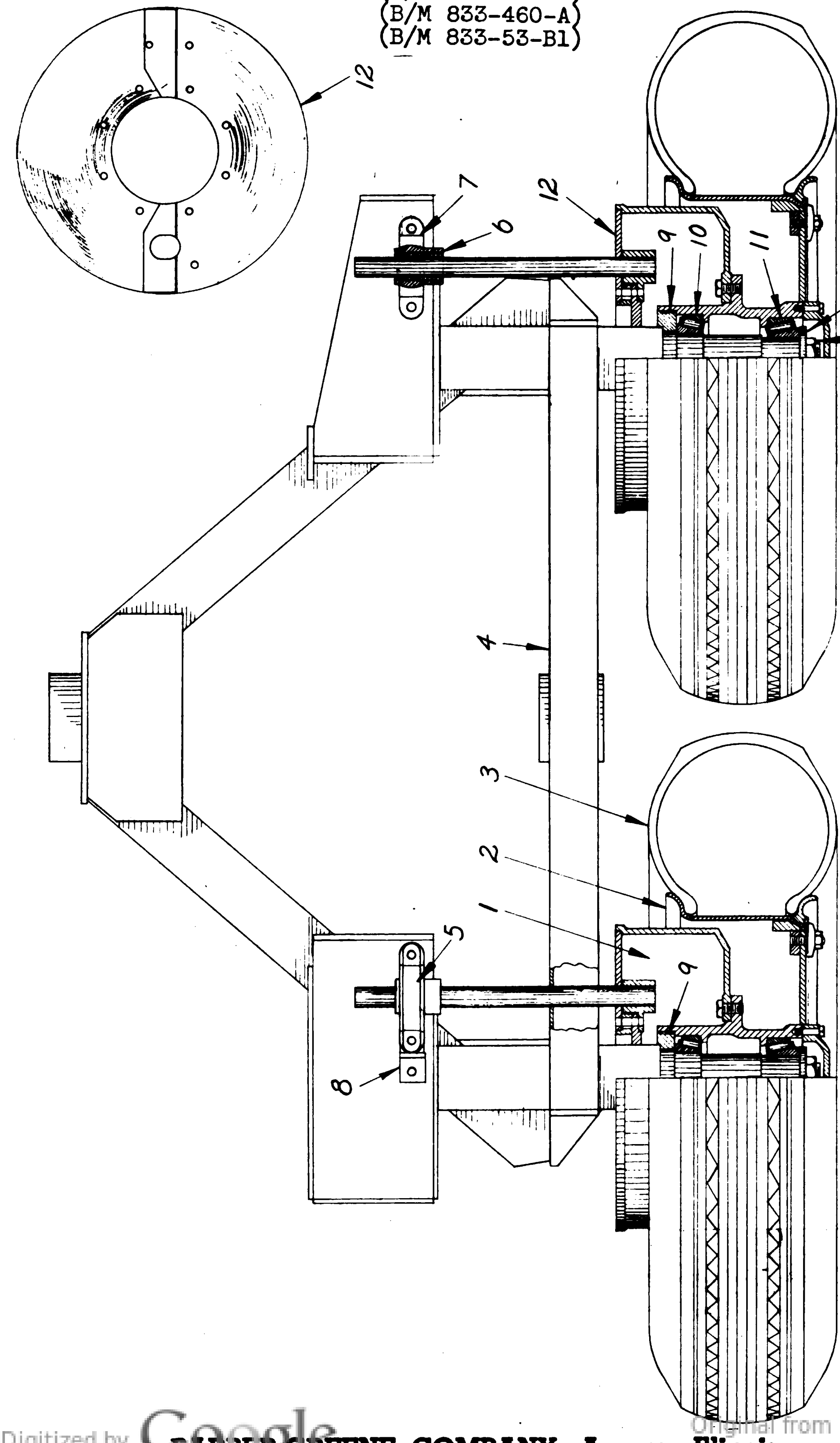
R E A R   A X L E

(B/M 848-326-A)
(B/M 833-460-A)
(B/M 833-53-B1)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2	BK-T-A1	Foundation Brake, one Pair. (For Details See Accessory Section)
2.	4	WH-E-J3	Wheel & Rim (For Details See Accessory Section)
3.	4	T1-G-E2	12.00 x 20" 14 Ply Goodrich Speedliner Tire
	4	TU-G-E2	12.00 x 20" Goodrich Regular Heavy Duty Tube
4.	1	H(R)-848-324W	Pivot Frame (Operator's Side)
	1	H(L)-848-324W	Pivot Frame (Opposite Operator's Side)
5.	4	3331	Bearing Cap
6.	4	2806A	Bearing
7.	2	3341	Bearing Base, Front Frame
8.	2	A-13-273W	Bearing Base, Rear Frame
	6		Machine Bolt, Nut, & Half Nut, 1/2" x 4"
	2		Flat Head Cap Screw, Nut, & Half Nut, 1/2" x 3-3/4"
	16	A-13-50	1/4" Pipe Nipple
	16		1/8" Button Head Alemite, Male
	4	N-17-71	Stop, 1/4"
	4		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/4"
	4		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/2"

Rear Axle (Continued)

(B/M 848-326-A)
(B/M 833-460-A)
(B/M 833-53-B1)



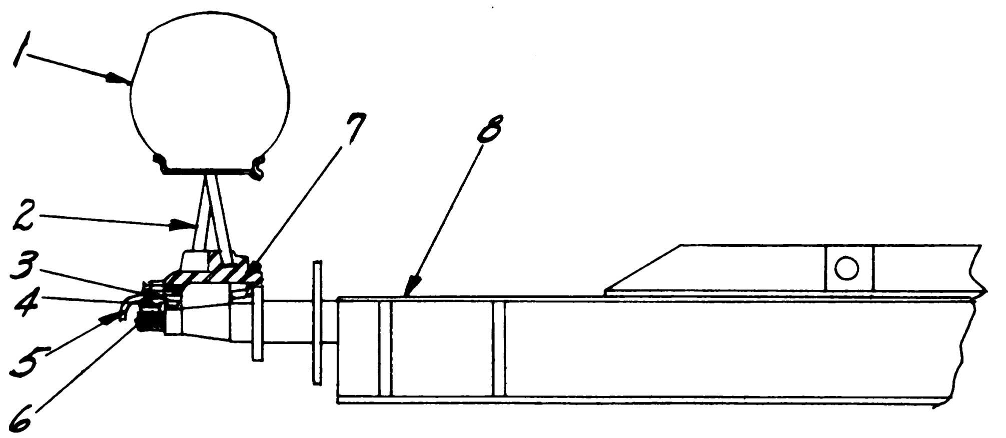
Rear Axle (Continued)

(B/M 848-326-A)
(B/M 833-460-A)
(B/M 833-53-B1)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	8	EA-17-111	Shim, 20 Ga.
	12	EB-17-111	Shim, 16 Ga.
	4	EC-17-111	Shim, 3/16"
	6	SS-17-109	Shim, 20 Ga.
	6	DU-17-139	Shim, 20 Ga.
9.	4	A-50-58	Seal
10.	4	BR-T-K1	Timken Cone & Roller #5760
11.	4	BR-T-L1	Timken Cone & Roller #5557
12.	2	C (R) 848-326W	Seal Plate (Operator's Side)
	2	C (L) 848-326W	Seal Plate (Opposite Operator's Side)
	32	A-17-99	Hex Head Cap Screw, 5/8" x 2-3/4", American Standard Fine Thread
	32		Castle nut American Standard Light, Castle 5/8" American Standard Fine Thread
	32		1/8" x 1" Cotter
13.	4	WS-T-A1	Timken K-6141 Washer
14.	4	NU-T-B1	Timken Nut
	4		Cotter, 3/8" x 2-3/4"

FRONT AXLE

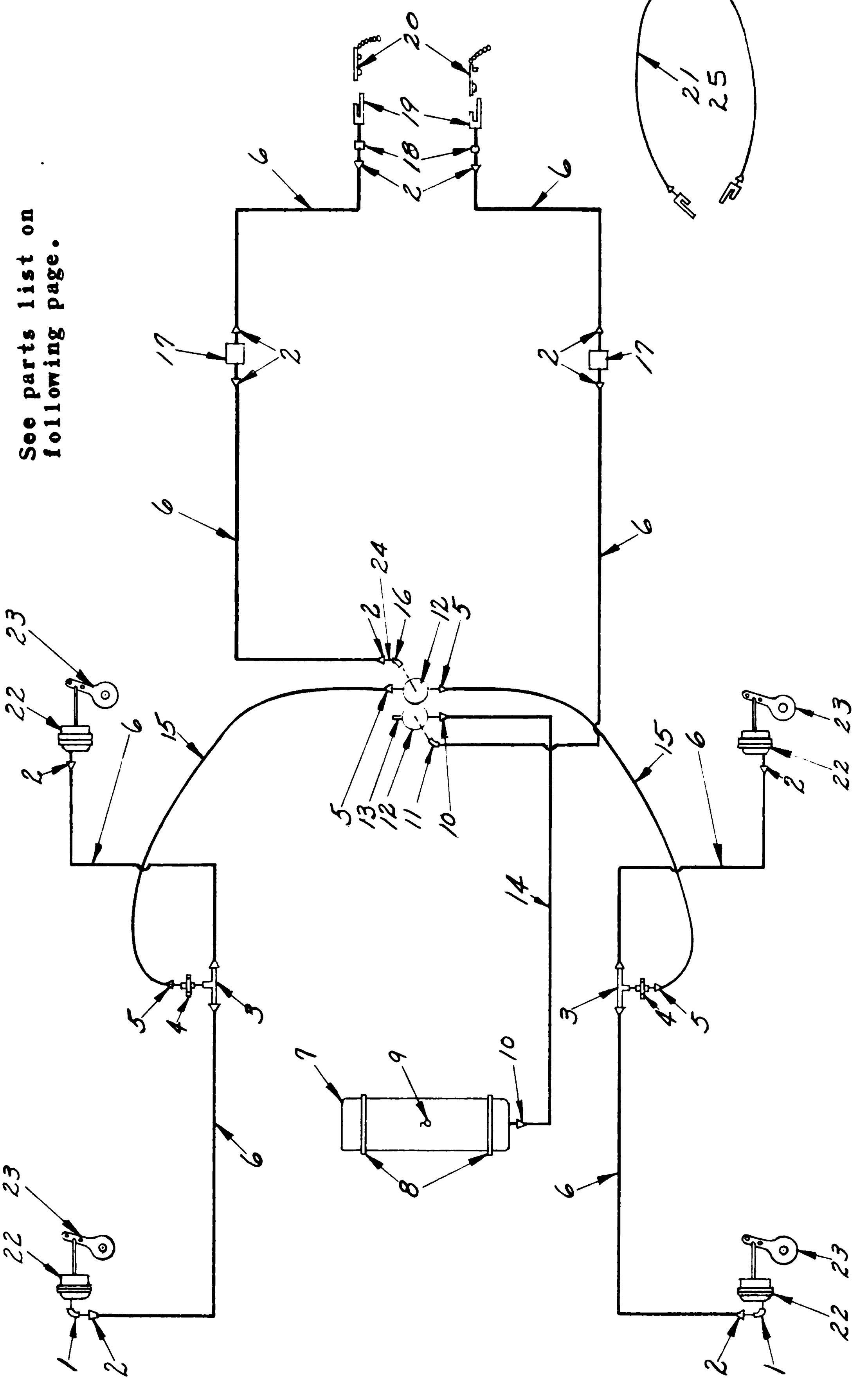
(B/M 833-247-A1)
(B/M 833-246-E)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2	T1-G-B1	Tire, 10.00" x 20" 12-Ply Heavy Duty Speed Liner
	2	TU-G-B1	Tube, 10.00" x 20" Regular Heavy Duty
2.	2	WH-E-T1	Wheel, For 20" x 8" Rim for 9.75" x 20" Tire
3.	2	BR-T-O1	Timken Bearing #419
4.	2		Washer, 1-1/4" Tongued
5.	2	L-458	Dust Cap
	4		Hex Head Cap Screw, 3/8" x 1-1/4"
6.	2		Nut, 1-1/4" Light Thick American Standard Slotted 12 Thread Per Inch
7.	2	BR-T-P1	Timken Bearing, #560
8	1	D1-833-247 W	Axle

AIR BRAKE CONTROL

See parts list on following page.



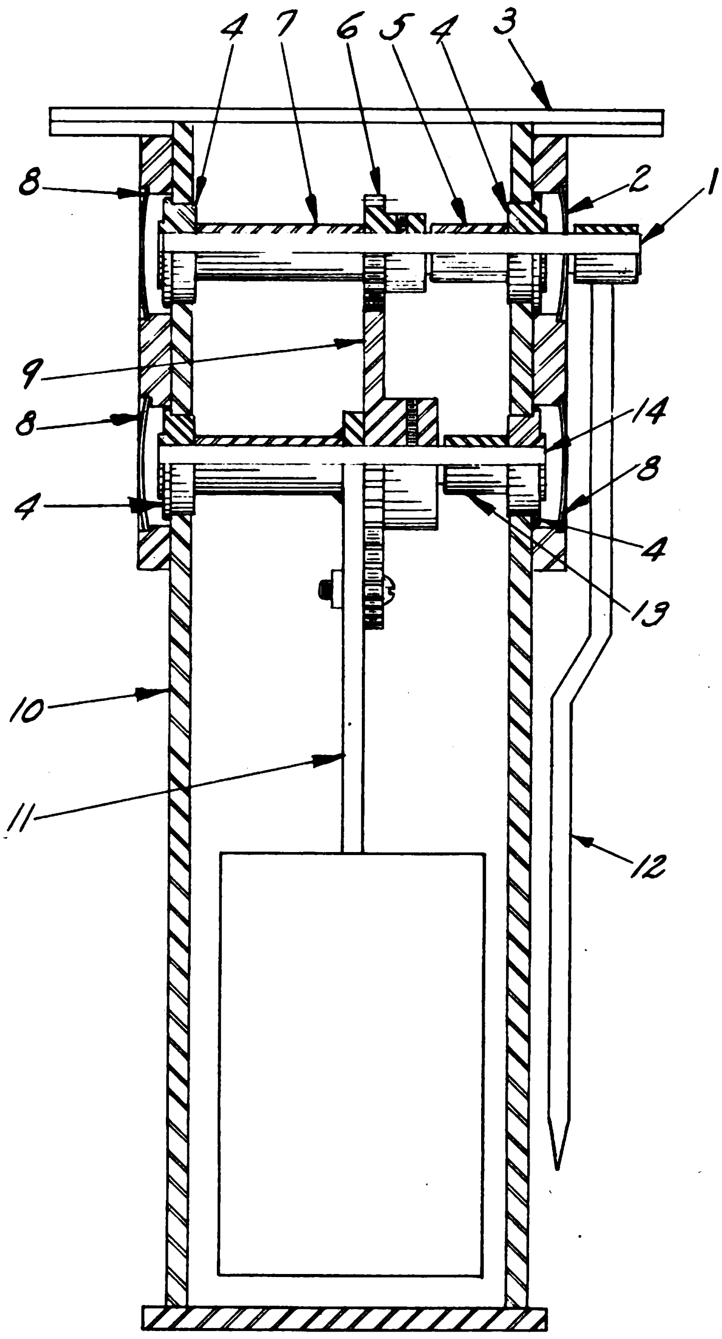
Air Brake Control (Continued)

(B/M 833-461-A)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2		1/4" x 90° Street Elbow
2.	10	205053	Connector 3/8" Tube x 1/4" Pipe Thread
3.	2	205103	Union Tee 3/8" Tube x 1/4" Pipe Thread
4.	2	201010	Frame Fitting 1/4" Pipe Taps
5.	4	215536	Hose Connector
6.	1		TUB-BE-A1 3/8" Tubing x 64'-10"
6.	1		LM-BE-A1 7/16" Loom x 68'0"
7.	1	215689	7" x 36" Reservoir
8.	2	205267	Reservoir Bracket
9.	1	215310	1/4" Drain Cock
10.	2	217525	Connector 1/2" Tube x 3/8" Pipe Thread
11.	1	205102	Elbow 3/8" Tube x 1/4" Pipe Thread
12.	1	220353	Relay Emergency Valve (For Details See Accessory Section)
13.	1	221087	Exhaust Check Valve
14.	1		LM-BE-A2 9/16" I.D. Loom x 4'-0"
	1		TUB-BE-A2 1/2" O.D. Copper Tube x 4'-0"
15.	2		BW-101-M hose x 3'-0"
16.	2		3/8" x 90° Street Elbow
17.	2	221022	Type E Filter 1/4" Pipe Tap (For Details See Accessory Section)
18.	2	205730	Clamping Stud
19.	2	220165	Lock type hose coupling
20.	2	220636	Dummy Hose Coupling
21.	2	221180	Flex Connecting Hose Assembly (HO-BE-A2) 146-1/2" Center to center of couplings
22.	4	216619	Stud type "B" brake chamber (For Details See Accessory Section)
23.	4	220269	Type "K" Slack adjuster (For Details See Accessory Section)
24.	1	205824	Connector 3/8" Tube x 3/8" Pipe thread
	1	201500	Service Connection tag
	1	201499	Emergency Connection tag
	4		1/8" x 90° Street Elbow
	4		1/8" Button Head Alemites, Male
	2		3/8" Pipe Plug

LEVEL INDICATOR

(B/M 833-60-A)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	O-833-60	Shaft, 3/8" x 4-5/8" S.A.E. #1020
2.	1	J-833-60	Disc Plug
3.	1	N-833-60	Cover
	4		Round Head Stove Bolt, Nut, & Lock Washer, 1/4" x 1/2"
4.	4	BR-BG-A1	Ball Bearing, 3/8" Flanged Boston #5543
5.	1	M-833-60	Spacer

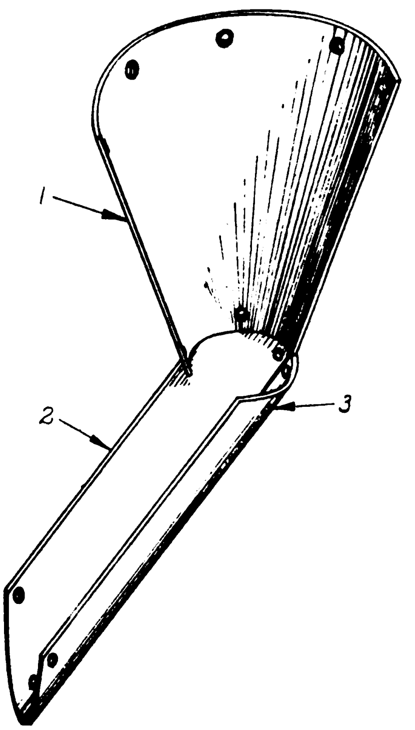
Level Indicator (Continued)

(B/M 833-60-A)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
6.	1	C-18-276	Gear, 32-Tooth
	1		Allen Cup Point Safety Set Screw, 3/16" x 1/4"
7.	1	X-833-60	Spacer
8.	3	H-833-60	Disc Plug
9.	1	C-18-277	Gear, 96-Tooth
	1		Round Head Stove Bolt, Nut, & Lock Washer, 3/16" x 3/4"
	1		Allen Cup Point Safety Set Screw, 3/16" x 7/16"
10.	1	V-833-60 W	Housing
	2		Machine Bolt, Nut, & Lock Washer, 1/2" x 1"
11.	1	W-833-60 W	Counter Weight
12.	1	Y-833-60 W	Pointer
	1		Set Screw, 1/4" x 5/8"
13.	1	Z-833-60	Spacer
14.	1	Q-833-60	Shaft, 3/8" x 3-5/8" S.A.E. #1020
	1	833-60-A	**Level Indicator Includes All Above Parts**

RECEIVING HOPPER LINER

(B/M 833-261-A4)



See Parts List on following page.

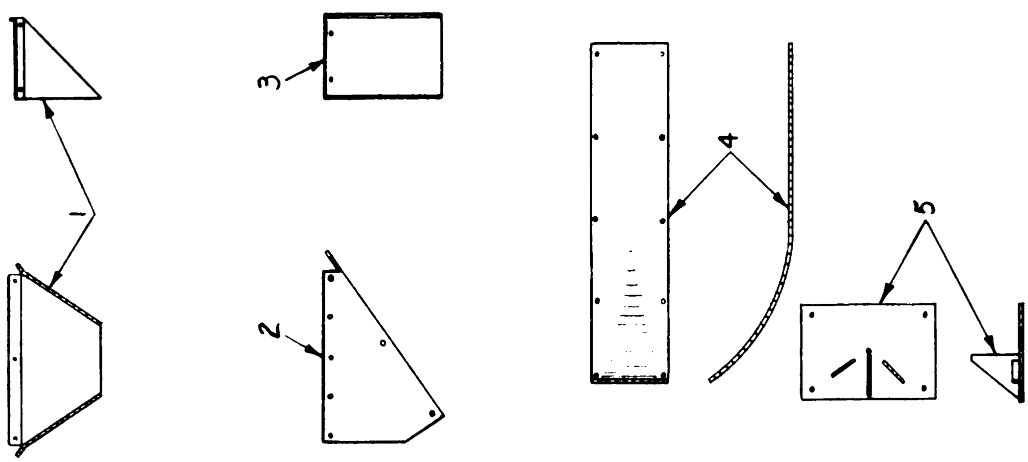
Receiving Hopper Liner (Continued)

(B/M 833-261-A4)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2	B-833-261	Hopper Liner Plate
	16		Flat Head Cap Screw, Nut, Lock Washer, & Cut Washer, 1/2" x 1-1/4"
2.	1	C (L) 833-261	Chute Liner Plate (Operator's Side)
	1	C (R) 833-261	Chute Liner Plate (Opposite Operator's Side) Operator's Side)
	8		Flat Head Cap Screw, Nut, Lock Washer, & Cut Washer, 1/2" x 1-1/4"
3.	1	A (L) 833-261	Chute Liner Plate (Operator's Side)
	1	A (R) 833-261	Chute Liner Plate (Opposite Operator's Side)
	8		Flat Head Cap Screw, Nut, Lock Washer, & Cut Washer, 1/2" x 1-1/4"

DISCHARGE CHUTE LINER

From (B/M 833-335-A1) (B/M 833-335-B1)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	J1-833-334 W	Discharge Spout (For Discharging Into Hot Elevator)
	9		Machine Bolt, Nut, & Lock Washer, 1/2" x 1"
2.	2	P1-833-334	Side Plate (For Spout Discharging Into Conveyor)
3.	1	O1-833-334	Bottom Plate (For Spout Discharging Into Conveyor)
	9		Machine Bolt, Nut, & Lock Washer, 1/2" x 1"
4.	2	V1-833-334	Liner Plate
	20		Flat Head Cap Screw, Nut, & Lock Washer, 1/2" x 1-1/4"
5.	2	W1-833-334 W	Liner Plate
	8		Flat Head Cap Screw, Nut, & Lock Washer, 1/2" x 1-1/4"

OIL BURNER
(B/M 833-257-A2)

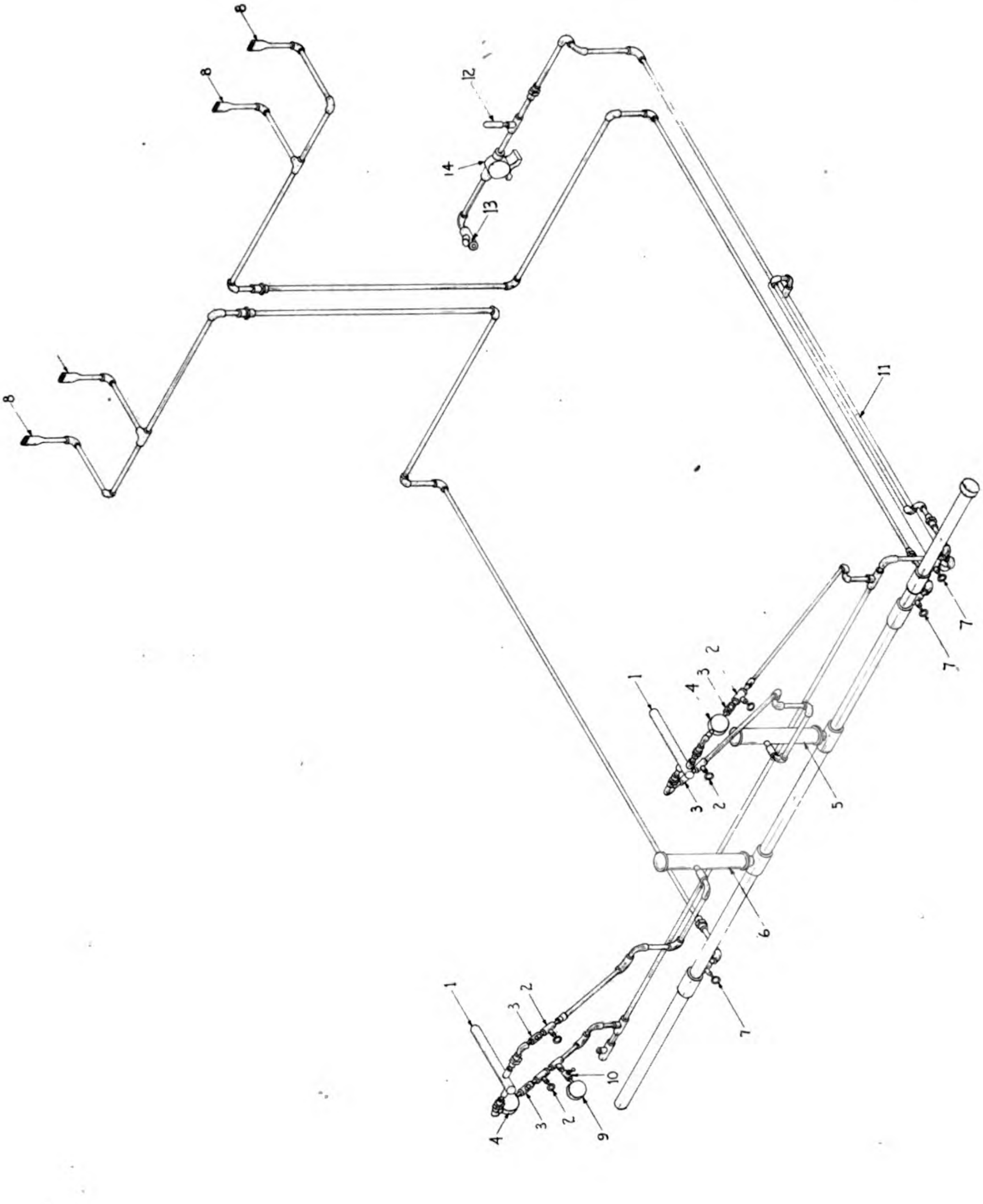
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	2	BU-HA-E1	#511 Hauck Oil Burner Complete
1.	—		Consisting of: Burner #511 Hauck Venturi Burner
2.	—	BU-HA-E1-10	1/2" Globe Valve
3.	—	BU-HA-E1-8	1/2" Strainer
4.	2	VA-HA-C1	Hauck #A 3/8"-10 Micro-Cam Regulating Valve (For Details See Accessory Section)
	4		Reducing Bushing, 1/2" to 3/8"
	4	B-17-121	Close Nipple, 3/8" x 1-1/2"
	4	B-17-122	Close Nipple, 1/2" x 1-1/2"
	2		Reducing Bushing, 3/4" to 1/2"
	2		Street Elbow, 1/2" x 90°

STEAM PIPING
(B/M 833-386-A)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
5.	1	F1(R)-833-256W	Steam Trap (Operator's Side)
6.	1	F1(L)-833-256W	Steam Trap (Opposite Operator's Side)
	4		Machine Bolt, Nut, & Lock Washer, & two Cut Washers, 1/2" x 1-1/2"
	1	A (R)-833-385	Angle (Operator's Side)
	1	A (L)-833-385	Angle (Opposite Operator's Side)
	4		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/4"
7.	3		3/4" Crane Brass Globe Valve 150# Pressure
	3		Tee, 2" x 2" x 3/4"
	2		Tee, 2" x 2" x 1"
	1		Pipe Cap, 2"
	1	F-17-159	Pipe Nipple, 2" x 4-1/2"
	1		Pipe, 2" x 9'-0"
	4	E-3-1126	U-Bolt, 3/8"
	14		Hex Nut, & Lock Washer, 3/8"
	4	H-833-385	Angle
	8		Machine Bolt, Nut, & Lock Washer, & Cut Washer, 1/2" x 1-1/4"
8.	4	A-833-119	Steam Jet
	2		Pipe Coupling, 1"
	4		Street Elbow, 1" x 90°
	4		Pipe Elbow, 1" x 90°
	2		Reducing Coupling, 1" to 1/2"
	2	EE-17-156	Pipe Nipple, 1" x 9-1/2"
	2	H-17-156	Pipe Nipple, 1" x 5"
	2		Pipe Nipple, 1/2" x 2-1/2"
	1		Pipe, 1" x 6'-6"
	3	B-17-202	Elbow, 3/4" x 45° (Tapped 1/4")
	3		1/4" Pet Cock
	5		Union, 3/4"
	10		Elbow, 3/4" x 90°

BURNER, OIL & STEAM PIPING

(B/M 833-257-A2)
(B/M 833-386-A & B)



Steam Piping (Continued)
(B/M 833-386-A)

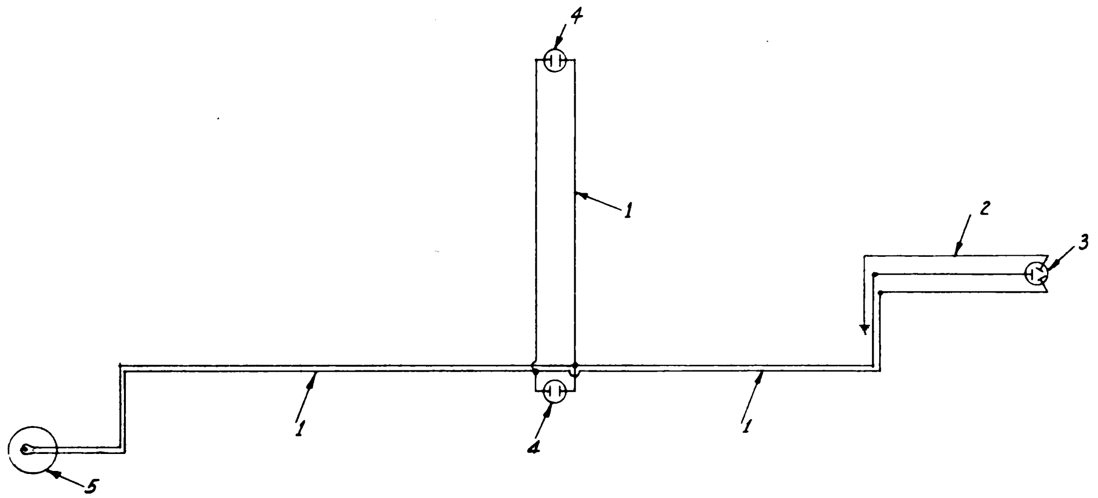
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	2		Street Elbow, 3/4" x 90°
	2		Pipe Coupling, 3/4"
	6	G-17-155	Pipe Nipple, 3/4" x 4-1/2"
	3	E-17-155	Pipe Nipple, 3/4" x 3-1/2"
	4	B-17-155	Pipe Nipple, 3/4" x 2"
	2	H-17-155	Pipe Nipple, 3/4" x 5"
	1		Pipe, 3/4" x 70'-0"
	2	D-833-385W	Bracket
	1	G-833-385	Pipe Hanger Bar
	6		Machine Bolt, Nut, & Lock Washer, 1/2" x 1"
	5	F-3-1126	U-Bolt, 3/8"
	2	C-833-385	Pipe Hanger Plate

OIL PIPING
(B/M 833-386-B)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
9.	1	PF-PG-B1	3-1/2" Dial Pressure Gauge 0-75#
10.	1	PF-GC-A1	1/4" Gauge Cock
11.	1	C-17-191W	Steam Jacket
	2		Pet Cock, 1/4"
12.	1	PF-RV-D1	3/4" Relief Valve
13.	1	PF-ST-B1	1" Strainer
14.			1" Fuel Pump (For Details See Page)
	2		Tee, 1" x 1" x 3/4"
	1		Pipe Plug, 1"
	1		Union, 1"
	1	E-17-150	Elbow, 1" x 90° (Tapped 1/4")
	5		Street Elbow, 1" x 90°
	3		Elbow, 1" x 90°
	1		Pipe Coupling, 1"
	1		Pipe Plug, 1/2"
	1		Reducing Bushing, 3/4" x 1/4"
	2		Tee, 1" x 1" x 1"
	1		Pipe Plug, 3/4"
	1		Reducing Elbow, 1" x 3/4", 90°
	1		Pipe Coupling, 3/4"
	1		Tee, 3/4" x 3/4" x 1/4"
	5	H-17-124	Pipe Nipple, 1" x 5"
	2	SS-17-124	Pipe Nipple, 1" x 9-1/2"
	2	TT-17-124	Pipe Nipple, 1" x 8-1/2"
	1	B-17-124	Pipe Nipple, 1" x 2"
	1	B-17-123	Pipe Nipple, 3/4" x 1-3/8"
	1	C-17-43	Pipe Nipple, 1/4" x 7/8"
	1		Pipe, 1" x 23'-0"
	1		Pipe, 3/4" x 8'-9"
	2	B-833-385	Pipe Hanger Plate
	1	C-833-385	Pipe Hanger Plate
	10		Machine Bolt, Nut, & Lock Washer, & Cut Washer, 1/2" x 1-1/4
	6		Bevel Washer, 1/2"
	5	A-3-1126	U-Bolt, 3/8"
	10		Hex Nut, 3/8"

L I G H T I N G   S Y S T E M

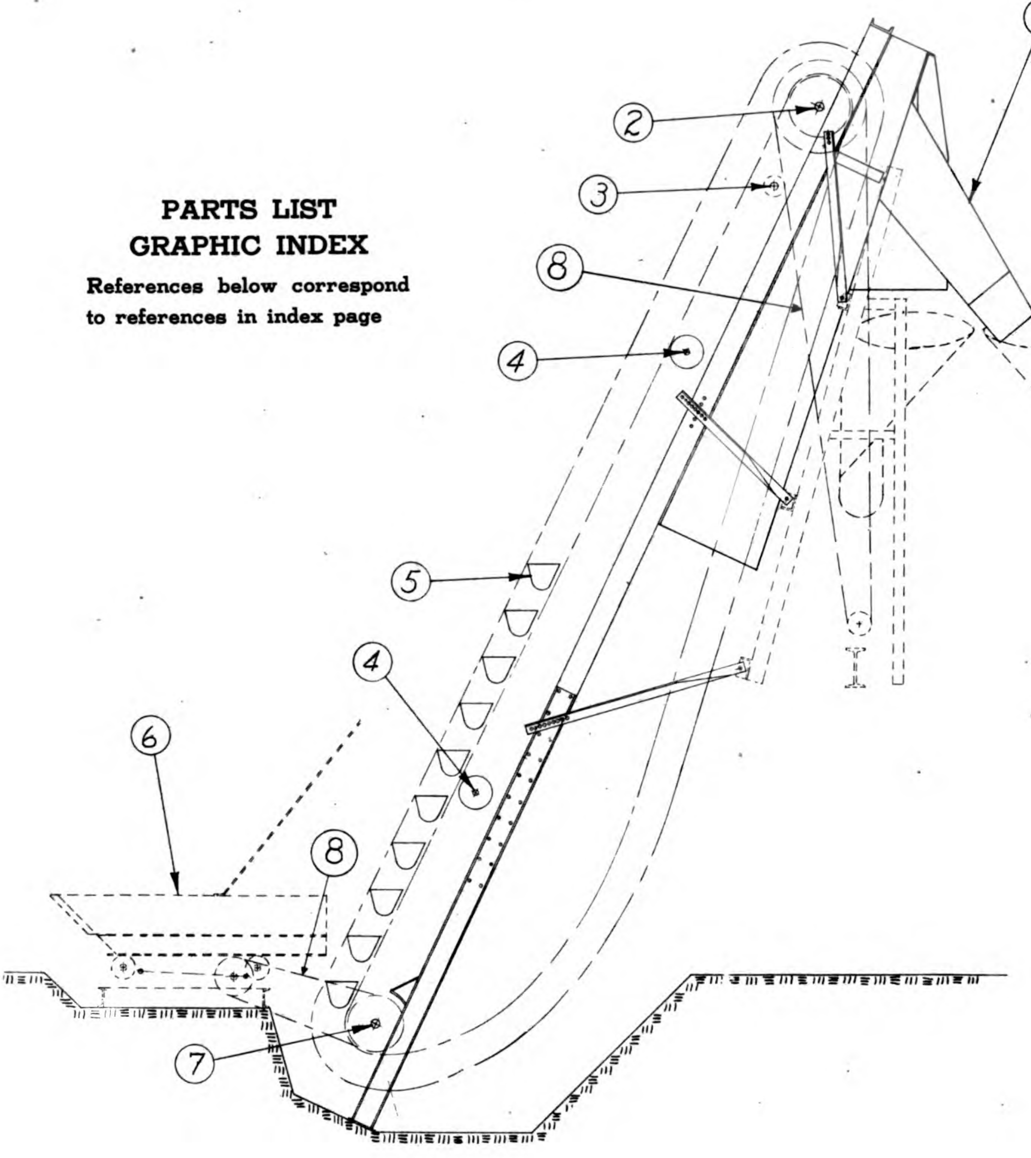
FROM (B/M 833-455-A)
(B/M 833-455-B)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1		#14-2 B.X.L. Cable x 50'-0"
2.	1		#14-3 Tirex Cable x 6'-0"
3.	1	EL-PL-A1	Cord Cap, Rubber, 3-Wire, Polarized, with cord grip, 15 AMP. - 125 Volt.
4.	2	EL-RC-C1	2 Wire Porcelain Receptacle for panel surface mounting - 15 AMP. - 125 Bolt
5.	1	EL-RE-A1	Dome Reflector, 100 W. 12 " Diameter with 2-1/4" fitter
	1	EL-SO-A1	Weather proof Socket, 1/2"-90° Angle tap with 2-1/4" shade holder bottom
	1		100 W., 110 Volt Bulb
	1		#14 Solid Single Braid Rubber Covered Wire x 20'-0"
	4	RE-KD-A2	Red Reflector #A-2042-1A #333 Round
	2	RE-KD-A1	Amber Reflector #A-2042-1A #333 Round
	12		Round Head Stove Bolt, Nut, and Lock-washer, 1/4" x 3/4"

PARTS LIST
GRAPHIC INDEX

References below correspond to references in index page



COLD ELEVATOR INDEX

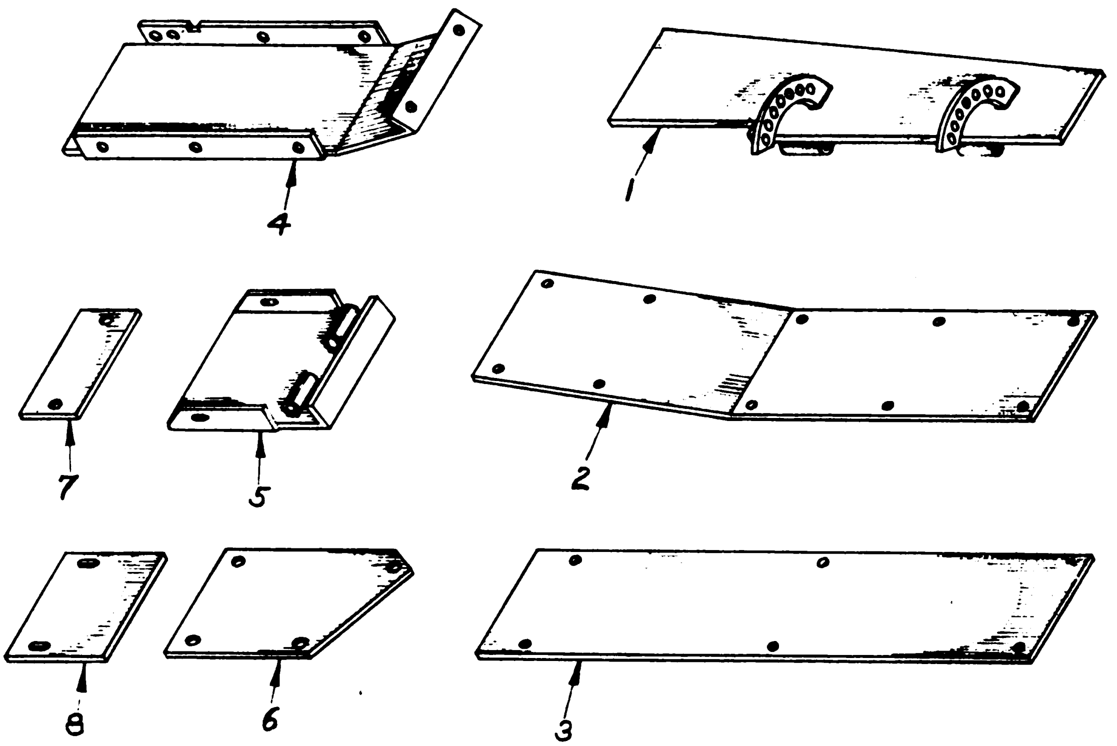
SAMPLE SERIAL NUMBER PLATE

The Serial Number Plate appears on reciprocating feeder drive sprocket side at the foot end. Always give the serial number of your machine, part number and description when ordering parts.

COLD ELEVATOR DISCHARGE CHUTE

Liner Plates, Baffles, & Flashing

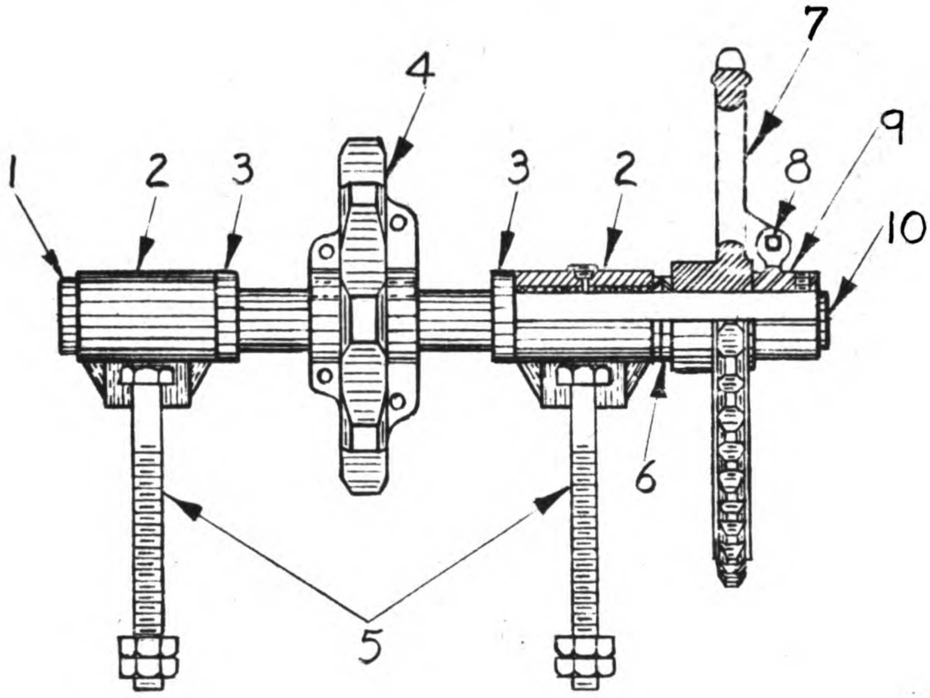
(B/M 833-472-A2)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	C-833-471W	Wing Plate
	1	KM-17-25	Rod, 1/2" x 1' 5-11/16"
	2		Cotter, 1/8" x 1-1/4"
2.	1	H-833-471	Liner Plate
	10		Flat Head Cap Screw, Nut & Lock Washer, 3/8" x 1"
3.	1	E-833-467	Liner Plate
	4		Flat Head Cap Screw, Nut & Lock Washer, 3/8" x 1"
	2		Machine Bolt, Nut & Lock Washer, 3/8" x 1-1/4"
4.	1	G-833-468W	Stationary Baffle
	6		Machine Bolt, Nut & Lock Washer, 3/8" x 1"
	2		Machine Bolt, Nut & Lock Washer, 3/8" x 1-1/4"
5.	1	J-833-468W	Lower Baffle
	2		Machine Bolt, Nut & Lock Washer & Cut Washer, 3/8" x 1"
	1	EC-17-25	Rod, 1/2" x 10-1/2"
	2		Cotter, 1/8" x 1-1/4"
6.	1	F-833-467	Liner Plate
	4		Flat Head Cap Screw, Nut & Lock Washer, 3/8" x 1"
7.	1	H-833-467	Backing Plate
8.	1	G-833-467	Rubber Flashing

COLD ELEVATOR HEAD SHAFT

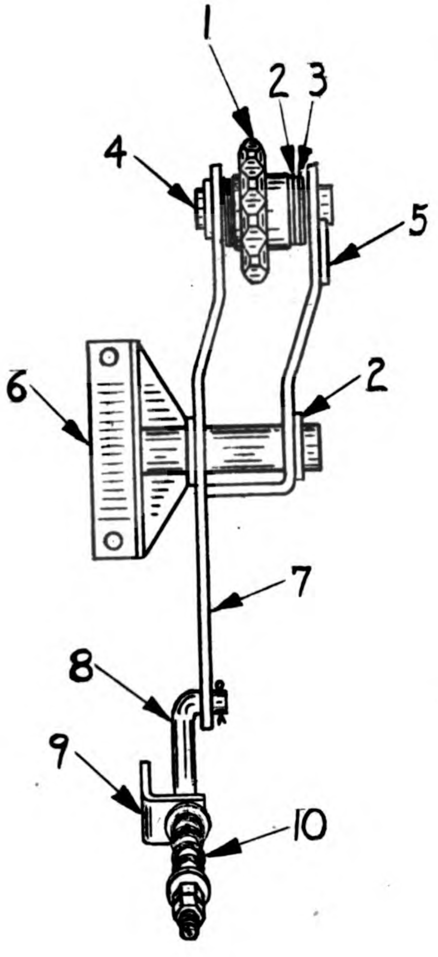
(B/M 833-165-A2)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	N-3-947	Collar
	2		Set Screw, 1/2" x 3/4"
2.	2	3431 A	Take-up Bearing
	2		1/4" Button Head Alemite, Male
3.	2	K-3-947	Collar
	4		Set Screw, 5/8" x 1"
4.	1	2994 B	Sprocket, 8 Tooth
	1		Set Screw, 5/8" x 1-1/4"
	4		Hex Head Cap Screw, Nut & Lock Washer, 7/8" x 3-1/2"
	1	M-17-34	Key, 5/8" x 5/8" x 4-7/8"
5.	2	CP-17-24	Machine Bolt, 1-1/4" x 1' 6" (4 Acme Thd. Per Inch)
	2		Cut Washer, 1-1/4"
	4	BU-17-24	Hex Nut, 1-1/4" (4 Acme Thd. Per Inch)
6.	2	NZ-17-9	Washer
7.	1	356 A	Sprocket, 46 Tooth
8.	1		Machine Bolt & 2 Half Nuts, 5/8" x 7" (Safety Bolt)
9.	1	1243 A	Safety Hub
	2		Set Screw, 5/8" x 3/4"
	1	DD-17-34	Key, 5/8" x 5/8" x 3-1/4"
10.	1	A1-833-165	Shaft, 2-7/16" x 3' 0" S.A.E. 4140

COLD ELEVATOR DRIVE CHAIN IDLER

(B/M 833-197-A2)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	2161 B	Sprocket 11 tooth
	2	E-8-74	Bronze Bushing
2.	5	V-17-9	Washer
3.	2	DD-17-9	Washer
4.	1	Q1-833-190W	Shaft
	1		1/4" Button Head Alemite, Male
5.	1	F-833-41	Keeper Bar
	1		Machine Bolt, Nut & Lock Washer, 1/2" x 1-1/4"
6.	1	J-833-190W	Bracket
	1		Cotter, 1/4" x 3"
	2		Machine Bolt, Nut & Lock Washer, 1/2" x 1-1/2"
	2		Machine Bolt, Nut & Lock Washer, 1/2" x 1-1/4"
	2		Bevel Washer, 1/2"

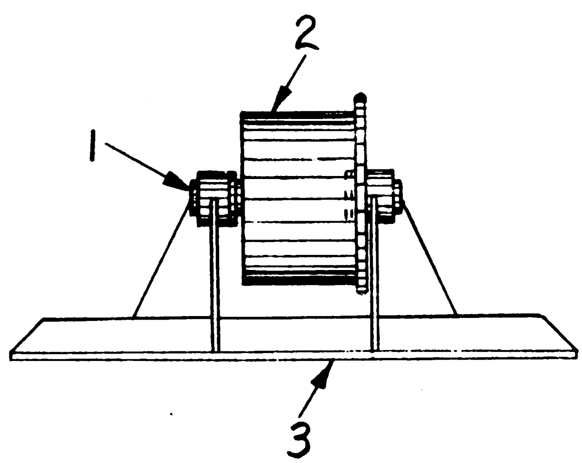
Cold Elevator Drive Chain Idler (Continued)

B/M 833-197-A2

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
7.	1	C2-833-197W	Yoke
8.	1	F-17-145	Rod, 3/4" x 1' 11"
	1		Cotter, 3/16" x 1-1/2"
	2		Hex Nut, 3/4"
	2		Cut Washer, 3/4"
9.	1	F-833-197W	Bracket
	2		Machine Bolt, Nut & Lock Washer, 1/2" x 1-1/2"
10.	1	A-46-201	Spring

BUCKET LINE IDLER SHAFT

(B/M 833-167-A)

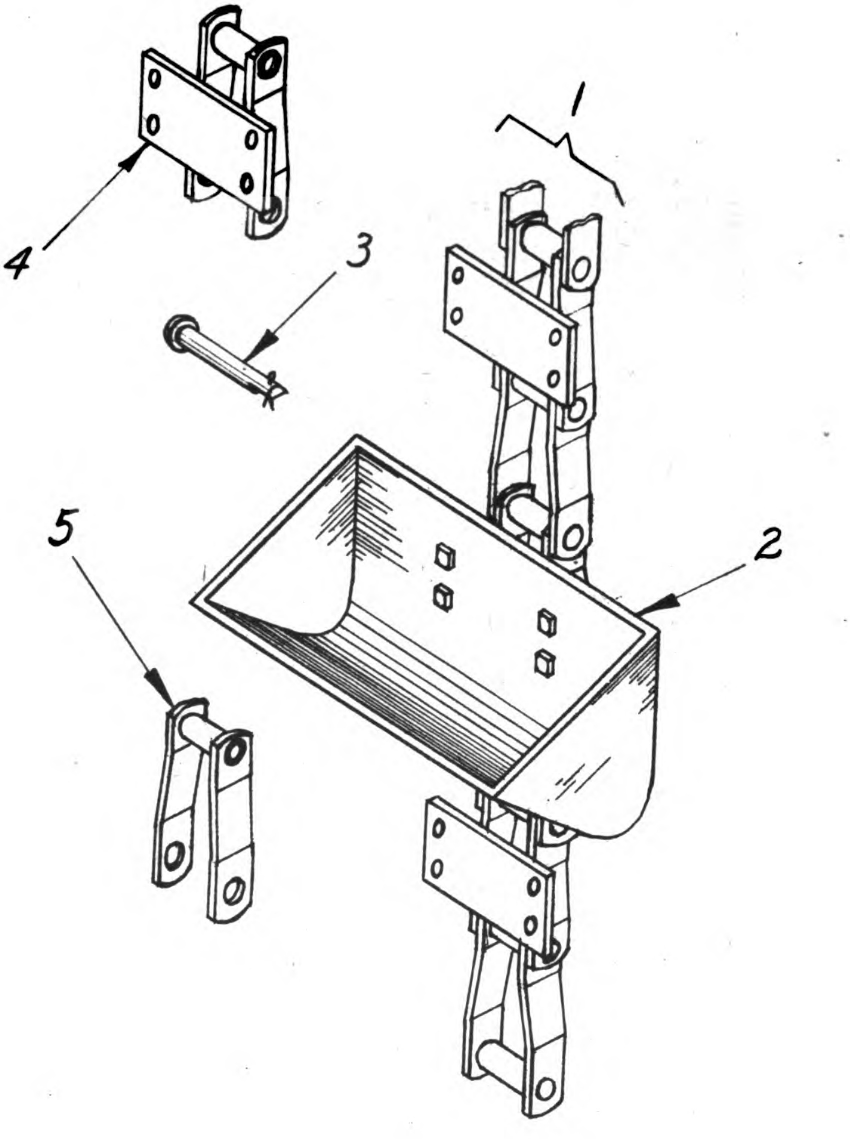


REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2.	A-833-167	Shaft, 1-7/16" x 9-1/4" S.A.E. 1020
	2		1/4" Button Head Alemite, Male
2.	2	679 A	Single Flange Roller
	4	AV-17-9	Washer
3.	2	E-833-167W	Bracket
	8		Machine Bolt, Nut & Lock Washer, 1/2" x 1-1/2"
	8		Bevel Washer, 1/2"
	4		Set Screw, 1/2" x 1"

COLD ELEVATOR BUCKET LINE

With Chabelco A 2842 Chain

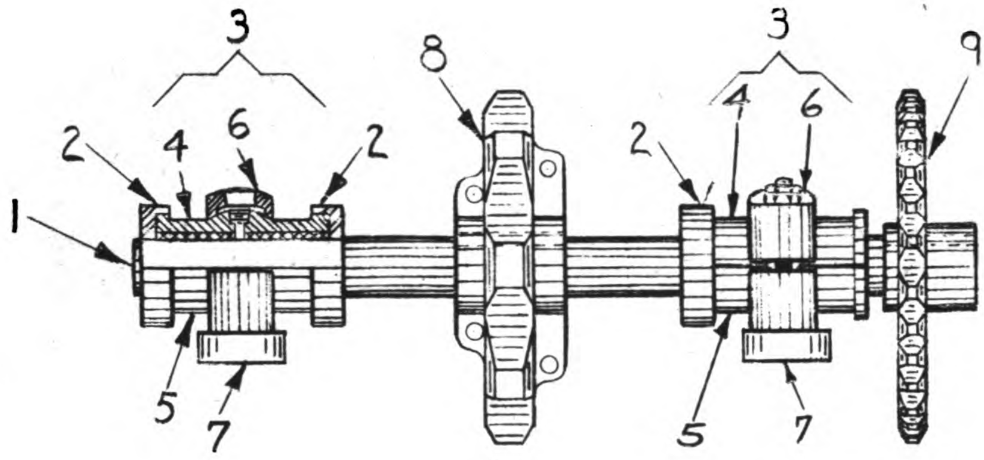
(B/M 833-168-A4)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	**BX-6-146**	Strand 98 Links of Chabelco #A-2842 Chain With K-22 Attachment, B-6-25W Every Second Link
2.	49	**H-46-250**	Bucket, 16" x 8" x 8-1/2"
	196		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/4"
3.	2	**HH-26-F**	Pin
	6		Cotter, 1/4" x 1-1/8"
4.	1	**B-6-25W**	Attachment Link With Cotter Pin
5.	1	**A-6-146**	Plain Link With Cotter Pin, Chabelco #A-2482 Chain

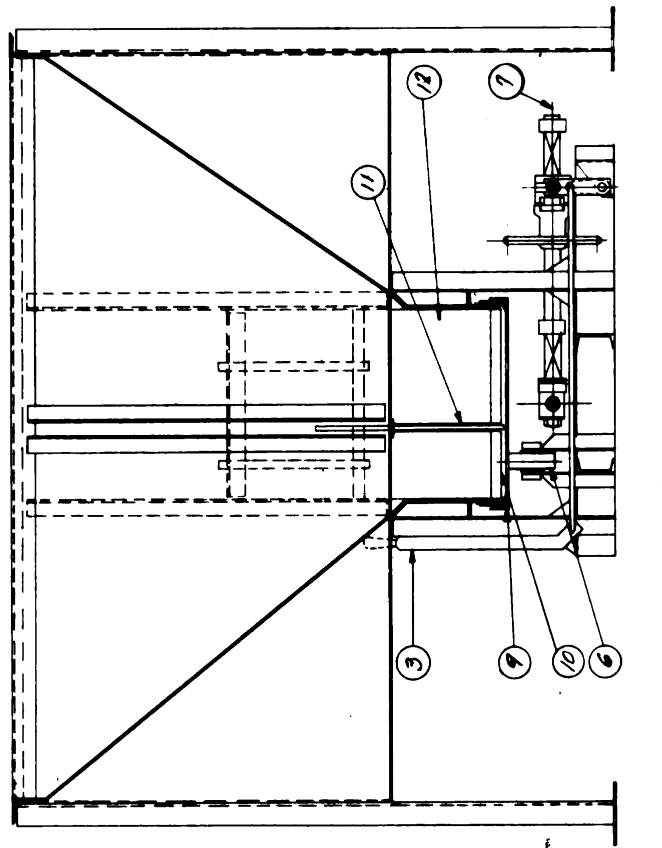
COLD ELEVATOR FOOT SHAFT

(B/M 833-166-A3)



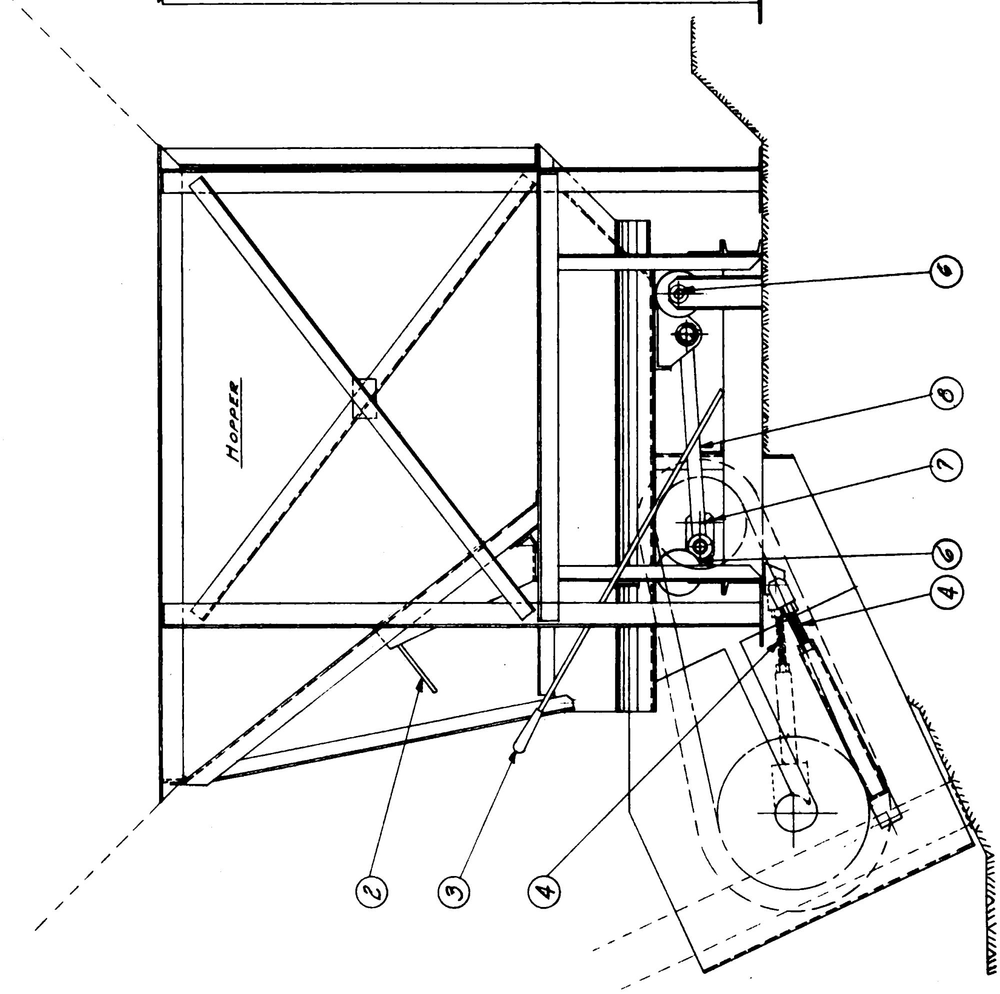
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	A1-833-166	Shaft, 2-7/16" x 3' 3-1/8" S.A.E. 1045
2.	3	F-3-1200	Dust Seal
	6		Set Screw, 1/2" x 1-3/4"
3.	2	13-219-A	2-7/16" Ball & Socket Bearing, Complete
4.	2	1364	Bearing, Upper Half
	2	A0-17-43	Grease Pipe, 1/4" x 2' 4"
	2	U-17-43	Grease Pipe, 1/4" x 5"
	2		Elbow, 1/4" x 90°
	2		Pipe Coupling, 1/4"
	2		1/4" Button Head Alemite, Male
5.	2	1364 A	Bearing, Lower Half
6.	2	1365	Bearing Cap
	4		Machine Bolt, Nut & Jam Nut, 3/4" x 7"
7.	2	1363	Bearing Base
	4		Machine Bolt, Nut & Lock Washer, 3/4" x 3-1/2"
	4		Bevel Washers, 3/4"
8.	1	2994 B	Sprocket, 8 Tooth
	1	M-17-34	Key, 5/8" x 5/8" x 4-7/8"
	1		Set Screw, 5/8" x 1-1/4"
	4		Hex Head Cap Screw, Nut & Lock Washer, 7/8" x 3-1/2"
9.	1	2992 B	Sprocket, 37 Tooth
	1	KK-17-34	Key, 5/8" x 5/8" x 3-5/8"
	1		Set Screw, 5/8" x 1"
	1		Set Screw, 5/8" x 7/8"

Always give Serial Number of Machine, Part Number, and Description.



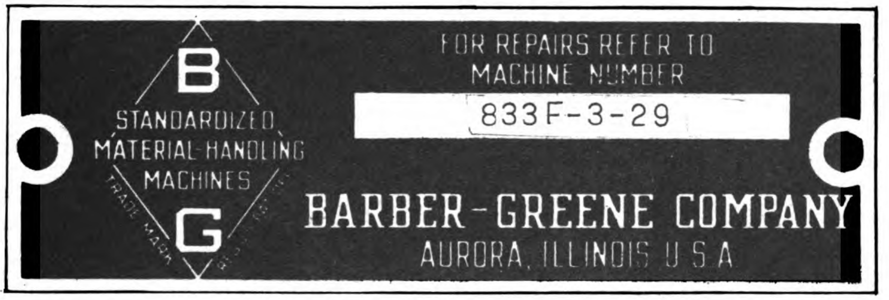
PARTS LIST
GRAPHIC INDEX

References correspond to references in index page.



RECIPROCATING FEEDER INDEX

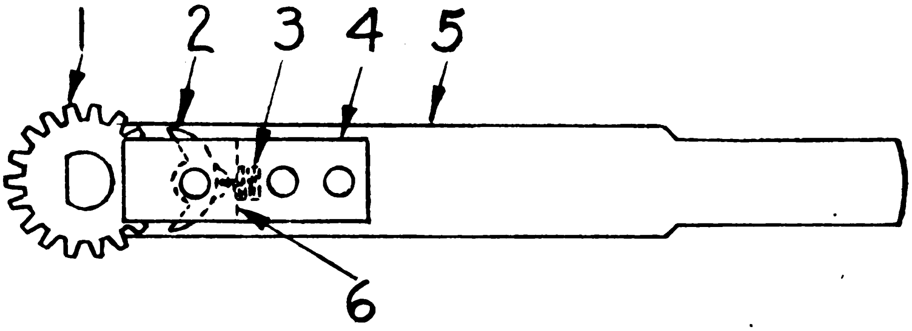
SAMPLE SERIAL NUMBER PLATE



The Serial Number Plate appears on top of the frame on the drive chain side. Always give the serial number of your machine, part number and description, when ordering parts.

RATCHET

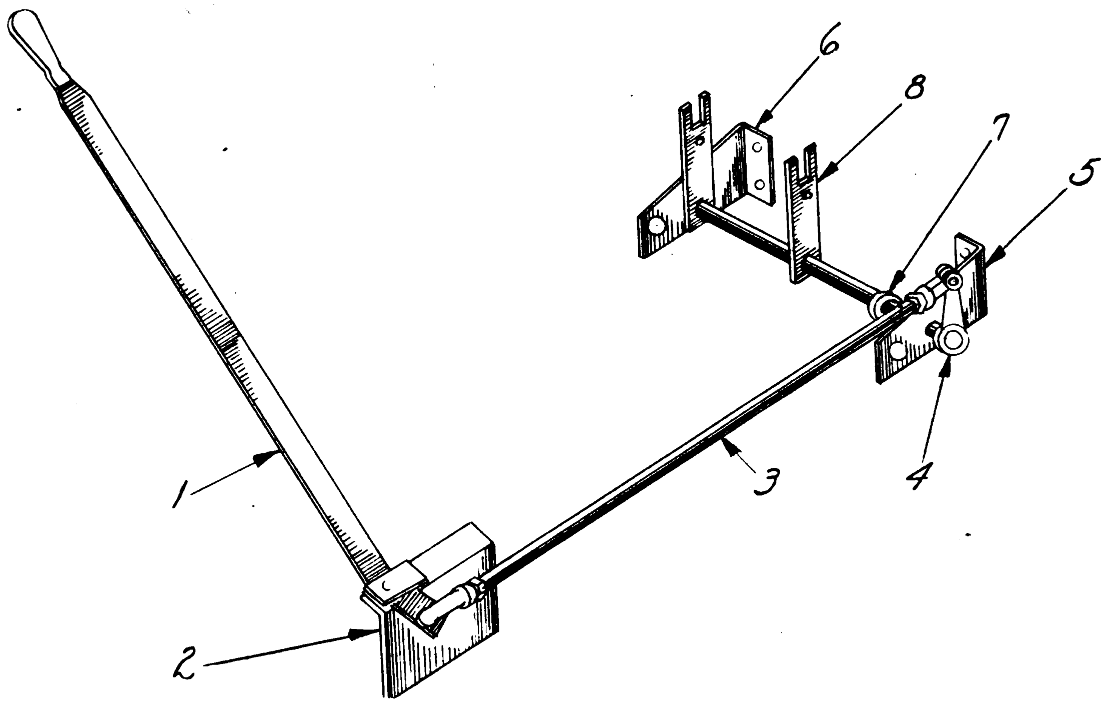
(F-46-221R)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	3447	Ratchet Wheel
2.	1	3448	Pawl
3.	1	B-46-217	Spring
4.	1	C-46-221	Bar
5.	1	E-46-221	Handle
6.	1	D-46-221	Spacer
	3		Button Head Rivet, 1/4" x 1-7/8"

RECIPROCATING FEEDER LEVER

(B/M 834-329-A)



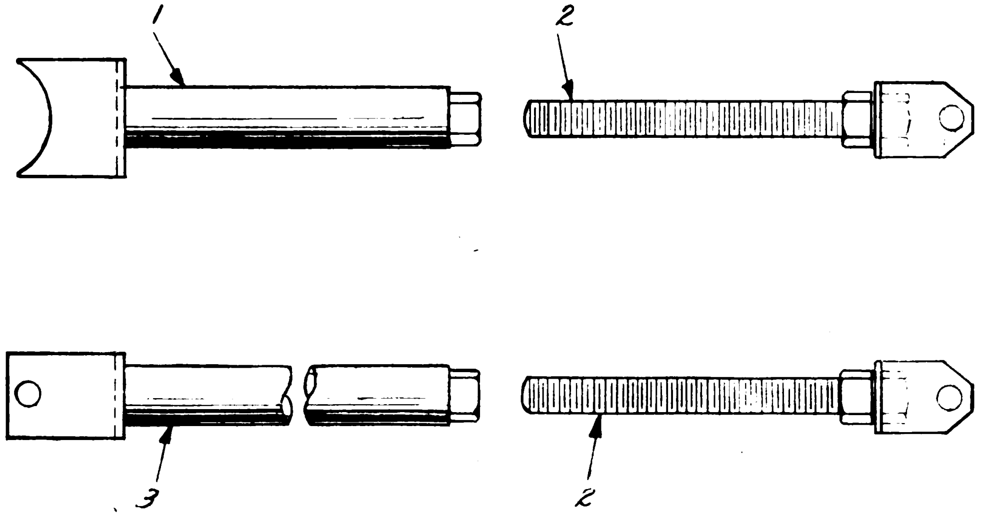
RECIPROCATING FEEDER LEVER (Continued)

(B/M 834-329-A)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	J-834-329	Lever
	1	0-17-23	Rivet
	1		Cotter, 1/8" x 1"
2.	1	E-834-329W	Lever Bracket
	3		Machine Bolt, Nut & Lock Washer, 1/2" x 1-1/4"
3.	1	CK-17-144	Lever Rod, 3/4" x 3' 3"
	2	B-3-149	Yoke End
	2	C-17-23	Rivet
	2		Cotters, 1/8" x 1"
	2		3/4" Hex Nut
4.	1	725 E	Shifter Arm
	1	C-17-30	Key, 1/4" x 1/4" x 1-1/2"
	1		Machine Bolt, Nut & Lock Washer, 1/2" x 2-1/2"
5.	1	D (L) 834-329	Bracket
6.	1	D (R) 834-329	Bracket
	4		Machine Bolt, Nut & Lock Washer, 1/2" x 3"
7.	1	C-3-951	Collar
	1		Set Screw, 3/8" x 5/8"
8.	1	A-834-329W	Shifter Arm
	1	F-3-1028	Keeper Bar
	1		Machine Bolt, Nut & Lock Washer, 3/8" x 1-1/4"

RECIPROCATING FEEDER ADJUSTABLE STRUTS

(B/M 834-260-B1)



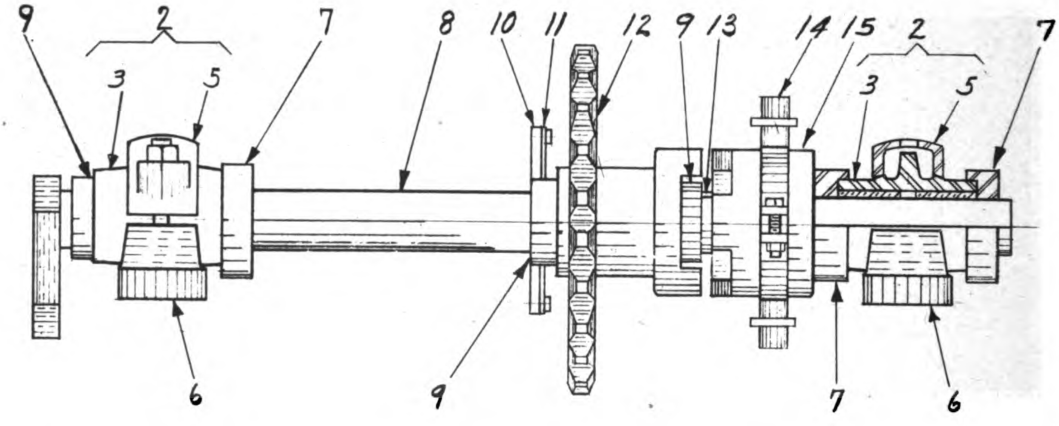
RECIPROCATING FEEDER ADJUSTABLE STRUTS (Continued)

(B/M 834-260-B1)

REF.NO	NO.REQ.	PART NO.	DESCRIPTION
1.	1	A-834-260W	Strut (Drive Side)
2.	2	M-834-260W	Yoke
	2	FI-17-25	Pin
	4		Cotter, 3/16" x 1-1/4"
	2		Half Hex Nut, 1-1/4"
3.	1	F-834-260W	Strut (Opposite Drive Side)
	1	KB-17-25	Pin
	2		Cotter, 3/16" x 1-1/4"

RECIPROCATING FEEDER CRANK SHAFT

(B/M 834-249-B2)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
2.	2	13-213-S	Ball & Socket Bearing (Complete)
	2		Machine Bolt, Nut & Lock Washer, 5/8" x 7-1/2"
	2		Machine Bolt, Nut & Lock Washer, 5/8" x 2-1/2"
3.	2	3705	Bearing
	2	C-17-43	Pipe, 1/4" x 7/8"
	2		Coupling, 1/4"
	1		Street Elbow, 1/4" x 90°
	2		1/4" Button Head Alemite, Male
	1	HH-17-43	Pipe, 1/4" x 1-3/4"
4.	4	M-8-75	Bushing
5.	2	3488	Bearing Cap
6.	2	821	Bearing Base
	6	AD-17-111	Stop Shims, 1/4"
	12	AF-17-111	Stop Shims, #16 Ga.
	2		Machine Bolt, Nut & Lock Washer, 3/8" x 2"
	4		Machine Bolt & Anco Nut, 5/8" x 5-3/4"

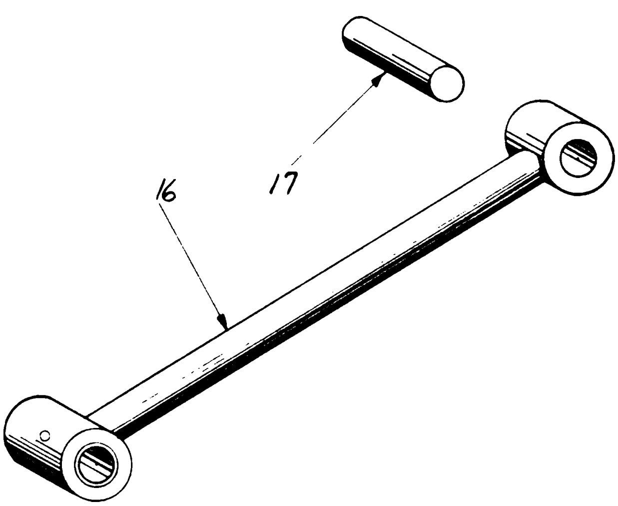
Always include B/M Number when ordering parts.

RECIPROCATING FEEDER CRANK SHAFT (Continued)

(B/M 834-249-B2)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
7.	3	C-3-1200	Dust Seal
	6		Set Screws, 1/2" x 1-1/2"
8.	1	B1-834-249W	Shaft, 1-15/16" x 2' 10-9/16" S.A.E. #4140
9.	3	Q-3-941	Collar
	2		Allen Cup Point Set Screw, 3/8" x 1/2"
10.	1	G-834-247W	Seal
11.	1	J-834-247	Felt
	4		Machine Bolt & Lock Washer, 3/8" x 1-1/4"
12.	1	1120	Sprocket, 22 Tooth
	1		1/4" Button Head Alemite, Male
13.	1	AK-17-106	Feather Key, 1/2" x 1/2" x 5-1/8"
14.	1	897	Double Shifter Yoke
	2		Machine Bolt, Nut & Lock Washer, 3/8" x 2-1/4"
	1		1/8" Button Head Alemite, Male
15.	1	896 D	Jaw Clutch

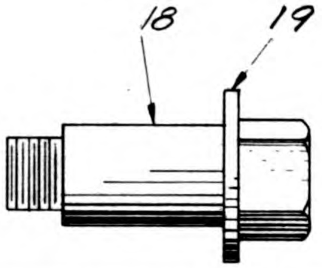
CONNECTING ROD



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
16.	1	M1-834-69W	Connecting Rod
	2	A-3-1212	Steel Bushing
	1		1/4" Button Head Alemite, Male
17.	1	F-834-69	Shaft, 1-11/16" x 4-1/2" S.A.E. 4140
	1		1/4" Button Head Alemite, Male

RECIPROCATING FEEDER CRANK SHAFT (Continued)

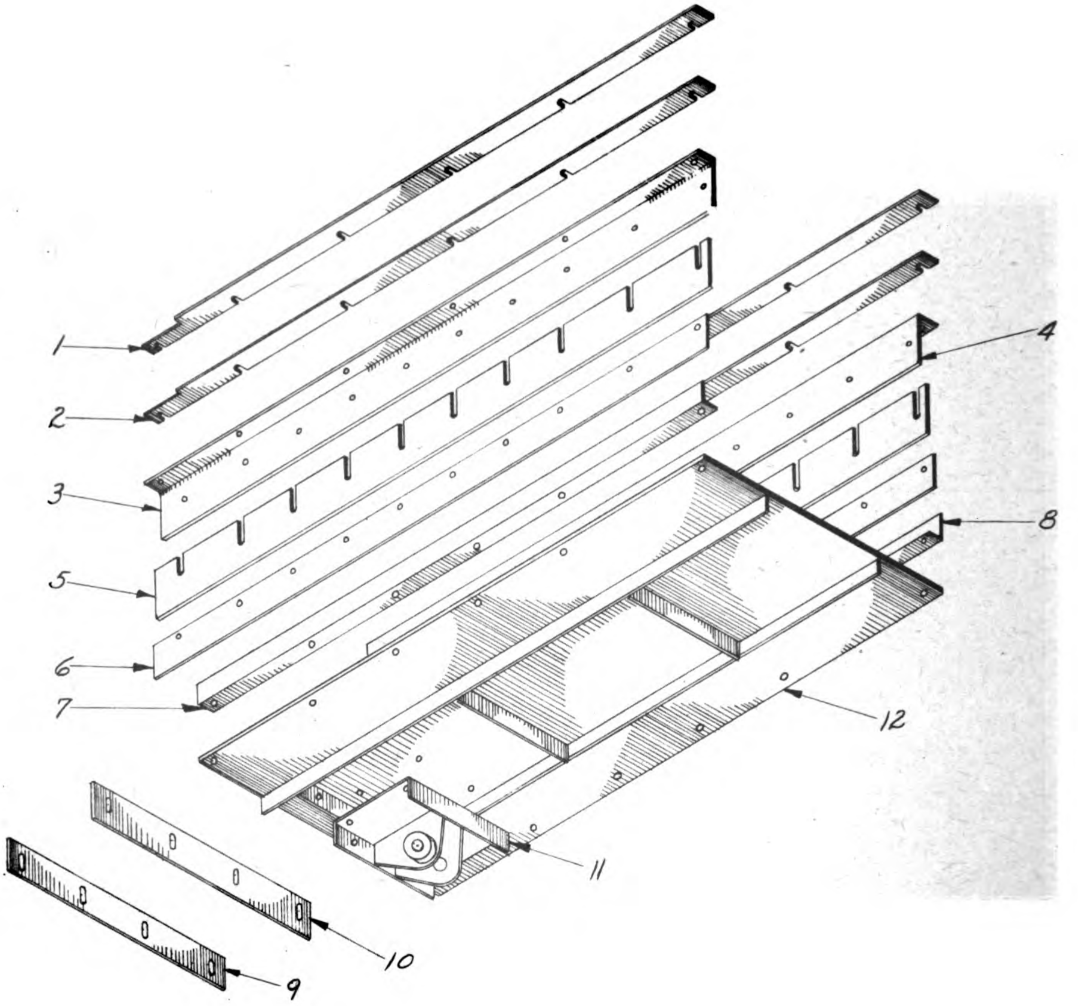
(B/M 834-249-B2)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
18.	1	J-834-69W	Crank Pin
	1		Half Nut, 1-1/4"
19.	1	DP-17-9	Washer

RECIPROCATING FEEDER PAN

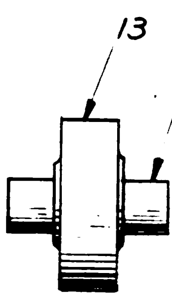
From (B/M 834-257-B1)



RECIPROCATING FEEDER PAN (Continued)
From (B/M 834-257-B1)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	4	J-834-255	Shims, 1/4"
2.	4	K-834-255	Shims, #10 Ga.
3.	1	J (L)-834-253	Skirt
4.	1	J (R)-834-253	Skirt
	12		Machine Bolt, Nut & Lock Washer, 1/2" x 2"
5.	2	M-834-253	Rubber Flashing
6.	2	O-834-253	Backing Bar
	18		Plow Bolt, Nut & Lock Washer, #3 Head, 3/8" x 1-1/4"
	2		Machine Bolt, Nut & Lock Washer, 1/2" x 1-1/4"
7.	1	S (L)-834-258	Pan Wearing Angle
8.	1	S (R)-834-258	Pan Wearing Angle
	12		Flat Head Cap Screw, Nut & Lock Washer, 1/2" x 1-1/2"
9.	1	P1-834-256	Backing Bar
10.	1	S-834-256	Rubber Flashing
	4		Machine Bolt, Nut & Lock Washer & Cut Washer, 1/2" x 1-1/2"
11.	1	O-834-258W	Pan Bracket
	6		Flat Head Cap Screw, Nut & Lock Washer, 1/2" x 1-3/4"
	2		Machine Bolt, Nut & Lock Washer, 1/2" x 1-3/4"
12.	1	B-834-258W	Feeder Pan

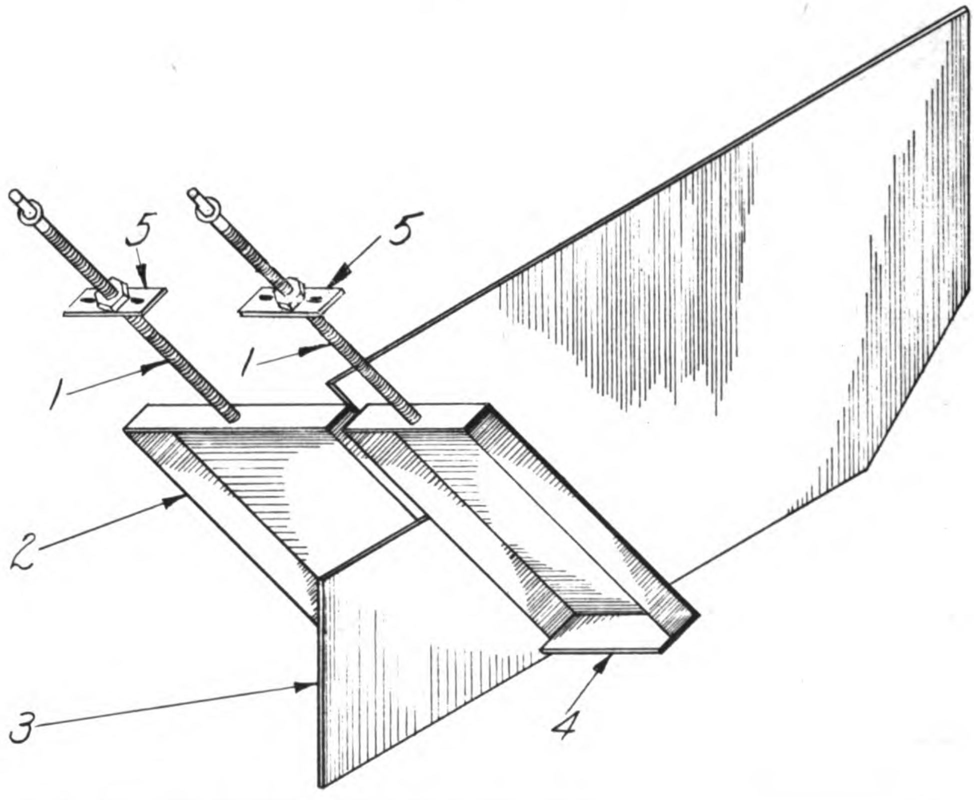
RECIPROCATING FEEDER ROLLER
(B/M 834-257-B1)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
13.	4	A-3-1200	Roller
	8	K-8-55	Bronze Bushing
14.	4	A-834-69	Shaft, 1-11/16" x 5-1/2" S.A.E. 1020
	28	MQ-17-9	Washer
	4		1/4" Button Head Alemite, Male
	3		Coupling, 1/4"
	3		Street Elbow, 1/4" x 90°
	2		Elbow, 1/4" x 90°
	2	BB-17-43	Pipe, 1/4" x 4-1/2"
	1	X-17-43	Pipe, 1/4" x 7"
	1	GG-17-43	Pipe, 1/4" x 1' 8"

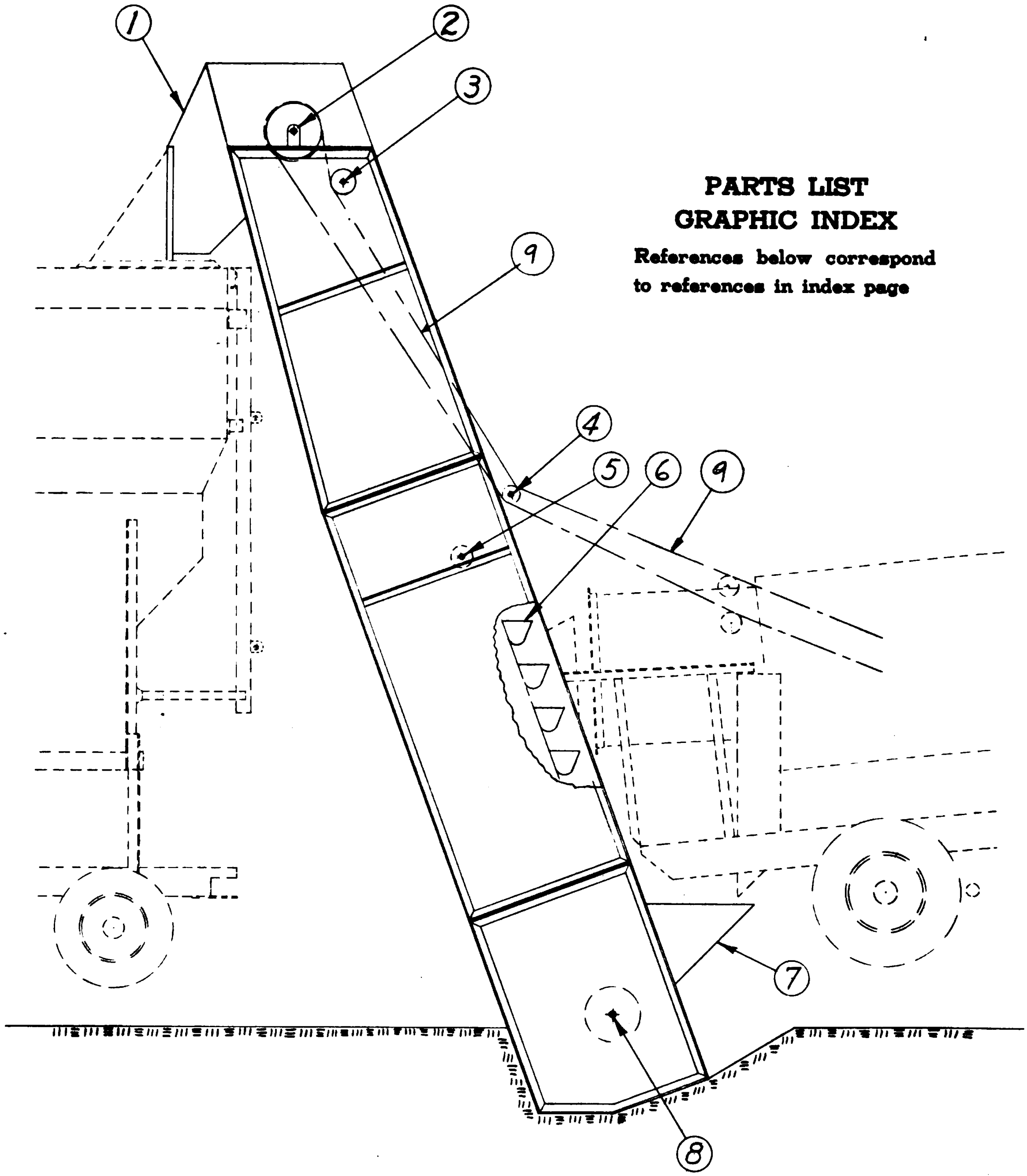
RECIPROCATING FEEDER GATE

From (B/M 834-263-D1)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2	Q-834-331W	Gate Control Screw
	2	F-46-221R	Ratchet (For Details See **Page** 254)
	2	C-3-953	Collar
	2	FJ-17-26	Pin
2.	1	H-834-331W	15" Gate
3.	1	A-834-332W	Divider Plate
	4		Machine Bolt,Nut & Lock Washer, 1/2" x 1-1/4"
4.	1	A-834-331W	9" Gate
5.	2	Q-848-149W	Screw Guide
	4		Machine Bolt, Nut & Lock Washer 1/2" x 1-1/2"

Always give Serial Number of Machine, Part Number, and Description.



PARTS LIST
GRAPHIC INDEX

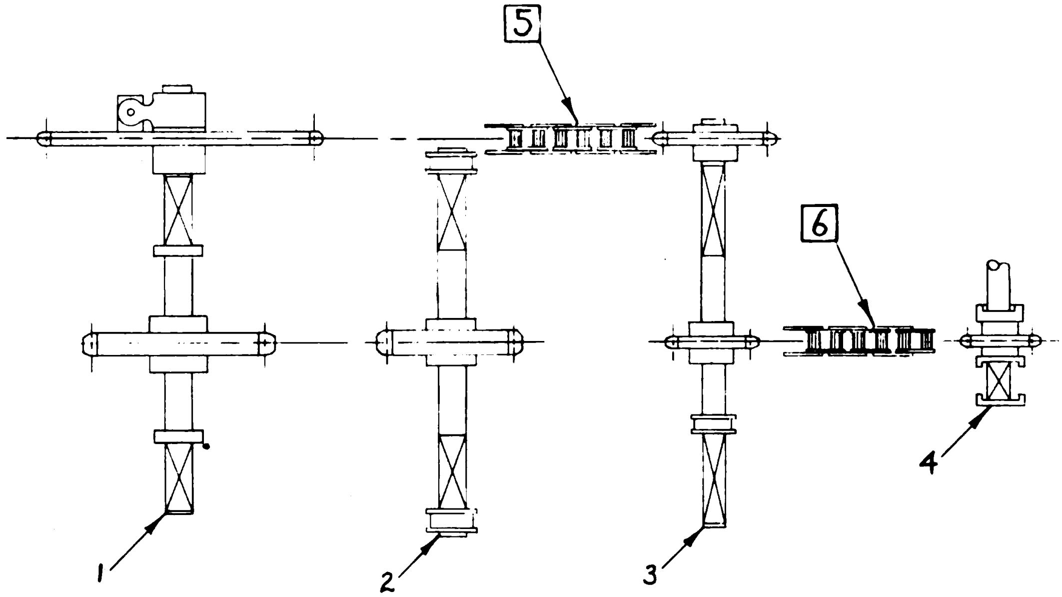
References below correspond to references in index page

HOT ELEVATOR INDEX

SAMPLE SERIAL NUMBER PLATE

The Serial Number Plate appears on the drive chain side of lower end of the 10 foot intermediate section. Always give the serial number of your machine, part number and description, when ordering parts.

SHAFTING & DRIVE CHAINS FOR HOT ELEVATOR



Shafting

REF.NO.	DESCRIPTION
1.	Hot Elevator Head Shaft
2.	Hot Elevator Foot Shaft
3.	Hot Elevator Countershaft
4.	Hot Elevator Drive Shaft on Dryer

Drive Chains

(B/M 834-119-A1)

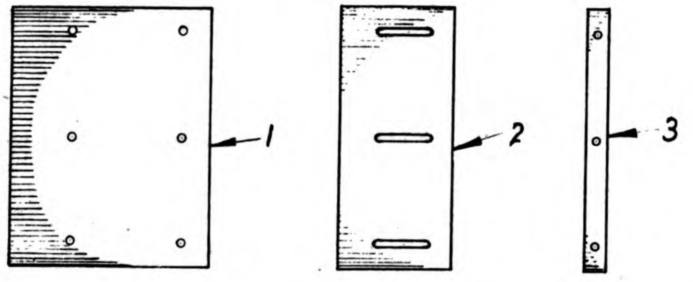
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
5.	1	FB-6-82C	Strand of Baldwin #0362, 1.654" P., 176 links and 1 offset
6.	1	JQ-6-82C	Strand of Baldwin #0362, 1.654" P., 290 links and 1 offset
		A-6-82	Roller Link Baldwin #0362
		B-6-82	Connecting Link Baldwin #0362
		C-6-82	Offset Link Baldwin #0362

Always give Serial Number of Machines, Part Number, and Description.

HOT ELEVATOR DISCHARGE CHUTE

Liner Plate and Flashing

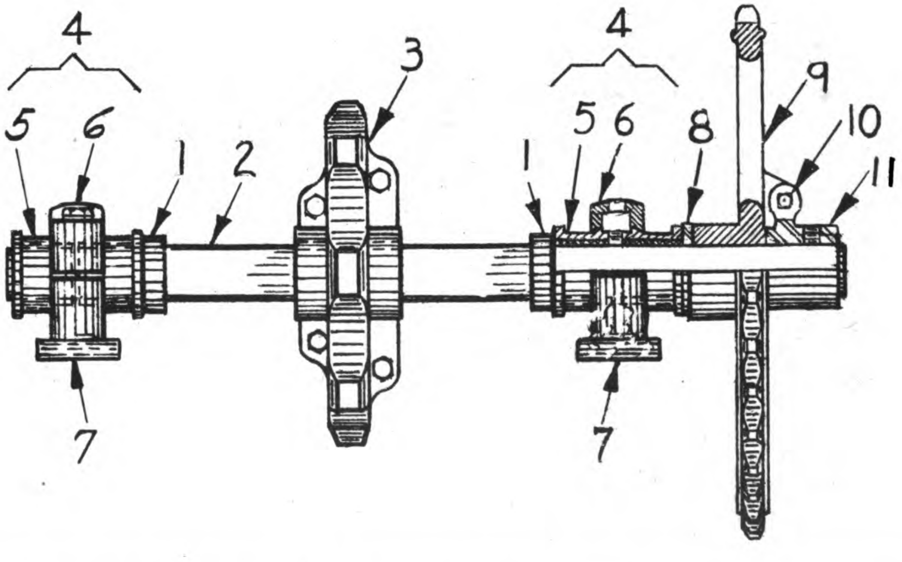
(B/M 834-327-A1)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	D1-834-328	Liner Plate
	3		Flat Head Cap Screw, Nut & Lock Washer, 3/8" x 3/4"
2.	1	0-834-328	Weartex Flashing, High Temperature
	3		Carriage Bolt, Nut & Lock Washer, 3/8" x 1-1/4"
3.	1	P-834-328	Backing Bar.

HOT ELEVATOR HEAD SHAFT

(B/M 834-80-A3)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2	0-3-947	Collar
	4		Allen Cup Point Safety Set Screw, 1/2" x 1/2"

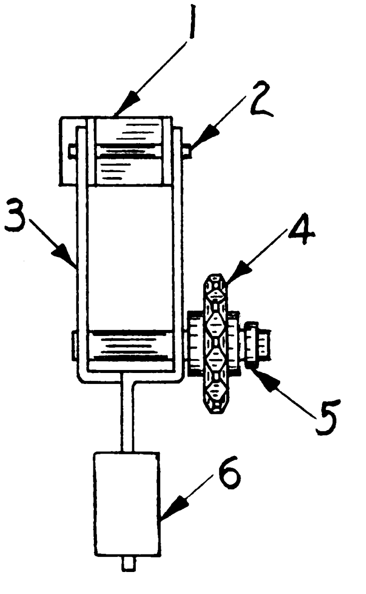
HOT ELEVATOR HEAD SHAFT (Continued)

(B/M 834-80-A3)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
2.	1	A1-834-80	Shaft, 2-7/16" x 3' 3-3/8" S.A.E. 4140
3.	1	2994 B	Sprocket, 8 Tooth
	1	M-17-34	Key, 5/8" x 5/8" x 4-7/8"
	4		Hex Head Cap Screw, Nut & Lock Washer, 7/8" x 3-1/2"
	1		Set Screw, 5/8" x 1-1/4"
4.	2	13-219-E	Ball & Socket Bearing, Complete
5.	2	3716	Bearing
	2	F-17-43	Grease Pipe, 1/4" x 2"
	2		Pipe Coupling, 1/4"
	2		1/4" Button Head Alemite, Male
	4		Machine Bolt, Nut & Jam Nut, 5/8" x 6-1/4"
	2	CC-8-92	Bronze Bushing
6.	2	961A	Bearing Cap
7.	2	960	Bearing Base
	4		Machine Bolt, Nut & Lock Washer, 5/8" x 2-1/2"
	4	EF-17-109	Shim, 16 Ga.
	2	EG-17-109	Shim, 12 Ga.
	4	M-17-28	Stop Shim, 1/4"
	4		Machine Bolt, Nut & Lock Washer, 1/2" x 1-3/4"
8.	1	0-17-9	Washer
9.	1	356 A	Sprocket 46 Tooth
10.	1		Machine Bolt & 2 Half Nuts, 5/8" x 7" (Safety Bolt)
11.	1	1243 A	Safety Hub
	1	DD-17-34	Key, 5/8" x 5/8" x 3-1/4"
	2		Set Screw, 5/8" x 3/4"

HOT ELEVATOR DRIVE CHAIN IDLER

(B/M 834-126-A)



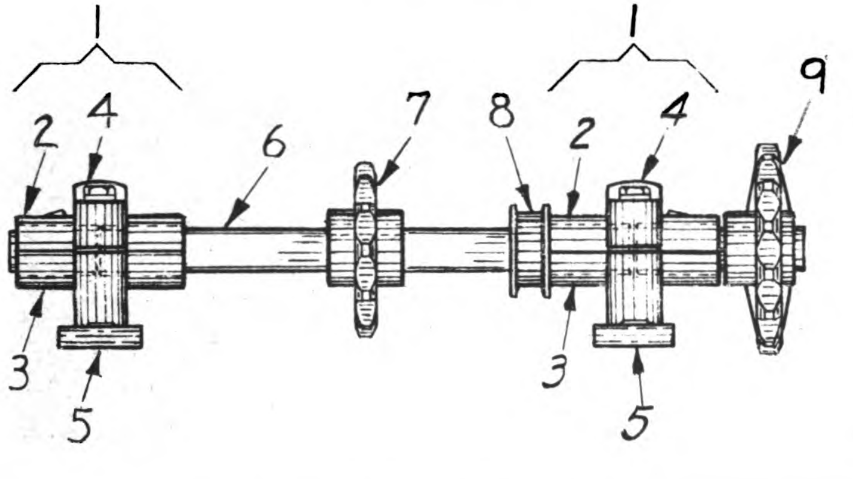
HOT ELEVATOR DRIVE CHAIN IDLER (Continued)

(B/M 834-126-A)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	F-834-126W	Bracket
	2		Machine Bolt, Nut & Lock Washer, 3/8" x 1-1/4"
2.	1	CT-17-25	Pin
	2		Cotter, 1/8" x 1"
3.	1	K-834-126W	Pivot Arm
	1		1/4" Button Head Alemite, Male
4.	1	414 H	Sprocket, 12 Tooth
	2	E-8-11	Bronze Bushing
5.	1	T-3-951	Collar
	2		Set Screw, 1/4" x 5/8"
6.	1	740	Counter Weight
	1		Machine Bolt, Nut & Lock Washer, 1/2" x 3-3/4"

HOT ELEVATOR COUNTER SHAFT

(B/M 834-127-A2)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2	13-214-D	Ball & Socket Bearing, Complete
2.	2	824	Bearing, Upper Half
	2		1/4" Button Head Alemite, Male
3.	2	824 A	Bearing, Lower Half
4.	2	822	Bearing Cap
	4		Machine Bolt, Nut & Jam Nut, 5/8" x 6-1/4"
5.	2	1362	Bearing Base
	4		Machine Bolt, Nut, Lock Washer & Cut Washer, 3/4" x 2-1/2"

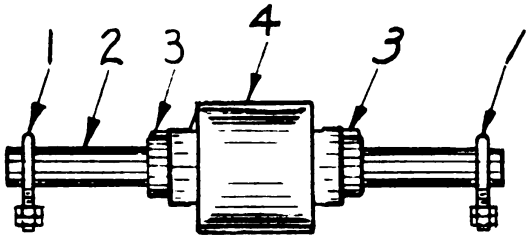
HOT ELEVATOR COUNTER SHAFT (Continued)

(B/M 834-127-A2)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
6.	1	A1-834-127	Shaft, 1-15/16" x 3' 1-1/4" S.A.E. 4140
7.	1	3748	Sprocket, 13 Tooth
	2		Set Screw, 5/8" x 1-1/8"
	1	E-17-33	Key, 1/2" x 1/2" x 3-1/2"
8.	1	136	Collar
	1		Low Head Set Screw, 5/8" x 7/8"
9.	1	2147 A	Sprocket, 17 Tooth
	1		Set Screw, 5/8" x 1"
	1		Set Screw, 5/8" x 1-1/4"
	1	E-17-33	Key, 1/2" x 1/2" x 3-1/2"

HOT ELEVATOR BUCKET LINE IDLER

(B/M 834-86-A1)



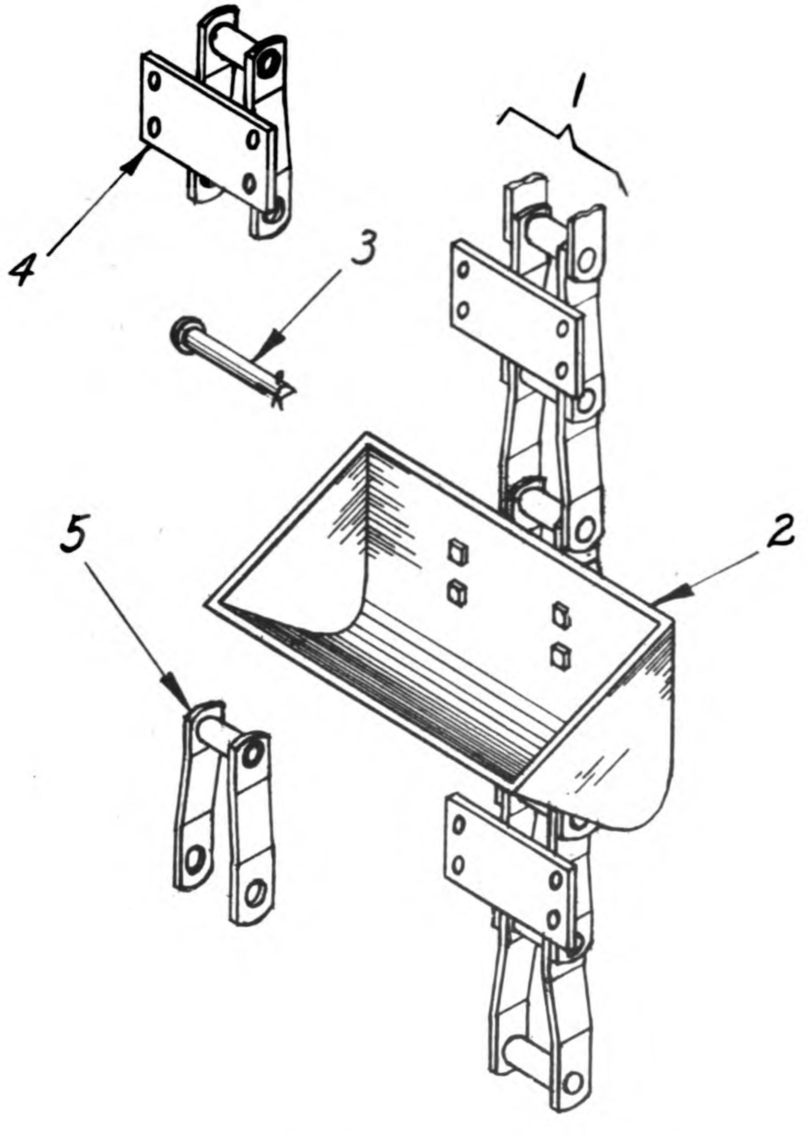
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2	B-46-155	U Bolt
	4		Hex Nut & Lock Washer, 1/2"
2.	1	A1-834-86	Shaft, 1-11/16" x 1' 11-1/4" S.A.E. 1020
	1		1/4" Button Head Alemite, Male
3.	2	2568	Collar
	2		Set Screw, 1/2" x 1-1/4"
4.	1	2569 A	Roller

Always give serial number of machine, part number, and description.

HOT ELEVATOR BUCKET LINE

With Chabelco #A 2842 Chain

(B/M 834-83-A2)

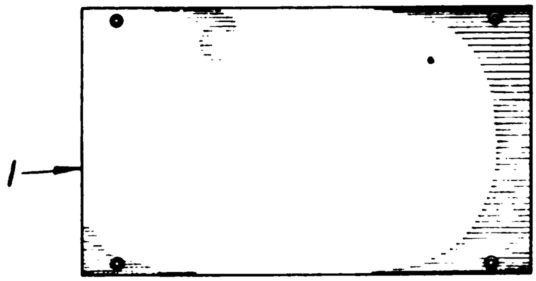


REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1		Strand of 95 Links, Chabelco #A-2842 Chain With K-22 Attachment, B-6-25W, Every Second Link
2.	47	H-46-250	Bucket, 16" x 8" x 8-1/2"
	188		Machine Bolt, Nut, & Lock Washer, 1/2" x 1-1/4"
3.	2	HH-26-F	Pin
	6		Cotter, 1/4" x 1-1/8"
4.	1	B-6-25W	Attachment Link With Cotter Pin
5.	1		Plain Link With Cotter Pin, Chabelco #A-2842 Chain

HOT ELEVATOR RECEIVING HOPPER

Liner Plate

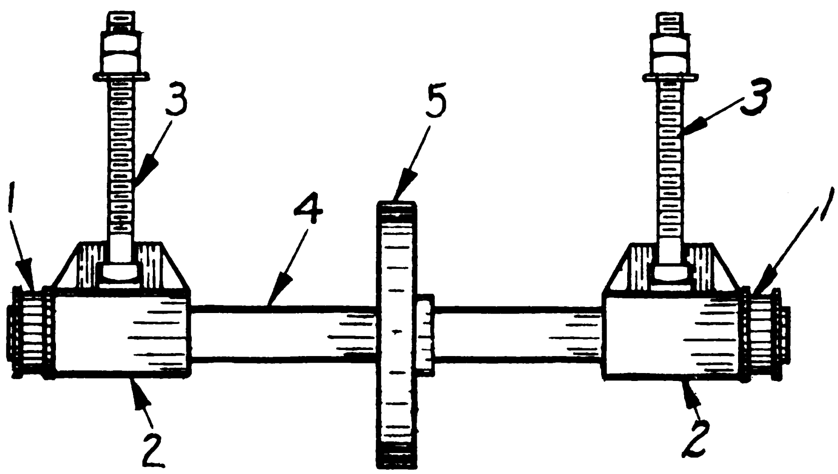
(B/M 834-90-A2)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	E1-834-90	Liner Plate
	4		Flat Head Cap Screw, Nut & Lock Washer, 3/8" x 3/4"

HOT ELEVATOR FOOT SHAFT

(B/M 834-84-A3)



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	2		2-7/16" Standard Collar
	4		Set Screw, 5/8" x 1"
2.	2	3431 B	2-7/16" Take-up Bearing
	2		1/4" Button Head Alemite, Male
	4	EE-8-95	Bronze Bushing
3.	2	F-46-208	Machine Bolt, 1-1/4" x 1' 2" (4 Acme Thds. Per Inch)
	4	BU-17-24	Hex Nut, 1-1/4" (4 Acme Thds. Per Inch)
	2		Cut Washer, 1-1/4"
4.	1	A2-834-84	Shaft, 2-7/16" x 3' 0-3/4" S.A.E. 1020
5.	1	3526	Traction Wheel
	2		Set Screw, 5/8" x 1-1/4"

NUMERICAL INDEX

BARBER-GREENE 833 PARTS

"No. Req." is total for entire parts list.
Prices subject to change without notice.

Part Number	Page No.	No. Req.	Lbs. Each	Unit Price
B-3-149	225	16	.5	.36
	226			
	227			
	228			
	255			
A-3-604	228	2	.4	.24
B-3-932	228	1	.5	.94
E-3-941	218	2	.6	1.08
	220			
O-3-941	219	1	1.0	1.30
Q-3-941	257	3	.9	1.38
W-3-941	220	1	2.5	1.44
K-3-947	247	2	2.8	1.65
N-3-947	247	1	1.5	1.28
O-3-947	265	2	1.4	1.67
C-3-951	255	1	.5	.66
T-3-951	267	1	.4	.90
C-3-953	260	2	.6	.68
F-3-1028	255	1	.4	.29
G-3-1032W	230	1	1.5	1.95
F-3-1058W	222	1	4.3	2.06
A-3-1126	242	5	.2	.34
E-3-1126	240	4	.3	.53
F-3-1126	242	5	.1	.51
F-3-1197	230	1	.5	.47
H-3-1197	230	1	.6	.12
M-3-1197	230	1	3.5	1.80
O-3-1197W	230	1	7.3	3.38
P-3-1197	230	1	.3	.36
A-3-1200	259	4	15.0	6.45
C-3-1200	218	7	3.3	1.60
	257			
D-3-1200	212	8	2.5	1.84
E-3-1200	206	2	3.0	2.56
F-3-1200	251	3	5.0	3.54
G-3-1200	219	3	3.0	2.88
B-3-1205W	222	1	4.9	2.92
A-3-1212	257	2	.4	2.50
B-6-25W	250	2	5.3	2.08
	269			
A-6-64	206		.3	.27
AZ-6-64C	206	1	19.8	14.47
B-6-64	206		.3	.20
C-6-64	206		.3	.61
A-6-65	206		.6	.54
AJ-6-65C	206	1	32.0	25.25
B-6-65	206		.4	.43
C-6-65	206		.7	1.35
A-6-82	206			
	264		.5	.32
B-6-82	206			
	264		.3	.22
BE-6-82C	206	1	28.2	16.87
C-6-82	206			
	264		.4	.49

Part Number	Page No.	No. Req.	Lbs. Each	Unit Price
JQ-6-82C	264	1	103.9	61.39
FB-6-82C	264	1	63.2	37.45
FT-6-82C	206	1	69.3	40.74
A-6-86	206		.8	.54
AT-6-86C	206	1	49.7	27.60
B-6-86	206		.7	.43
C-6-86	206		.8	.81
A-6-120	206		1.8	.57
AZ-6-120R	206	1	132.8	42.75
BD-6-120R	206	1	138.1	44.46
A-6-146	250	1		
BU-6-146C	269	1		
BX-6-146C	250	1		
E-8-11	267	2	.3	1.38
K-8-55	259	8		.63
E-8-74	248	2	.6	1.32
M-8-75	256	4	1.0	1.10
P-8-75	219	4	.8	1.00
	220			
S-8-75	219	4	2.5	1.15
CC-8-92	266	2		4.71
BB-8-94	212	8	1.9	2.20
DD-8-95	205	4	2.5	2.88
EE-8-95	270	4	2.0	2.13
E-8-115	210	16		2.80
C-8-123	220	4	1.7	1.22
A-8-126	210	16		2.62
A-13-50	232	16	.1	.24
13-213-K	218	3	27.6	8.11
13-213-Q	219	2	26.4	14.77
13-213-S	256	2	21.1	13.17
13-214-D	267	2	32.7	10.14
13-219-A	251	2	50.6	16.24
13-219-E	266	2	32.3	16.01
13-220-A	212	4	40.8	29.18
13-220-C	205	2	45.3	19.10
13-222-F	210	16	50.6	31.05
A-13-273W	232	2	2.8	1.90
AV-17-9	249	4	.3	.06
B-17-9	227	3	.3	.06
DD-17-9	248	2	.3	.06
DM-17-9	230	4	.3	.06
DP-17-9	258	1	.3	.06
HH-17-9	226	2	.3	.06
JN-17-9	211	16	.3	.06
KE-17-9	209	56	.1	.06
MQ-17-9	259	28	.3	.06
NZ-17-9	247	2	.3	.06
O-17-9	266	1	.3	.06
V-17-9	248	5	.3	.06
YY-17-9	212	4	.3	.06
B-17-10	230	1	.1	.11

Part Number	Page No.	No. Req.	Lbs. Each	Unit Price
C-17-10	226	1	.1	.12
E-17-11	226	2	.2	.14
TT-17-13	212	2	.6	.18
BG-17-23	226	1	.1	.06
C-17-23	225	16	.1	.06
	226			
	227			
	228			
	255			
CP-17-23	228	2	.2	.06
DC-17-23	230	1	.2	.06
O-17-23	255	1	.3	.06
Q-17-23	225	1	.1	.06
WW-17-23	228	5	.5	.06
Z-17-23	226	3	.2	.06
	228			
Y-17-24	224	2	.4	.24
BG-17-24	204	2	.6	.26
BK-17-24	221	1	.3	.16
BU-17-24	247	8	.7	.24
	270			
CP-17-24	247	2	4.5	2.56
CT-17-24	221	1	.5	.28
CT-17-25	267	1	.2	.07
EC-17-25	246	1	.6	.25
F1-17-25	256	2	.5	.19
KB-17-25	256	1	.5	.36
KJ-17-25	246	1	1.0	.50
KM-17-25	246	1	1.8	.47
FJ-17-26	260	2	.1	.11
M-17-28	266	4	.3	.06
BB-17-30	222	3	.1	.20
	225			
C-17-30	228	3	.1	.08
	230			
	255			
E-17-30	230	1	.1	.09
D-17-33	205	2	.1	.18
	220			
E-17-33	268	2	.2	.18
U-17-33	218	1	.1	.16
Z-17-33	218	2	.1	.16
DD-17-34	247	2	.1	.24
	266			
GG-17-34	206	1	.1	.18
KK-17-34	251	1	.4	.18
M-17-34	247	3	.1	.18
	251			
	266			
MM-17-34	204	1	.1	.18
XX-17-34	212	2	.1	.18
Y-17-34	206	1	.1	.18
W-17-41	221	1	.1	.18
AE-17-43	216	8	1.0	.40
AF-17-43	205	13	.2	.07
	216			
	218			
AO-17-43	251	2	1.0	.38
BB-17-43	259	2	.2	.09

Part Number	Page No.	No. Req.	Lbs. Each	Unit Price
C-17-43	242	4	.1	.05
	224			
	256			
D-17-43	232	1	.2	.04
E-17-43	232	1	.2	.04
F-17-43	216	4	.1	.07
	266			
I-17-43	224	1	.1	.07
GG-17-43	216	6	.7	.24
	259			
HH-17-43	212	6	.5	.05
	232			
	256			
M-17-43	216	1	.8	.26
T-17-43	216	3	.2	.14
	232			
U-17-43	251	2	.2	.09
WW-17-43	218	1	.1	.05
X-17-43	259	1	.2	.13
N-17-71	232	4	.3	.06
D-17-92	205	2	.4	.99
	220			
A-17-99	234	32	.3	.42
V-17-105	210	16	.1	.44
AK-17-106	257	1	.2	.26
G-17-106	218	2	.2	.27
	220			
AX-17-109	218	12	.3	.06
	219			
AY-17-109	218	7	.3	.06
BX-17-109	206	22	.3	.06
	212			
EF-17-109	266	4	.3	.06
EG-17-109	266	2	.3	.06
SS-17-109	234	6	.3	.06
AD-17-111	212	18	.3	.06
	256			
AE-17-111	212	16	.3	.06
AF-17-111	212	20	.3	.06
	256			
EA-17-111	234	8	.3	.06
EB-17-111	234	12	.3	.06
EC-17-111	234	4	.3	.06
QQ-17-111	206	52	.3	.06
	210			
	218			
	219			
SS-17-111	206	50	.3	.06
	210			
	218			
	219			
TT-17-111	206	81	.3	.06
	210			
	218			
	219			
B-17-121	240	4	.1	.07
B-17-122	240	4	.1	.08
B-17-123	242	1	.1	.05
B-17-124	242	1	.8	.15

Part Number	Page No.	No. Req.	Lbs. Each	Unit Price
H-17-124	242	5	.7	.08
SS-17-124	242	2	1.1	.19
TT-17-124	242	2	1.0	.08
D-17-139	210	48	.3	.06
DM-17-139	221	4	.3	.06
DU-17-139	234	6	.3	.06
E-17-139	210	32	.3	.06
A-17-144	228	1	2.1	.76
AZ-17-144	230	1	2.0	.99
BC-17-144	227	2	1.0	.36
BZ-17-144	226	1	14.5	2.43
CK-17-144	255	1	2.0	1.24
CP-17-144	226	1	4.5	1.30
T-17-144	227	1	1.0	.68
F-17-145	249	1	3.35	1.58
F-17-149	232	1	.1	.26
E-17-150	242	1	.6	.40
B-17-155	242	4	.2	.05
E-17-155	242	3	.3	.09
G-17-155	242	6	.4	.09
H-17-155	242	2	.5	.07
H-17-156	240	2	.7	.10
EE-17-156	240	2	1.9	.16
F-17-159	240	1	1.4	.19
T-17-178	231	1	.2	.17
U-17-178	231	1	.3	.13
C-17-191W	242	1	26.0	8.10
A-17-202	210	16	.3	.66
B-17-202	240	3	.3	.40
A-18-238	205	2	36.0	31.65
	220			
C-18-276	238	1	.1	1.56
C-18-277	238	1	.6	3.05
19-601-D	218	1	30.5	20.00
19-632-A	212	2	84.3	36.90
19-632-B	206	1	22.0	22.68
D-19-742	212	2	36.0	13.32
E-19-742	212	2	41.0	13.32
A-19-759	204	1	19.3	30.12
B-19-759	204	1	4.9	8.10
HH-26-F	250	4		.27
	269			
F-38-144	224	4	.1	.05
AH-46-20	222	1	1.8	7.25
AN-46-20	222	1	3.4	5.75
B-46-20	222	1	.27	.47
BB-46-20	222	1	.3	.18
F-46-20	222	1	1.85	2.95
FF-46-20	224	2	.5	.90
MM-46-20	222	1	2.0	1.68
WW-46-20	222	1	2.3	1.20
B-46-63	213	2	.1	.75
B-46-64	227	2	.2	.18
D-46-154	230	1	.1	.08
B-46-155	268	2	.5	.40
A-46-201	249	1	.2	.28
F-46-208	270	2	8.9	1.40
B-46-217	254	1	.1	.21
C-46-221	254	1	.4	.18
D-46-221	254	1	.5	.14
E-46-221	254	1		.61
F-46-221R	260	2	4.9	4.55
A-46-240W	224	1	75.2	10.72
D-46-240	224	4	1.9	1.04
F-46-240	224	4	4.0	.52
H-46-240	224	2	3.0	.94
H-46-250	250	96	1.47	3.90
	269			
53-54-A	224	1	.2	.38
A-50-58	234	4	3.9	2.70
F-58-10	228	1	6.0	1.26
G-62-33	230	1	.2	.39
136	218	2	3.0	1.38
	268			
356A	247	2	82.5	24.00
	266			
0362*	206		.4	.21
	264			
414H	267	1	8.5	4.80
L-458	234	2		2.40
470*	206		.3	.19
D470*	206		.6	.41
474*	206		.2	.39
679A	249	2	33.0	8.28
725E*	255	1	1.4	2.13
740	267	1	20.4	1.45
821	256	2	8.0	1.50
822	267	2	3.4	.72
822B	218	3	3.4	1.08
823	218	5	14.8	3.42
	219			
824	267	2	5.7	3.18
824A	267	2	5.9	2.88
C1-833-28W	211	4	20.3	3.30
G2-833-28WB	211	4	50.0	19.76
HI-833-28	211	4	9.5	1.12
K1-833-28	211	8	2.5	.31
J1-833-28	211	8	4.8	.57
E-833-41	212	2	2.0	.81
F-833-41	212	3	.5	.07
	248			
H-833-60	238	3	.1	.06
J-833-60	237	1	.1	.04
M-833-60	237	1	.1	.18
N-833-60	237	1	1.5	.22
O-833-60	237	1	.1	.20
Q-833-60	238	1	.1	.20
V-833-60W	238	1	12.0	9.47
W-833-60W	238	1	2.3	.64
X-833-60	238	1	.1	.07
Y-833-60W	238	1	.1	1.33
Z-833-60	238	1	3.0	.18
833-60-A	238	1	20.1	17.92
B1-833-76W	209	2	4065.0	584.00
A-833-77	209	56	54.0	4.39
B(R)833-77	209	7	35.0	4.06
B(L)833-77	209	7	35.0	4.06
C1-833-77	209	28	6.5	.64

Part Number	Page No.	No. Req.	Lbs. Each	Unit Price
C1-833-79W	221	1	10.4	1.45
A3-833-82	219	1	18.8	7.75
A1-833-88W	209	2	317.5	71.00
E1-833-88	209	168	2.3	.06
F1-833-88	209	84	1.2	.06
G1-833-88	209	84	.8	.06
B1-833-89W	209	2	375.0	64.20
E1-833-89	209	112	1.5	.06
F1-833-89	209	56	1.0	.06
G1-833-89	209	56	.7	.06
A1-833-92	206	1	142.0	43.10
D-833-93W	212	2	5.0	3.72
E-833-105W	224	2	8.8	3.42
G-833-105	224	2	1.4	.27
A-833-119	240	4	.5	.20
A1-833-165	247	1	44.0	10.62
A1-833-166	251	1	51.0	8.57
A-833-167	249	2	4.0	1.35
E-833-167W	249	2	17.1	8.33
J-833-190W	248	1	7.0	4.37
Q1-833-190W	248	1	5.3	2.28
C2-833-197W	249	1	12.0	3.35
F-833-197W	249	1	2.9	.87
A1-833-239	218	1	18.0	3.54
B2-833-239	218	1	21.0	4.10
D1-833-247W	234	1	391.5	92.80
F1(R)833-256W	240	1	10.7	6.05
F1(L)833-256W	240	1	10.7	6.05
A(R)833-261	239	1	23.3	2.94
A(L)833-261	239	1	23.3	2.94
B-833-261	239	2	66.0	8.33
C(R)833-261	239	1	26.3	3.33
C(L)833-261	239	1	26.3	3.33
E1-833-279W	222	1	3.5	1.21
F1-833-279W	222	1	10.0	7.74
J-833-279W	222	1	10.3	2.16
A-833-280	222	1	7.0	.81
A-833-285W	209	2	305.0	77.80
C-833-285W	209	28	6.3	1.70
K-833-307W	220	2	12.0	4.75
M-833-307	220	2	5.0	1.89
A-833-321	210	8	31.1	4.05
B-833-321	210	16	2.2	.26
C-833-321	210	16	.1	.12
A(R)833-322	205	1	102.0	7.95
A(L)833-322	205	1	102.0	7.95
B-833-322	204	1	23.8	6.50
A-833-333	212	2	31.0	8.52
J1-833-334W	239	1	2.19	6.67
O1-833-334	239	1	26.0	3.02
P1-833-334	239	2	29.0	3.37
V1-833-334	239	2	36.0	4.20
W1-833-334W	239	2	.9	1.47
A-833-337W	212	2	31.0	7.88
G(R)833-337W	213	2	3.8	.93
G(L)833-337W	213	2	3.8	.93
K-833-337	213	2	4.0	.48
M-833-337W	213	2	2.8	1.38
O-833-337	213	2	.8	.10
P-833-337W	213	2	1.3	.47
D-833-343WB	206	1	15.5	8.38
F-833-343	204	1	.1	.23
G-833-343WB	204	1	21.0	4.05
M-833-343WB	218	2	14.5	7.61
O-833-343	204	1	3.2	.36
P-833-343	204	1	.4	3.38
U-833-343	204	1	1.0	.12
A-833-352	226	1	2.0	.24
C-833-352	226	1	4.3	.50
D-833-352	226	1	1.5	.17
E-833-352	226	1	1.0	.12
H-833-352	226	1	1.8	.21
J-833-352	226	1	2.8	.33
K-833-352	226	1	5.3	.62
O-833-352W	226	1	3.4	.88
P-833-352W	226	1	3.3	.69
Q-833-352	226	1	.5	.07
A-833-367W	225	1	5.9	1.00
D-833-367W	225	1	3.0	.67
F-833-367W	225	1	5.4	1.47
J-833-367	225	1	4.5	1.37
M-833-367W	225	1	3.5	1.40
N-833-367	225	2	.3	.06
O-833-367	225	2	.9	.10
S-833-367W	225	1	1.8	.52
V-833-367W	225	1	7.0	1.50
A(R)833-385	240	1	1.1	.15
A(L)833-385	240	1	1.1	.15
B-833-385	242	2	2.0	.25
C-833-385	242	3	1.8	.23
D-833-385W	242	2	2.0	.73
G-833-385	242	1	2.0	.26
H-833-385	240	4	.8	.11
A-833-451	227	2	5.8	1.86
B-833-451	227	1	9.8	1.27
A-833-452W	227	2	26.0	7.27
AA-833-452W	228	1	17.8	3.11
BB-833-452	227	1	.5	.10
J-833-452W	227	3	1.3	1.35
M-833-452W	227	1	3.5	1.97
P-833-452W	227	1	15.0	4.45
U-833-452	228	2	4.8	.60
V-833-452W	228	1	6.3	2.31
A(R)833-453	232	1	6.5	.80
A(L)833-453	232	1	6.5	.80
B-833-453W	232	1	11.0	4.30
D-833-459W	228	1	3.0	.84
J-833-459	230	1	4.8	1.69
N-833-459W	230	1	3.5	2.42
Q-833-459W	230	1	16.8	4.62
V-833-459W	228	3	2.3	.81
Z-833-459W	228	1	3.8	1.75
E-833-467	246	1	23.1	2.86
F-833-467	246	1	7.3	.92
G-833-467	246	1	.8	.90
H-833-467	246	1	1.8	.23
G-833-468W	246	1	16.0	2.68
J-833-468W	246	1	7.3	1.85

Part Number	Page No.	No. Req.	Lbs. Each	Unit Price
C-833-471W	246	1	17.0	3.11
H-833-471	246	1	23.3	2.91
A-834-69	259	4	3.0	.90
F-834-69	257	1	2.5	1.56
J-834-69W	258	1	3.0	8.46
M1-834-69W	257	1	23.5	10.80
A1-834-80	266	1	51.2	12.67
A2-834-84	270	1	49.0	5.52
A1-834-86	268	1	14.0	3.69
E1-834-90	270	1	23.5	2.78
F-834-126W	267	1	2.3	.29
K-834-126W	267	1	7.0	3.90
A1-834-127	268	1	31.0	8.32
G-834-247W	257	1	1.0	.48
J-834-247	257	1	.1	.90
B1-834-249W	257	1	32.3	15.85
J(R)834-253	259	1	19.8	2.70
J(L)834-253	259	1	19.8	2.70
M-834-253	259	2	2.8	4.20
O-834-253	259	2	6.0	.71
J-834-255	259	4	7.5	.90
K-834-255	259	4	3.8	.45
P1-834-256	259	1	3.3	.40
S-834-256	259	1	1.0	1.07
B-834-258W	259	1	181.0	23.05
O-834-258W	259	1	15.0	6.22
S(R)834-258	259	1	12.8	1.65
S(L)834-258	259	1	12.8	1.65
A-834-260W	256	1	3.6	2.45
F-834-260W	256	1	2.9	2.71
M-834-260W	256	2	5.0	2.28
D1-834-328	265	1	10.0	1.16
O-834-328	265	1	1.5	2.09
P-834-328	265	1	1.5	.17
A-834-329W	255	1	4.7	2.23
D(R)834-329	255	1	2.5	.31
D(L)834-329	255	1	2.5	.31
E-834-329W	255	1	8.5	1.69
J-834-329	255	1	11.8	1.40
A-834-331W	260	1	23.0	3.68
H-834-331W	260	1	38.5	5.33
Q-834-331W	260	2	4.3	3.81
A-834-332W	260	1	143.9	19.68
Q-848-149W	260	2	1.5	.43
H(R)848-324W	232	1	530.0	175.20
H(L)848-324W	232	1	530.0	175.20
C(R)848-326W	234	2	15.4	5.15
C(L)848-326W	234	2	15.4	5.15
896D	257	1	14.0	16.20
897	257	1	4.9	3.75
960	266	2	15.4	3.42
961A	266	2	5.2	1.68
1030*	206		1.8	.57
1120	257	1	29.0	10.98
1243A	247	2	5.9	8.76
	266			
1362	267	2	15.5	2.82
1363	206	8	18.9	4.74
	212			

Part Number	Page No.	No. Req.	Lbs. Each	Unit Price
	251			
1364	251	2	11.2	4.80
1364A	251	2	11.4	4.38
1365	205	8	6.3	1.38
	212			
	251			
1462A	218	3	4.0	1.68
1462D	218	3	3.9	1.68
2147A	268	1	15.4	11.50
2161B	248	1	10.5	11.25
2161D	220	2	10.5	11.33
2220A	212	4	20.0	22.50
2419B	219	2	6.5	9.15
	218			
2427	220	2	2.2	7.08
2568	268	2	2.0	2.16
2569A	268	1	24.0	9.18
2806A	232	4	4.5	2.39
#A-2842*	250		3.3	.85
	269			
2864B	218	2	4.8	19.86
	220			
2992B	251	1	4.8	29.52
2994B	247	3	66.8	23.16
	251			
	266			
3104	210	16	16.3	6.45
3105	210	16	7.9	3.80
3331	232	4	2.4	2.58
3341	232	2	2.3	1.56
3401	205	2	17.3	12.45
3431A	247	2	23.8	9.51
3431B	270	2	23.5	11.76
3447	254	1	.9	1.16
3448	254	1	.1	.61
3488	219	4	3.5	2.00
	256			
3513	228	5	.5	.25
3526	211	5	34.3	9.05
	270			
3554A	210	16	20.8	25.62
3619B	206	1	59.0	68.00
3632	220	1	12.9	17.85
3632A	219	1	12.9	16.05
3705	256	2	8.0	9.70
3716	266	2	10.1	10.71
3748	268	1	14.5	14.92
3770	204	1	29.5	18.15
3771	210	8	110.0	30.18
201010	236	2		.90
201499	236	1		.15
201500	236	1		.15
205053	236	10		.19
205102	236	1		.23
205103	236	2		.38
205267	236	2		.90
205730	236	2		1.13
205824	236	1		.19
215310	236	1		.75

Part Number	Page No.	No. Req.	Lbs. Each	Unit Price	Part Number	Page No.	No. Req.	Lbs. Each	Unit Price
215536	236	4		.71	EL-SO-A1	243	1	.5	.88
215689	236	1		9.68	EN-B-N9	204	1	1150.0	825.00
216619	236	4		14.63	HJ-BL-A1	222	1	7.80	11.85
217525	236	2		.30	HO-BL-A4	231	1	.8	3.50
220165	236	2		2.36	HO-BL-A5	232	1	2.0	7.10
220269	236	4		7.70	HP-BL-B2	231	1	33.0	23.00
220353	236	1		36.40	HR-BL-A6	231	2	64.0	74.00
220636	236	2		.60	HT-PD-B1	222	2	90.5	70.00
221022	236	2		14.70	LM-BE-A1	236		.04 per Ft.	
221087	236	1		1.95	LM-BE-A2	236		.05 per Ft.	
221180	236	2		44.23	NU-T-B1	234	4	1.3	.96
BE-DR-J1	206	1	.5	2.10	PF-GC-A1	242	1	.2	.68
BK-T-A1	232	2	151.0	92.55	PF-PG-B1	242	1	.8	5.16
BO-WM-A1	216	2	14.5	.29	PF-RV-D1	242	1	3.8	16.80
BR-BG-A1	237	4	.1	.40	PF-ST-B1	242	1	4.3	3.36
BR-F- Q1	221	1	1.4	3.57	PL-DR-G1	221	1	1.1	1.60
BR-T-K1	234	4	4.0	3.14	PU-VK-B	221	1	8.5	14.64
BR-T-L1	234	4	3.5	2.84	RE-KD-A1	243	2	.3	.63
BR-T-O1	234	2	1.0	1.33	RE-KD-A2	243	4	.3	.58
BR-T-P1	234	2	2.2	2.24	SR-TD-D4	204	1	237.0	336.60
BU-HA-E1	240	2		58.00	TH-EA-A1	224	2	2.4	30.78
BU-HA-E1-8	240				TI-G-B1	234	2	119.3	83.38
BU-HA-E1-10	240				TI-G-E2	232	4	171.8	122.42
BW-101-M	236		.26 per Ft.		TU-G-B1	234	2	11.8	9.46
CE-WM-A1	216	500	1.0	.06	TU-G-E2	232	4	20.0	17.33
CH-PD-A1	222	2	12.5	3.69	TUB-BE-A1	236		.14 per Ft.	
EL-BA-C1	205	1	58.0	13.50	TUB-BE-A2	236		.23 per Ft.	
EL-WT-BO	205	2	.1	.16	UJ-BW-A1	218	1	13.2	26.53
EL-WT-C6	205	2	.2	.25	VA-HA-C1	240	2	4.2	17.00
EL-PL-A1	243	1	.3	.83	WH-E-J3	232	4	2750	92.20
EL-RC-C1	243	2	.2	.56	WH-E-T1	234	2	141.3	25.85
EL-RE-A1	243	1	1.3	2.17	WS-T-A1	234	4	.5	.14

ACCESSORY SECTION

Operation, Maintenance and Parts Lists of All Accessories Including Engine

833 DUAL DRUM DRYER

CONTENTS

OIL VALVE

Description:

Hauck Model "A" - 3/8 - 10 Micro-Cam wheel type oil valve.

Principle and Operation:

This valve is calibrated and constructed to permit control of fuel oil flow rate. It produces a straight-line discharge and once the flow is established on a particular job the valve may be used for metering, since each calibration on the dial has the same increment of oil flow.

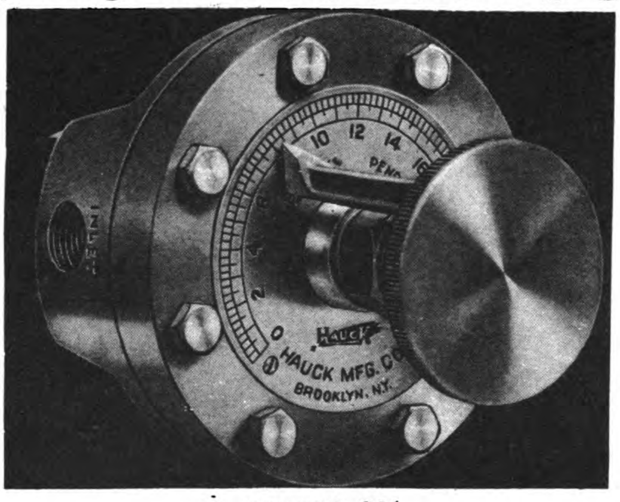


FIGURE 301

The flow of oil is governed by a cam (4) with a knife edge rotating against a V-slot in a flat plane of body (11) and working with very little bearing pressure. The cam movement over the triangular slot in the flat face permits any desired oil flow from minimum to maximum capacity. The cam is ground to produce a straight line discharge curve. With this straight line characteristic, the flow is directly proportional to the area of the slot opening and to the number on the calibrated dial. Thus the pointer at No. 6 position always indicates a flow three times the flow at No. 2 position. With the Micro-Cam valve the flow and repeat settings are set instantly and accurately at will.

Maintenance

If valve leaks around stem (9), tighten packing nut (6). To replace packing, remove wheel (1B) packing nut (6) and packing sleeve (7).

Valve may be completely taken apart by following steps above for replacement of packing, then removing cap screws (13).

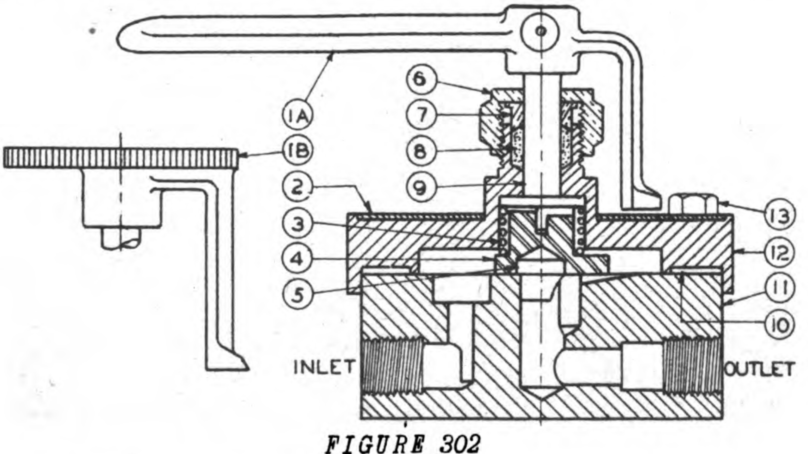


FIGURE 302

OIL VALVE PARTS LIST

Specification:

Hauck Model "A" -3/8 - 10 Micro Cam Wheel Type Oil Valve.

Barber-Greene Specification #VA-HA-Cl.

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1B	1	VA-HA-Cl-1B	Wheel Handle
2	2	VA-HA-Cl-2	Oil Control Valve Dial
3	1	VA-HA-Cl-3	Oil Control Valve Cam Spring
4	1	VA-HA-Cl-4	Oil Control Valve Cam
5	1	VA-HA-Cl-5	Oil Control Valve Cam Centering Pin
6	1	VA-HA-Cl-6	Packing Nut
7	1	VA-HA-Cl-7	Packing Sleeve
8	1	VA-HA-Cl-8	Packing
9	1	VA-HA-Cl-9	Oil Control Valve Stem
10	1	VA-HA-Cl-10	Oil Control Valve Gasket
11	1	VA-HA-Cl-11	Oil Control Valve Body
12	1	VA-HA-Cl-12	Oil Control Valve Cap
13a	4	VA-HA-Cl-13a	Body Screws "A" Size Valve (long)
13b	4	VA-HA-Cl-13b	Body Screws "A" Size Valve (short)

NOTE: When ordering parts give Model and Specification Number.

OIL BURNER

Description:

Hauck No. 511 high pressure type with 1/2" Globe valve, Strainer, and Union on steam side and 1/2" Globe valve, Strainer, and Union on oil side. Special wrench required and furnished.

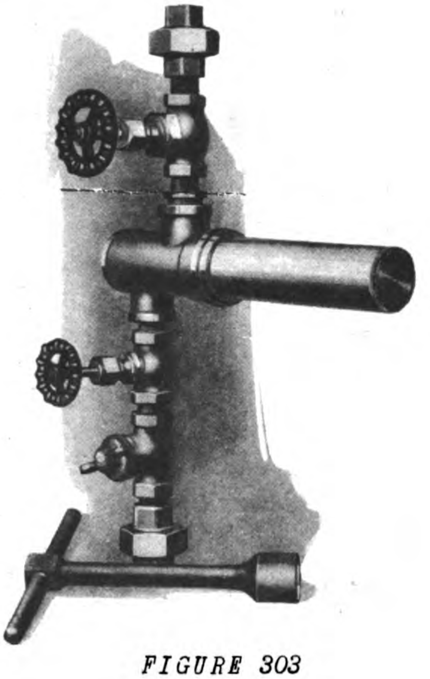


FIGURE 303

Principle

This burner is designed to burn fuels of a viscosity of 140 to 150 Seconds @ 100°F Saybolt without heating, and heavier oils, if preheated. Compressed air or steam is utilized as the atomizing agent.

The No. 511 burner has a capacity of 20 to 150 gallons of fuel oil per hour with an oil pressure from 45 to 60 lbs. per square inch, and a steam pressure from 100 to 150 lbs. per square inch.

Maintenance:

1. As long as the atomized oil and steam mixture at the burner outlet is the same all around, the burner is not defective. If the burner is clogged, the atomized mixture is different in density.

2. Clean all screens in the oil and steam lines at regular intervals, depending on the oil and water used. Once a week is enough in some locations. In others they may require cleaning every day.

3. If the plant smokes it is due to too much oil, or not enough air. This may be caused by insufficient draft in the drum, or the material entering the drum too wet, which causes steam to be generated in the drum. This steam displaces air, and causes a shortage of air for proper combustion.

Note: For operation of Burner see Main Operation Section.

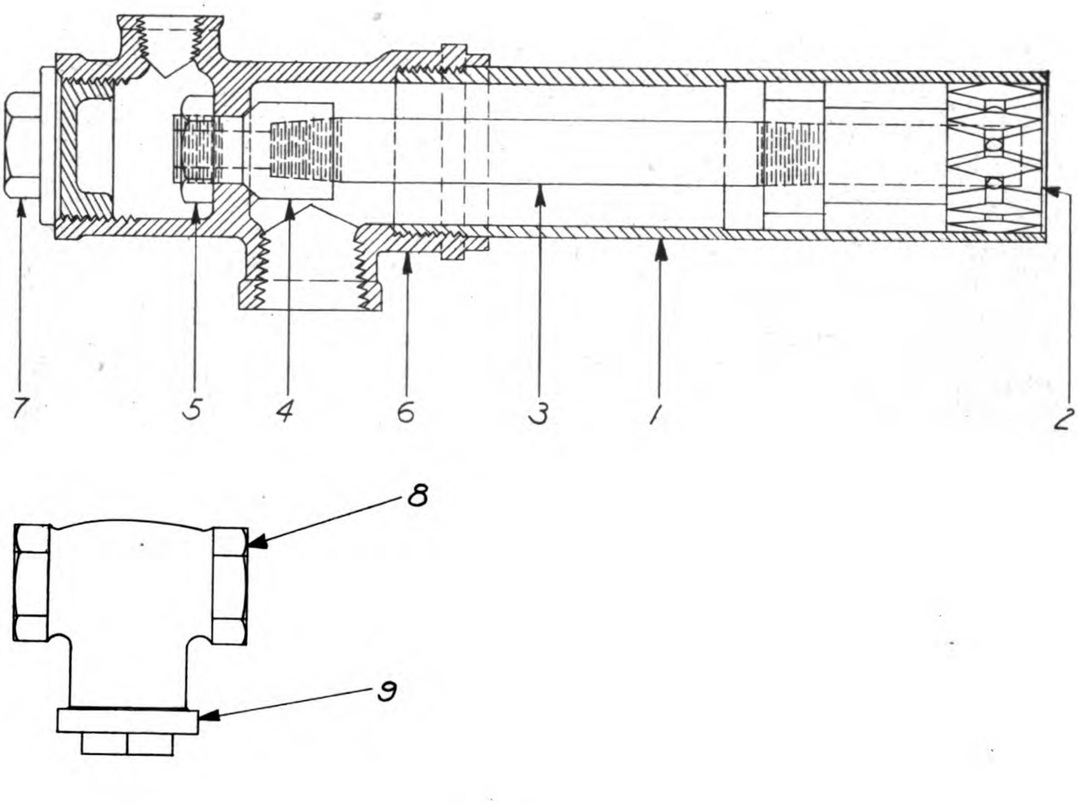


FIGURE 304

OIL BURNER PARTS LIST

Specification:

Hauck Model #511 High Pressure Type Fuel Oil Burner

Barber-Greene Specification #BU-HA-E1.

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1	1	BU-HA-E1-1	Atomizer Casing
2	1	BU-HA-E1-2	Atomizer Core
3	1	BU-HA-E1-3	Atomizer Nipple
4	1	BU-HA-E1-4	Reducing Coupling
5	1	BU-HA-E1-5	Reducing Coupling Nut
6	1	BU-HA-E1-6	Burner Body Casting
7	1	BU-HA-E1-7	Burner Cleanout Plug
8	2	BU-HA-E1-8	Strainer Unit (Complete)
9	2	BU-HA-E1-9	Strainer Screen (included in item 8)
	1	BU-HA-E1-10	Globe Valve, 1/2"
	1	BU-HA-E1-11	Needle Valve, 1/2"

Note: When ordering parts give Model and Specification Number.

MASTER CLUTCH AND REDUCER

Description:

Model - C-111-E4-RG3 Twin Disc Clutch and Reducer

Reducer - Ratio 4 to 1

Reducer Model - X-8368

Bell Housing - No. 3

Clutch Model - C-111

Principle:

This unit consists of a totally enclosed single spur gear reducer, operating in oil, with a clutch housing which adapts the assembly to the power unit. The gear pinion on the high speed clutch shaft drives the internal teeth on the large gear mounted on the slow speed power take-off shaft.

The clutch is a single dry plate type, mounted on the high speed reducer shaft, within the clutch housing, having a toothed friction driving plate which is driven by a ring gear which bolts to the engine flywheel.

Operation or Adjustment

If the clutch does not pull, heats, or operating lever jumps out, adjustment is necessary.

Remove hand hole plate (4) on the clutch housing and turn the clutch until the adjusting lock pin (19) can be reached. Caution: Be sure that engine is not running. Pull the lock pin out and turn adjusting yoke (18) one notch to the rignt, allowing the lock pin to drop into the notch. One notch is usually sufficient to adjust this clutch.

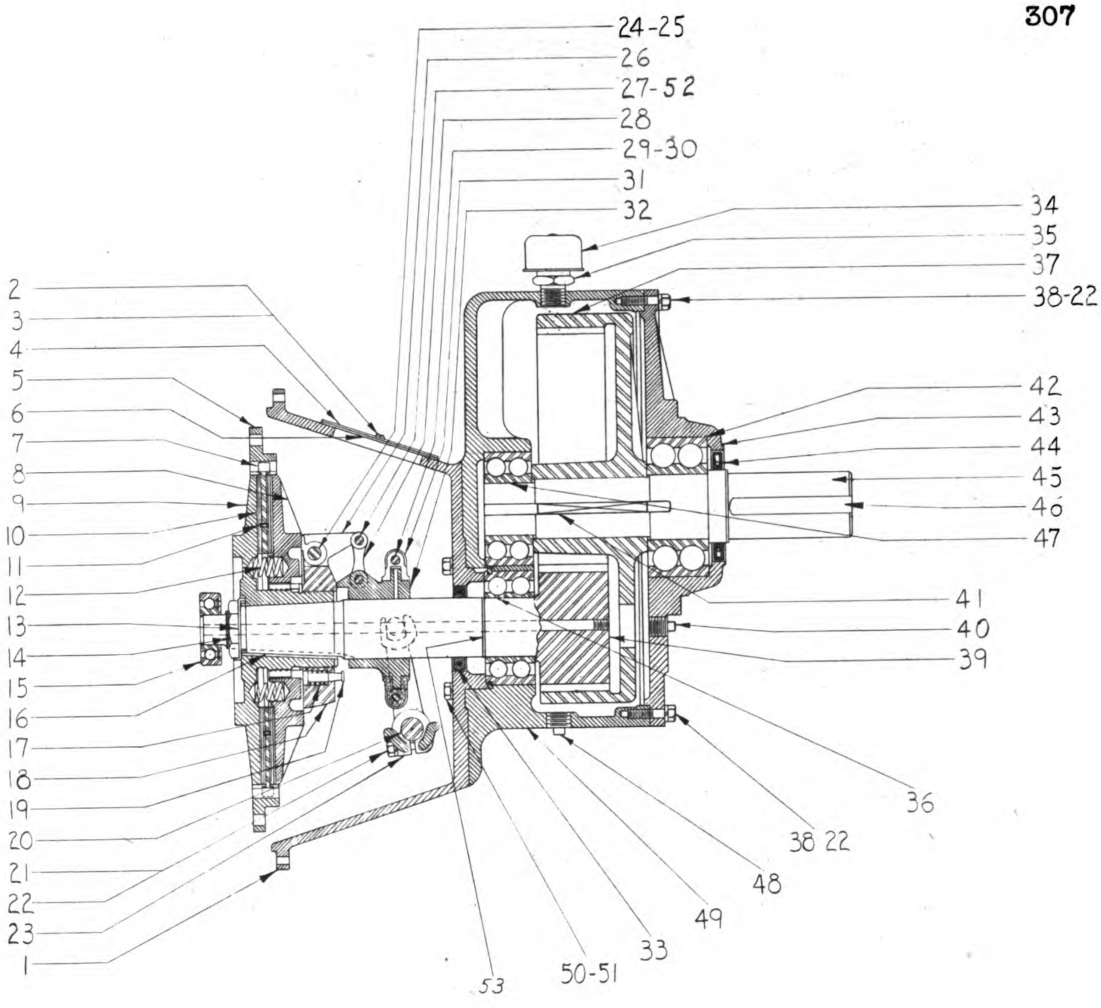


FIGURE 305

A new clutch requires more frequent adjustment until friction discs (10) are worn in.

Maintenance

Removal and dismantling of this unit may be accomplished as follows:

(A) Remove cap screws which hold clutch housing (1) to engine. The reducer and clutch may now be taken from the engine. Driving ring (5) is held by cap screws to the flywheel and will remain in place.

(B) Remove hub nut (14), lock washer (13), and the entire clutch assembly may be taken from clutch shaft (39).

REDUCER AND CLUTCH DISASSEMBLY

Cone collar, (31), is held to sliding sleeve (32), by two bolts (29). This collar should turn freely on sleeve, but should not be sloppy. Sleeve (32) is coupled to clutch by lever link (28) with pins (27) and snap rings (52).

Finger levers (26) which are held to adjusting yoke (18) by finger pins (24) with snap rings (25). Adjusting yoke (18) with lock pin (19) and spring (17) is threaded to hub and back plate and may be readily removed.

With adjusting yoke removed, the floating plate (8), driving plate (7), with friction discs (10), can be taken off hub and back plate. Release springs (12), mount between floating plate and back plate.

New facings may be installed by removing old from driving plate (7) and riveting new in place.

(C) Reducer unit may be dismantled by taking out cap screws (38) and remove cover plate (43) with shaft (45), bearing (42) and gear (37) which is keyed to the shaft. Shaft may be driven out of cover plate, then out of gear.

Shaft and pinion (39) are integral and may be taken out of the case by removing bell housing (1) from case (49) then taking out snap ring (53) and driving shaft out in the direction of the pinion end.

Bearing (36) is held in case by a snap ring against shoulder in the case.

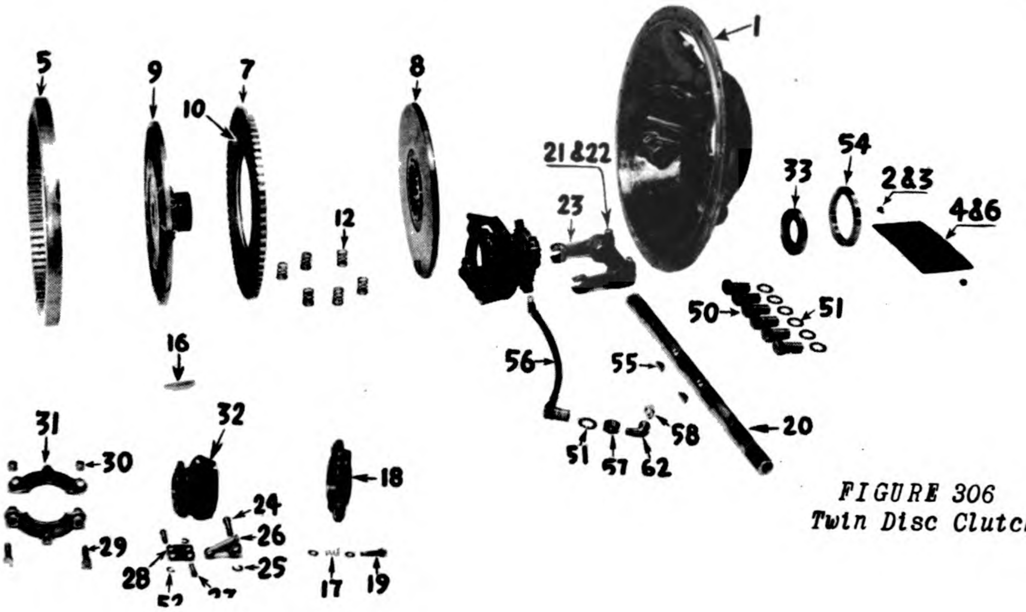


FIGURE 306
Twin Disc Clutch

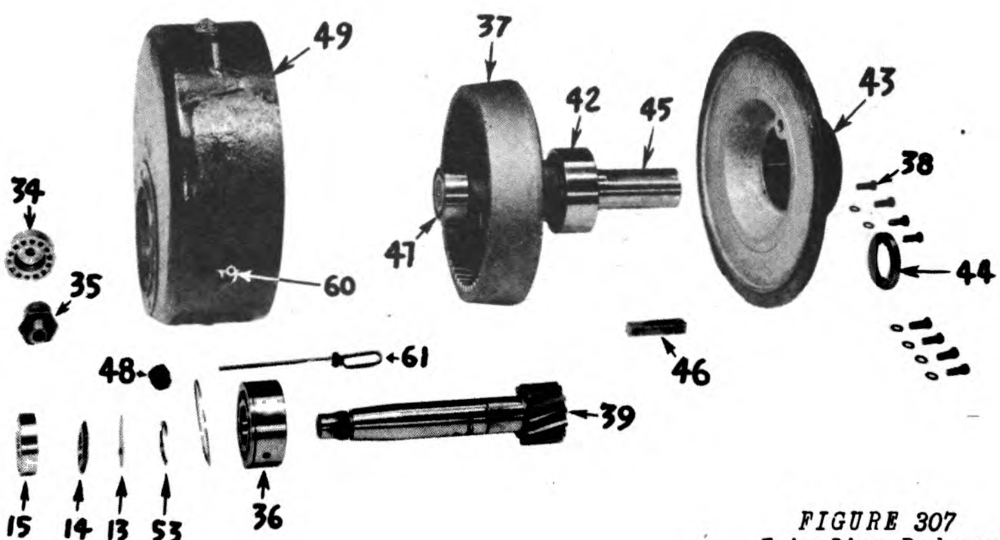


FIGURE 307
Twin Disc Reducer

MASTER CLUTCH AND REDUCER PARTS LIST

Specification:

Twin Disc Model #C111-E4 - RG 3 (4 to 1 Ratio) Clutch and Reducer

Twin Disc Specification #17537

Barber-Greene Specification #SR-TD-D4

REF.NO.	NO. REQ.	PART NO.	DESCRIPTION
1	1	8506	Clutch Housing (#3 Bell Housing)
2	2	M101	Lock Washer, 1/4"
3	2	M227	Button Head Screw, 1/4" x 1/2"
4	1	1965R	Hand Hole Plate
5	1	6625A	Driving Ring
6	1	A1339	Gasket for Hand Hole Plate
7	1	6310J	Driving Plate
8	1	5791	Floating Plate
9	1	6158	Hub and Back Plate
10	2	A5223 H	Friction Disc
11	24	M116	Tubular Rivets, 9/64" x 7/16"
12	6	A1069	Release Springs
13	1	A1588	Lock Washer
14	1	1092A	Hub Nut
15	1	M167	Ball Bearing
16	1	M356	Woodruff Key
17	1	115	Adjusting Lock Pin Spring
18	1	1990	Adjusting Yoke
19	1	2245	Adjusting Lock Pin
20	1	1144F	Operating Shaft
21	2	M258	Cap Screws, 3/8" x 1-1/2"
22	10	M256	Lock Washer, 3/8"
23	1	1037	Throwout Fork
24	4	106A	Finger Pins
25	4	M641	Snap Rings
26	4	103F	Finger Lever (set of 4)
27	8	1968A	Lever Link Pins
28	8	119B2	Lever Link
29	2	M945	Bolts
30	2	M645	Nuts
31	1	117C8S	Cone Collar with 2 Inserts (M1402)
32	1	2137	Sliding Sleeve
33	1	M108	Oil Seal
34	1	M639	Gear Case Breather
35	1	2830A	Breather Pipe
36	1	M398	Ball Bearing
37	1	8375	Internal Gear
38	8	M326	Cap Screws, 3/8" x 1"
39	1	A3091	Clutch Shaft
40	1	M343	Pipe Plug, 1/2"
41	1	M436	Key, 1/2" x 1/2" x 2-5/8" (For Internal Gear, 8375)
42	1	M184	Ball Bearing
43	1	8504	Cover Plate
44	1	M226	Oil Seal
45	1	A3089	Gear Shaft
46	1	M1246	Key, 5/8" x 5/8" x 3-3/8"
47	1	M399	Ball Bearing
48	1	M1344	Magnetic Pipe Plug, 3/4"

MASTER CLUTCH AND REDUCER PARTS LIST - Continued

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
49	1	8503D	Gear Housing
50	6	1497	Cap Screws, 5/8" x 1-1/2"
51	8	M236	Lock Washer, 5/8"
52	8	M642	Snap Rings
53	1	A1003	Snap Ring
54	1	A1558	Spacer
55	2	M291	Woodruff #15
56	1	A1663	Flexible Hose, 12"
57	1	M309	Jam Nut, 5/8", 18 S.A.E.
58	1	M236	1/8" Button Head Alemite, Male
59	2	M102	Oil Cup
60	1	A1557B	Oil Gauge Tube
61	1	A1461G	Oil Gauge
62	1	M302	1/8" x 90° Street Elbow
64	1	A1664	Name Plate
65	1	M266	1/2" x 3/4" Dog Point Set Screw
66	1	M507	3/8" Flush Pipe Plug
67	1	A1972	1/4" Flush Pipe Plug, drilled
68	1	M342	Pipe Plug, 3/4"

Note: When ordering parts give Model number and both Barber-Greene and Twin Disc Specification numbers.

HYDRAULIC JACK

Description:

Model - Blackhawk Model #CB10.5-C Hydraulic Jack

Capacity - 8 Ton

Size - 10-1/2" high by 7-3/4" lift

Type - Oil motor truck type with two piece handle

Principle:

When pump handle is raised plunger (25) raises which causes the oil in reservoir to be forced by check ball (6) filling the pump cylinder (24) with oil. On downward stroke pump plunger (25) forces oil back into the oil channel causing check ball (6) to seat and check ball (7) to open. Oil passing through check ball (7) passes directly into main cylinder (17) causes ram plunger (19) to raise which in turn lifts the load. For lowering, release valve (4) is opened all the way allowing oil, forced under pressure by load on main plunger (19) back in the reservoir (12).

Operation:

To raise load place jack under object, turning out screw extension either all the way or until saddle (23) contacts load. Raising screw extension makes it possible to take advantage of full hydraulic lift. Turn release valve, (4) with pump handle engaging slots in handle with cross pin (33). Place pump handle on pump beam (32) and with upward and downward

FIGURE 308

strokes on handle, jack will raise load. To lower, remove pump handle from pump beam (32) placing it over release valve (4) and speed of lowering will depend upon the amount release valve (4) is opened.

Maintenance:

If jack does not hold load either the main plunger cup (20) is leaking or check ball (7) is not seating.

If the cup leaks, remove top cap (9), reservoir (12) and cylinder (17). This will permit removal of entire plunger assembly, then remove retaining nut (21) and spreader (22), install new cup (20) and reassemble. Plunger assembly should always be put into the cylinder with the saddle (23) entering the cylinder first. The reason for this is to keep the main plunger cup (20) from distorting.

If leak is due to check ball (7) not seating remove valve plugs (41), spring (42), and finally ball (7). Use a magnet to clean out any chips that might be on valve seat, replace check ball (7) and tap lightly using small hammer and brass rod. Reassemble valve plugs.

If leakage occurs around pump cylinder (24), remove cotter pin and beam pin, then with open end wrench remove pump cylinder (24). Push pump plunger (25) sufficiently so cup (27) clears bottom of pump cylinder (24). Remove (29) pump cup retaining nut and (26) pump cup spreader installing new pump cup (27). Reassemble, place pump plunger assembly into pump cylinder and reassemble entire assembly into pump base.

Always use Blackhawk oil (71) when available. WARNING: Hydraulic brake or shock absorber fluid, alcohol, glycerine, castor oil will ruin cups because such fluid dissolves sizing which seals the pores in cup leathers and corrodes valve seats and cylinder walls. Use of these fluids waives guarantee. Use only SAE 10 or 10W as substitute.

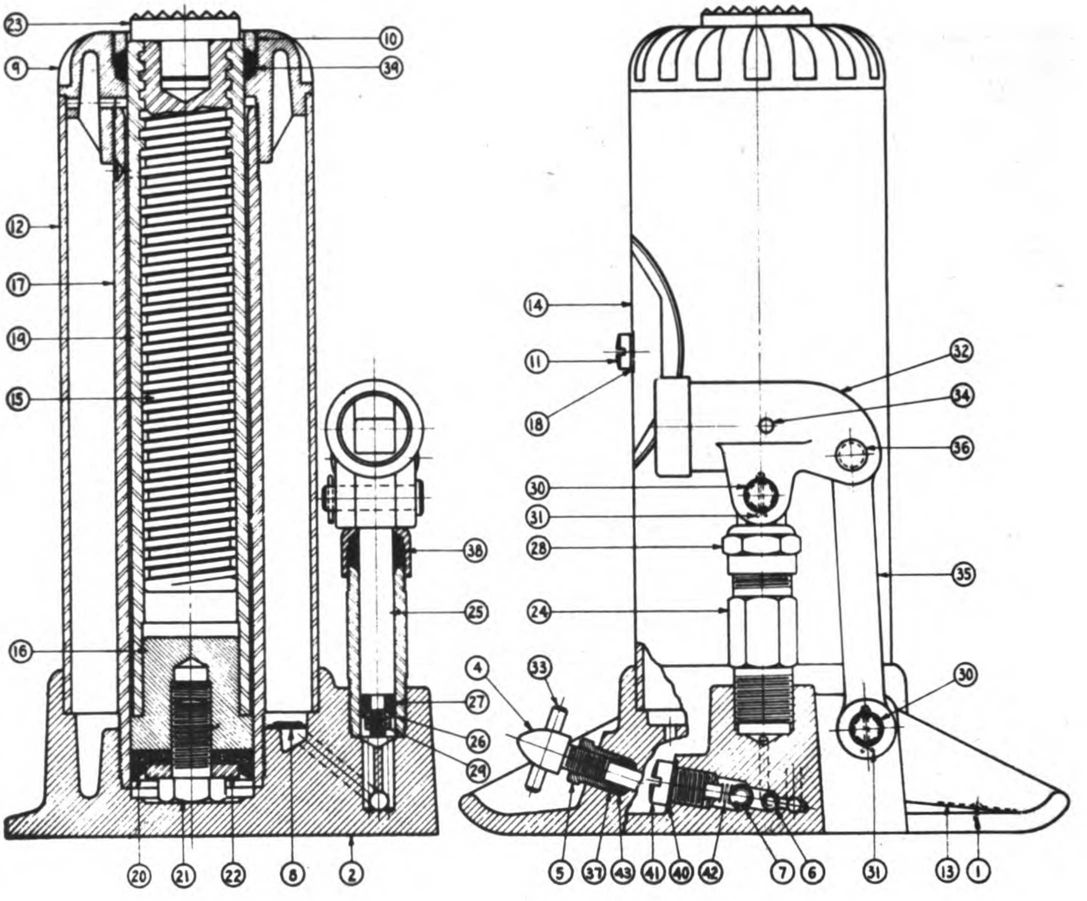


FIGURE 309

HYDRAULIC JACK PARTS LIST

Specification:

Blackhawk Model #CB10.5-C Hydraulic Jack

Barber-Greene Specification #HJ-BL-A1

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1	2	1.03	Drive Screw
2	1	CB9.05-2	Base
3	1	1.06-1	Base Plug
4	1	CB9.10	Release Valve Spindle
5	1	CB9.11	Release Valve Packing Nut
6	1	1.16	7/32" Ball
7	1	S1.16	5/16" Ball

HYDRAULIC JACK PARTS LIST - Continued

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
8	1	CB11.18	Oil Strainer Screen
9	1	CB9.20	Top Cap
10	1	CA11.21	Gland Nut
11	1	C9.22	Filler Plug
12	1	CB10.525-1	Reservoir
13	1	1.26E	Name Plate
15	1	CB10.528	Plunger Adjusting Screw
16	1	CB9.29	Plunger Plug
17	1	CB10.530-1	Cylinder
18	1	C9.37	Filler Plug Gasket
19	1	CB10.540-1	Plunger
20	1	M7.341	Plunger Cup.
21	1	CA11.42	Plunger Cup Retaining Screw
22	1	5.43	Plunger Cup Spreader
23	1	AA10.45	Saddle
24	1	CB9.50	Pump Cylinder
25	1	CB9.51	Pump Plunger
26	1	F11.52	Pump Cup Spreader
27	1	F11.53	Pump Cup
28	1	CB9.54	Pump Gland Nut
29	1	CB9.55	Pump Cup Retaining Nut
30	2	CB9.57	Beam Pin
31	2	1.58	Cotter Pin
32	1	CB9.60	Beam
33	1	S4.61	Release Valve Spindle Pin
34	1	CB9.61	Beam Handle Pin
35	1	CB9.62	Link
36	1	CB9.63	Link Rivet
37	1	1.74	Release Valve Packing
38	2	5.75	Pump Packing
39	2	CA11.76	Plunger Packing
40	1	S1.167B	Valve Plug Gasket
41	1	CB9.185	Valve Plug
42	1	S1.183	Outlet Valve Spring
43	1	CB9.335	Release Valve Packing Washer
	1	No. 2-1	Jack Handle (two-piece 34" long)
	1		Blackhawk Hydraulic Oil #71 24 Cu. In. (about 7/8 pint)
			Assemblies
	1	CB10.540C	Plunger Assembly Only (Items 15, 16, 19, and 23)
	1	CB10.540D	Plunger Assembly Complete (Items 15, 16, 19, 20, 21, 22, 23)

NOTE: When ordering parts give Model, Serial, and Specification Numbers.

FUEL PUMP

Description:

Model - EGX2 Viking Fuel Pump

Size - 1" Special

Type - All Iron

Capacity - Up to 325 gallons per hour at 1300 R.P.M.

Rotation - Clockwise facing drive end

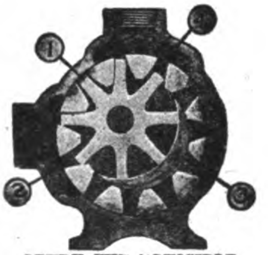


FIGURE 310

Principle of Operation:

With every revolution of the pump shaft a definite amount of liquid is drawn into the pump, filling the spaces between the teeth in the idler and rotor as they pass the inlet port. The liquid is forced out of these spaces into the outlet or discharge port by the meshing of the teeth at a point midway between the two ports.

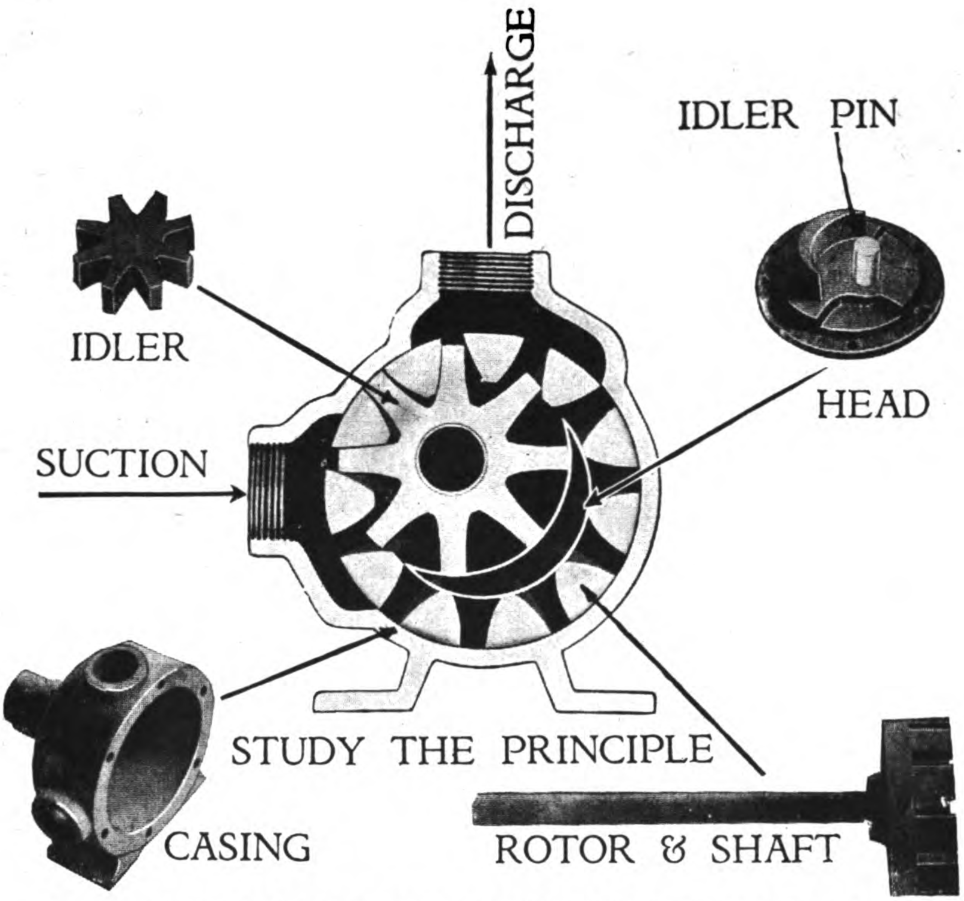
The amount pumped per minute varies in proportion to the revolutions per minute of the pump.

Refer to the accompanying illustration.

Rotor and idler mesh at position 1 forming a complete barrier between ports. At position 2 the idler is drawing away from the rotor, creating a suction and an opening which is filled with the liquid being pumped. At position 3 the spaces between the rotor and idler teeth are filled and are carrying their load around to position 4 where the idler teeth mesh again, forcing the liquid out the discharge port.

Construction:

The Viking Pump is fitted with all iron parts with the exception of the bushings and packing gland which are furnished in bronze and the rotor shaft and idler pin which are furnished in steel.



Above are illustrated the major parts of the Viking Pump—casing, head, rotor and idler, separately and assembled. Imagine the rotor and idler in motion operating in a counterclockwise direction. Follow the course of the liquid from point of suction to point of discharge.

FIGURE 311

Operation and Maintenance:

The simple two moving parts, "Gear within a gear", will give dependable service if clean liquids are used to eliminate excessive wear on the close fitting parts. All fittings on suction side of pump should be tight, so that full suction can be maintained.

In normal operation the pump requires the following attention:

(1) Keep grease cups filled (see lubrication chart).

(2) If packing gland #5 leaks turn gland nut (4) one-quarter turn at a time to stop leak. If taken up more than necessary, the shaft will heat, causing a scored shaft. A small drip is not objectionable.

(3) If new packing is required proceed as follows: Remove gland nut (4) and slide gland #5 out from packing box. Make a ring of packing by wrapping a length of packing around shaft and cut ends to meet. Insert one or more of these rings, as required, and replace gland and adjust as described above.

(4) If pump is removed and reinstalled, make sure that pump is properly aligned. After installation, the pump shaft should turn freely after bearing is pulled down tight.

Before putting pump in operation, remove head (3) and with feeler gauge check clearance of .018" to .020" all around between rotor and casing. This is the only assurance that shaft is properly aligned. When replacing head, be sure to use a factory replacement gasket to insure correct clearance between rotor and head.

Disassembly:

Remove cap screws (23) and take off head (3) which has idler pin (6) held in place. Idler with bushing (2) slides on pin (6). Remove gland nut (4) and gland (5). Rotor and shaft (11) can now be removed.

Rotor and shaft (11) may be pulled out of the case.

Unsatisfactory Pump Operation:

Should the transfer pump fail to operate satisfactorily, check for the following possible causes:

(1) Air Leak in Suction Line - make sure all fittings in suction line are tight and not pulling air into the line.

(2) Cold Spot in Line - too great a length of suction line unjacketed, allowing the bitumen to "freeze" in the line at that point. A cold spot can be detected by feeling the temperature of the pipe at various stations beginning at the storage tank and working toward the pump. If the line is warm or hot, the bitumen is flowing at that point. If the line is cold at any point there is a possibility that the bitumen at that point is sufficiently stiff to prevent proper flow. Heat cold sections by discharging live steam around the "cold spot" or by heating with some type of torch.

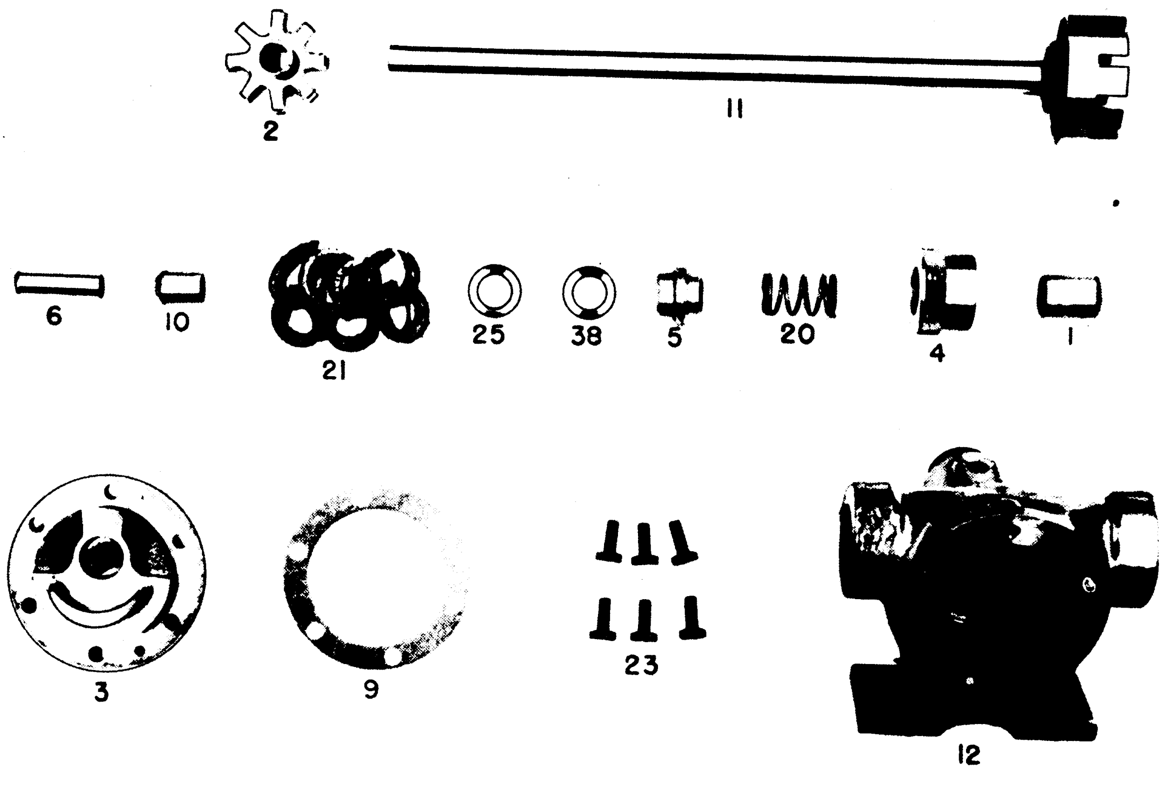


FIGURE 312

(3) Pump Needs Priming - to prime pump, screw the male end of a one-half inch street elbow into the bitumen drain cock, and screw a piece of one-half inch pipe approximately one foot long into the female end of the street elbow. Turn the pipe so it extends downward. With pump running, take a pail full of bitumen and bring it into a position so the pipe is immersed in the bitumen. Then open cock. The suction created will pull bitumen out of the pail and cause a sufficient prime. Close cock before bitumen in the pail lowers sufficiently to allow air to be pulled into the priming pipe.

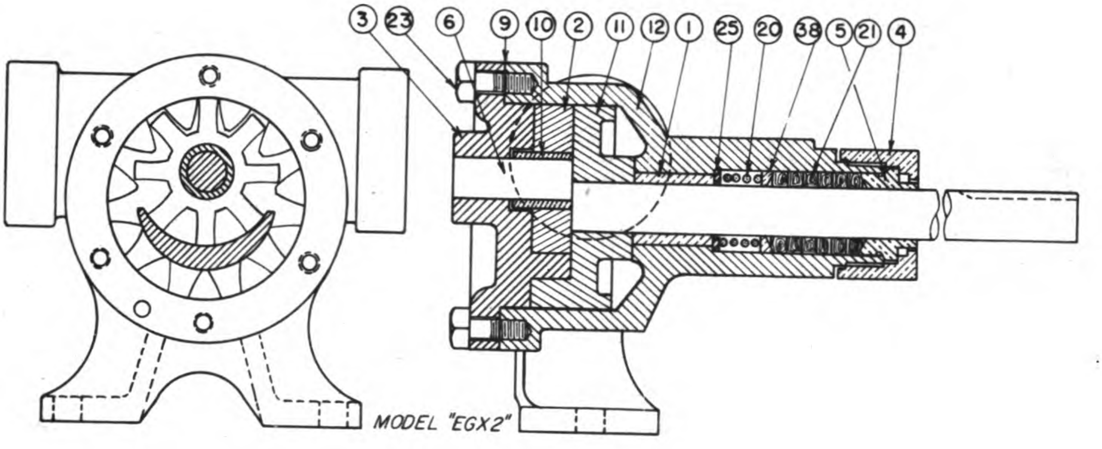


FIGURE 313

FUEL PUMP PARTS LIST

Specification:

Model EGX2 - 1" Viking Fuel Pump

Barber-Greene Specification #PU-VK-B

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1	1	PU-VK-B-1	Casing Bushing
2	1	PU-VK-B-2	Idler
3	1	PU-VK-B-3	Head
4	1	PU-VK-B-4	Packing Gland Nut
5	1	PU-VK-B-5	Packing Gland
6	1	PU-VK-B-6	Idler Pin
9	1	PU-VK-B-9	Head Gasket
10	1	PU-VK-B-10	Idler bushing
11	1	PU-VK-B-11	Rotor & Shaft
12	1	PU-VK-B-12	Casing
20	1	PU-VK-B-20	Packing Spring
21	1	PU-VK-B-21	Packing (Set of Seven)
23	6	PU-VK-B-23	1/4" x 1" Hex Head Cap Screws
25	1	PU-VK-B-25	Spring Thrust Washer
37	1	PU-VK-B-37	Grease Cup
38	1	PU-VK-B-38	Gland Ring

NOTE: When ordering parts give Model and Specification Number.

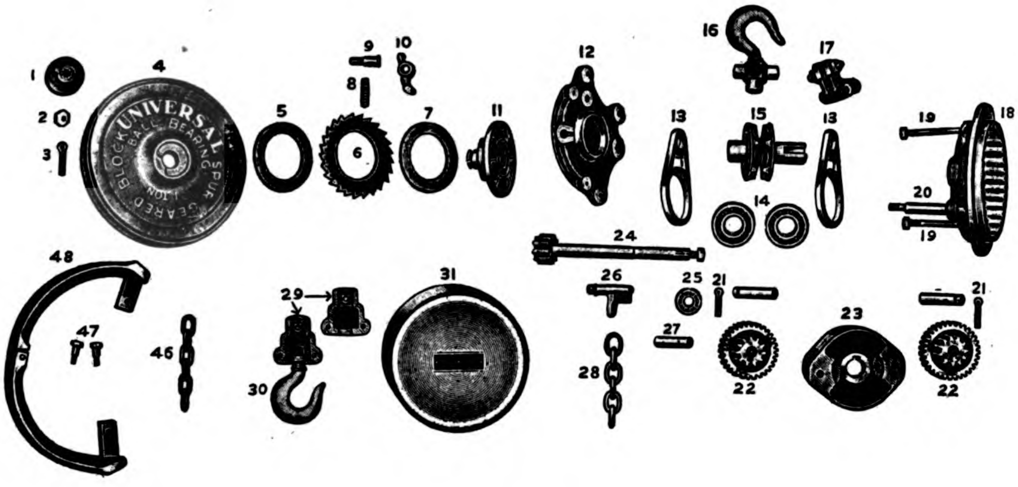


FIGURE 314

CHAIN HOIST

Description

McCollum 1 Ton Chain Hoist

CHAIN HOIST PARTS LIST

Specification:

McCollum 1 Ton Chain Hoist

Barber-Greene Specification #HT-PD-B1

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1	1	930	Check Washer
2	1	HT-PD-B1-2	Driving Pinion Nut
3	1	HT-PD-B1-3	Driving Pinion Cotter
4	1	931	Hand Wheel
5	1	934	Steel Brake Disc
6	1	935	Ratchet Disc
7	1	936	Moulded Brake Disc
8	1	937	Pawl Spring
9	1	939	Pawl Stud
10	1	938	Pawl
11	1	940	Disc Hub
12	1	941	Ratchet Case
13	2	942	Suspension Plate
14	2	HT-PD-B1-14	Load Shaft Ball Bearing
15	1	944	Load Sheave & Shaft
16	1	943	Top Hook Assembly
17	1	946	Load Chain Guide
18	1	950	Internal Gear
19	2	948	Small Separator Bolt
20	1	947	Large Separator Bolt

CHAIN HOIST PARTS LIST - Continued

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
21	2	953	Pinion Pin & Cotter
22	2	952	Gear & Pinion
23	1	951	Pinion Cage
24	1	954	Driving Pinion
25	1	HT-PD-B1-25	Driving Shaft Ball Bearing
26	1	945	Stripper
27	1	HT-PD-B1-27	Spreader Bolt Sleeve
28	1	HT-PD-B1-28	Load Chain
29	1	956	Lower Hook Swivel
30	1	HT-PD-B1-30	Lower Hook
31	1	HT-PD-B1-31	Gear Cover
46	1	HT-PD-B1-46	Hand Chain
47	2	HT-PD-B1-47	Hand Chain Guide Bolts
48	1	932	Hand Chain Guide

Note: When ordering parts give size and specification number.

HYDRAULIC RAM

Description:

Blackhawk Model #R-340 Hydraulic Ram

Operation:

This ram is used in conjunction with a separate power hydraulic pump.

Oil entering the ram by means of the oil line will cause plunger (5), to extend. Oil is sealed by cup, (6), and cylinder, (4).

When the release valve on the pump or the operating control valve on the power unit is opened, the load on the ram plunger, (5), forces the oil out through the passage in the ram base, (2), causing the ram to lower.

Maintenance:

When the ram begins to wear to such a degree that the load cannot be maintained, oil will appear around plunger (5), and will escape to the outside. When this occurs it is necessary to install a new plunger cup, (6). Place ram base, (2), into a vise or some other holding fixture and use a Parmalee wrench placed around the cylinder, (4), loosen the cylinder from the base. Force the plunger, (5), out of the cylinder, (4), so that the cup, protrudes from the end of the cylinder. Then place the end of the plunger, (5), into a vise or holding fixture, remove spreader, (7), and then the cup, (6), and the leather washer, (11). Install new cups and re-assemble pulling spreader, (7) up quite snug but be sure that when this is done the plunger is pushed into the cylinder, (4), so that the cylinder keeps the cup, (6), from distorting. Punch-mark the threads on the end of the plunger, (5), so as to keep the spreader, (7), from loosening up. Reassemble into base, (2).

Plunger, (5), is hard chrome plated so foreign material will not be carried back into the ram. Inspection should be made of the ram cylinder, (4), to be sure that the inside is not corroded as each time the cup, (6), passes a scratch, a corrosion mark or a bad mark in the cylinder it will begin to cut and thus result in leakage. Therefore, a new cup installed in a bad cylinder will result in leakage after a few applications of pressure. In such cases install a new cylinder.

Always use Blackhawk oil No. 71. WARNING: Hydraulic brake or shock absorber fluid, alcohol, glycerine, castor oil, will ruin cups because such fluids dissolve sizing which seals the pores in cup leathers and corrode valve seats and cylinder wall. Use of these fluids waives guarantee.

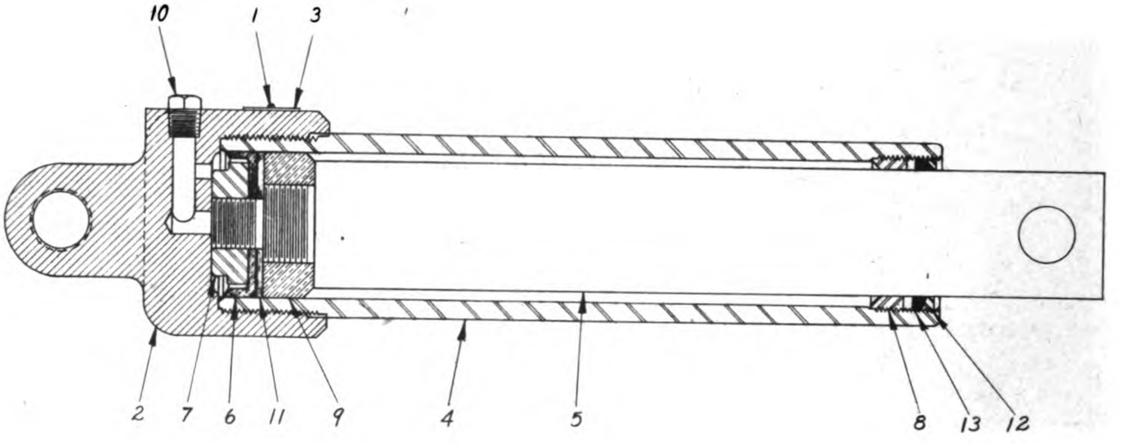


FIGURE 315

HYDRAULIC RAM PARTS LIST

Specification:

Model #R-340 Blackhawk Hydraulic Ram

Barber-Greene Specification #HR-BL-A6

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
2	1	R340.05	Base
4	1	R340.30	Cylinder
5	1	R340.40	Plunger
6	1	EA11.41	200 degrees Plunger Cup
7	1	EA11.43	Spreader
8	1	R294.44	Plunger Stop Ring
9	1	R294.71	Disc
10	2	BM1.245	Pipe Plug
11	1	R294.317	Leather Washer
12	1	R294.21	Gland Nut
13	2	EA11.76	Packing

NOTE: When ordering parts give both Model and Specification Numbers.

HYDRAULIC POWER PACKER

Description:

Blackhawk #P-156 Power Packer

Operation:

This pump is used in conjunction with a separate hydraulic ram for raising or shifting a load. They are connected together by means of either high pressure flexible hose, copper tubing, steel pipe or some other means which will withstand a working pressure of at lease 5,000 pounds per square inch.

To raise the load, turn release valve, (8), until the valve seats and then with forward and backward strokes on the pump handle, (35) and (15), oil will then be forced into the oil line extending the ram and raising the load. To lower, open release valve, (8); and the speed of lowering will depend upon the amount the release valve is open.

The pump functions as follows: When the pump handle, (15), is moved forward or backward the pump plunger,(14), causes oil in the reservoir to be forced by check ball, (9) filling the pump cylinder with oil. On the opposite stroke of the pump handle (15), oil is forced into the oil channel causing check ball, (9), to close and check ball, (10) to open. Oil passing through check ball, (10), passes directly into the oil line which, in turn, raises the load. Inasmuch as the pump is a double piston pump this action occurs both on the forward and backward stroke of the handle. In lowering, release valve, (8), is opened, allowing oil, forced under pressure by load on ram, back into the reservoir, (2).

Maintenance:

If the setup does not raise the load, either the ram is leaking or the check ball, (10), is not seating.

If the leakage is due to the check ball (10), not seating, remove valve plug, (25), spring (24), and finally, the ball, (10). Use a magnet to clean out any chips that might be on the valve seat, replace check ball (10), and tap lightly with a small hammer and brass rod. Reassemble valve plug. It must be remembered that in this twin pump there will be two seats of valves that must be cleaned and re-set as either one will cause the load to lower.

In some instances air will get into the line and sometimes will get into the oil passages in the pump causing the pump to function only on one side. To expel this air, open release valve, (8), and give the pump handle, (15), a few quick strokes which will expel this air from the oil passages back into the oil reservoir, (2), where it will no longer be harmful.

Repair of P-156 Pump

Always use Blackhawk oil No. 71. WARNING: Hydraulic break or shock absorber fluid, alcohol, glycerine, castor oil, will ruin cups because such fluids dissolve sizing which seals the pores in cup leathers and corrode valve seats and cylinder wall. Use of these fluids waives guarantee. SAE 10 or 10-W may be used as a substitute.

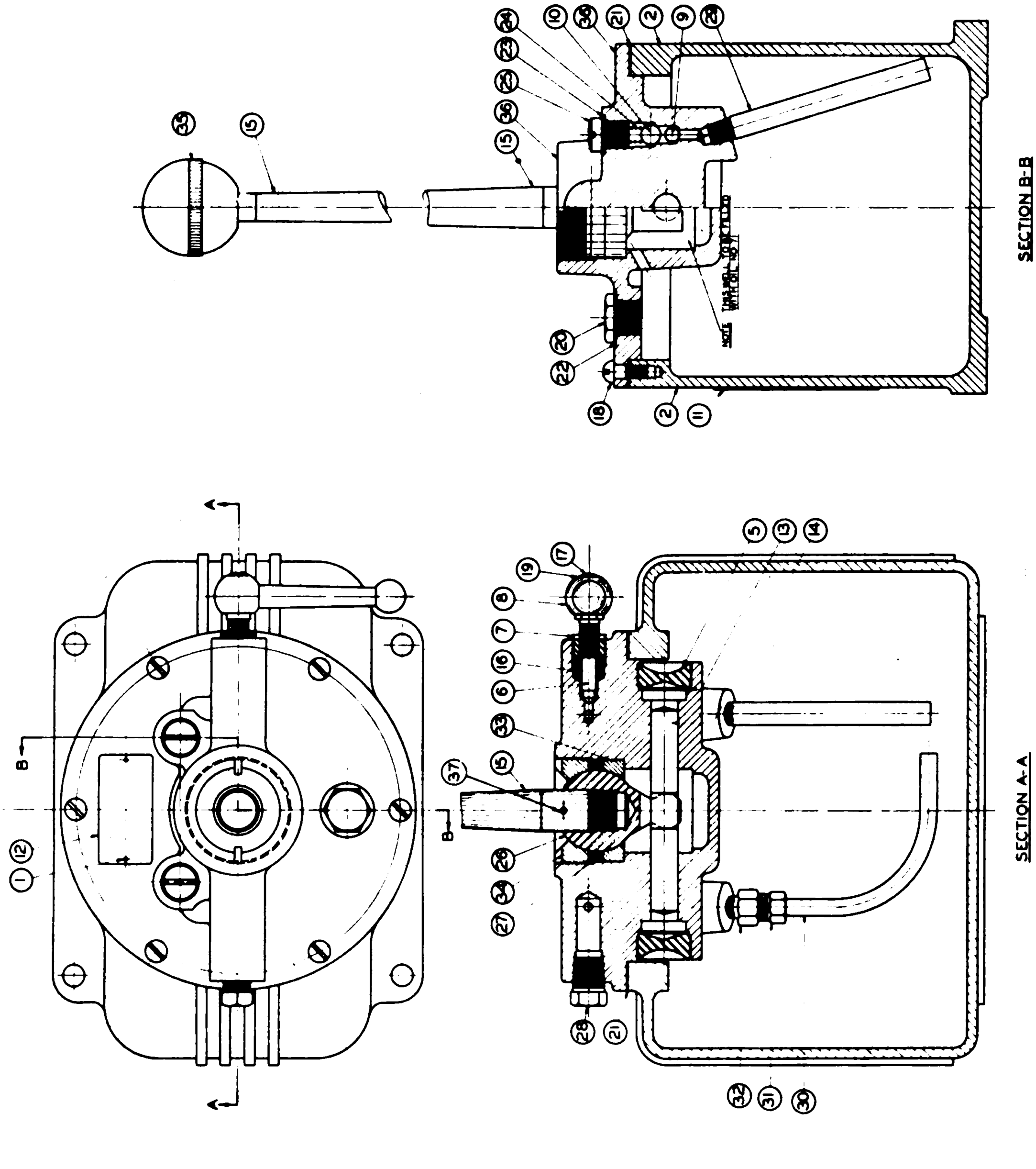


FIGURE 316

HYDRAULIC POWER PACKER PARTS LIST

Specification:

Model # P-156 Blackhawk Hydraulic Power Packer

Barber-Greene Specification #HP-BL-B2

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1	2	1.03	Drive Screw
2	1	P156.05	Base
3	1	1.06	Base Plug
4	2	1.06-1	Base Plug
5	2	P60.06	Plug
6	1	P60.10	Release Valve Spindle
7	1	P60.11	Release Valve Packing Nut
8	1	P60.12	Release Valve Lever
9	2	E14.16	Ball
10	2	W12.16	Ball
11	1	P60.26	Transfer
12	1	P61.26	Name Plate
13	2	P60.37	Gasket
14	1	P63.51-1	Pump Plunger
15	1	*P156.70	Pump Handle
16	4	D11.74	Release Valve Packing
17	1	P45.138	Release Valve Lever Screw
18	6	S3.138	Base Screw
19	1	P45.139	Release Valve Lever Lock Washer
20	1	P60.24	Air Vent Plug
21	1	P60.161	Base Gasket
22	1	S1.167	Filler Plug Gasket
23	2	S15.167	Valve Plug Gasket
24	2	S1.183	Outlet Valve Spring
25	2	W12.185	Valve Plug
26	1	*P101.234	Rocker Arm
27	1	P60.236	Rocker Arm Packing
28	1	BM1.245	Special Pipe Plug
29	1	P60.268	Oil Tube
30	1	P63.268	Oil Tube
31	1	X1-269	Inverted Flared Tube Nut
32	1	X30.270	Inverted Male Connector
33	1	P60.306	Rocker Arm Seat
34	1	P60.307	Rocker Arm Cap
35	1	*P60.308	Pump Handle Knob
36	1	P63.264-1	Valve Head
37	1	*P111.61	Beam Handle Pin
39	1	W154.245	Pipe Plug
40	1		Instruction Sheet
41	2 Qt.		Blackhawk Hydraulic Winter Oil No. 71, 115 Cu.In.
	1	P156.70-A	Rocker Arm Lever Assembly

NOTE: When ordering parts give Model and Specification Numbers.

* Part of assembled unit P156.70-A rocker arm lever assembly.

FOUNDATION BRAKES (one pair) 17-1/4" x 5" TIMKEN DETROIT AXLE CO.

Barber-Greene Specification #BK-T-A1

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
**1	1	2210-S-1293	Cam Shaft
* 1	1	2210-T-1294	Cam Shaft
**2	1	A1-3211-Z-546	Brake Spider Assembly for Operator's Side
**2	1	A1-3211-A547	Brake Spider Assembly for Opposite Operator's Side
3	4	A2-3222-V-282	Brake Shoe Assembly
3b	4	2240-B-496	Brake Lining for #3
3c	64	X-1838	Rivet for #3
4	2	A-1229-J-166	Washer Assembly
	2	10X39	Flat Head Cap Screw for #4
	4	1229-R-122	Washer for #4
5	4	1259-B-28	Pin
6	2	X-652	Plug
7	2	1229-D-108	Lock
	2	X-702	5/16" x 7/8" Hex Head Cap Screw for #7
	2	X-528	5/16" Lock Washer for #7
8	2	2258-T-124	Spring
9	2	X-1402	Elbow

* Camshafts to fit Bendix Westinghouse type "K" Slack Adjuster, 18¼" from center line of brake shoe to center line of slack adjuster.

** Refer to numbers cast or stamped on old part when ordering.

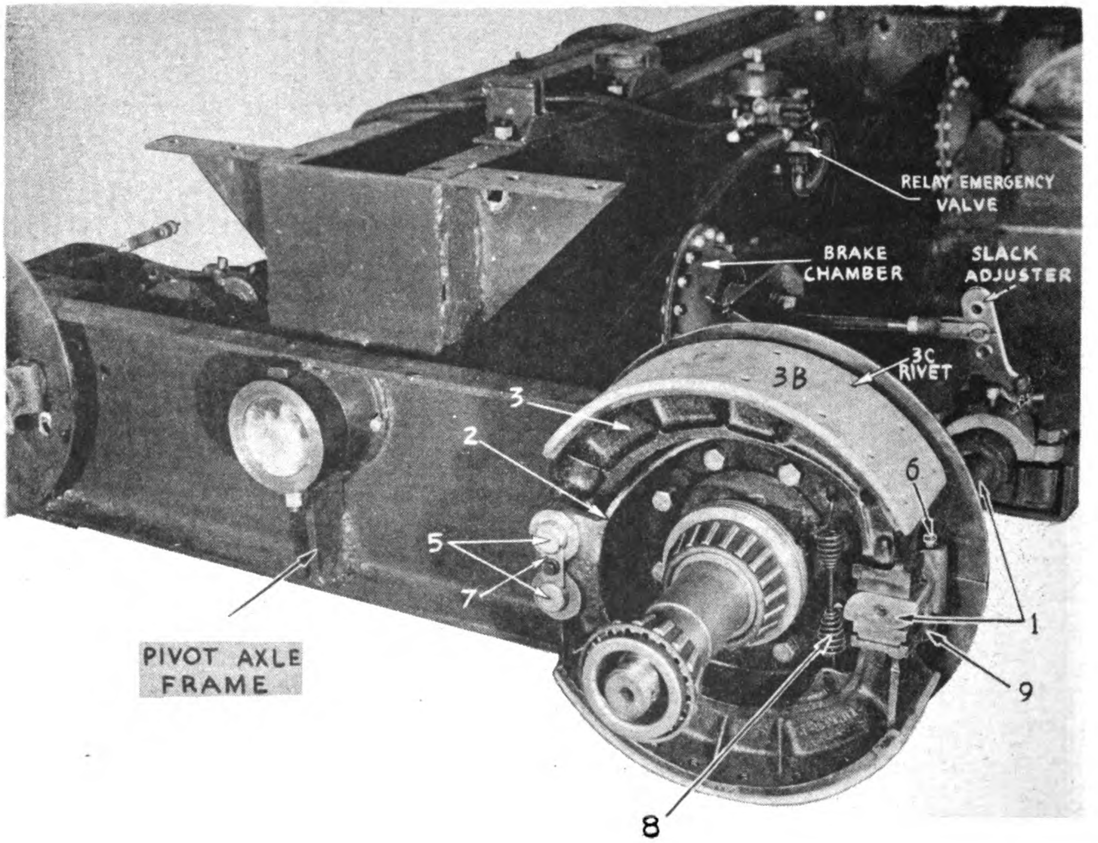


FIGURE 317

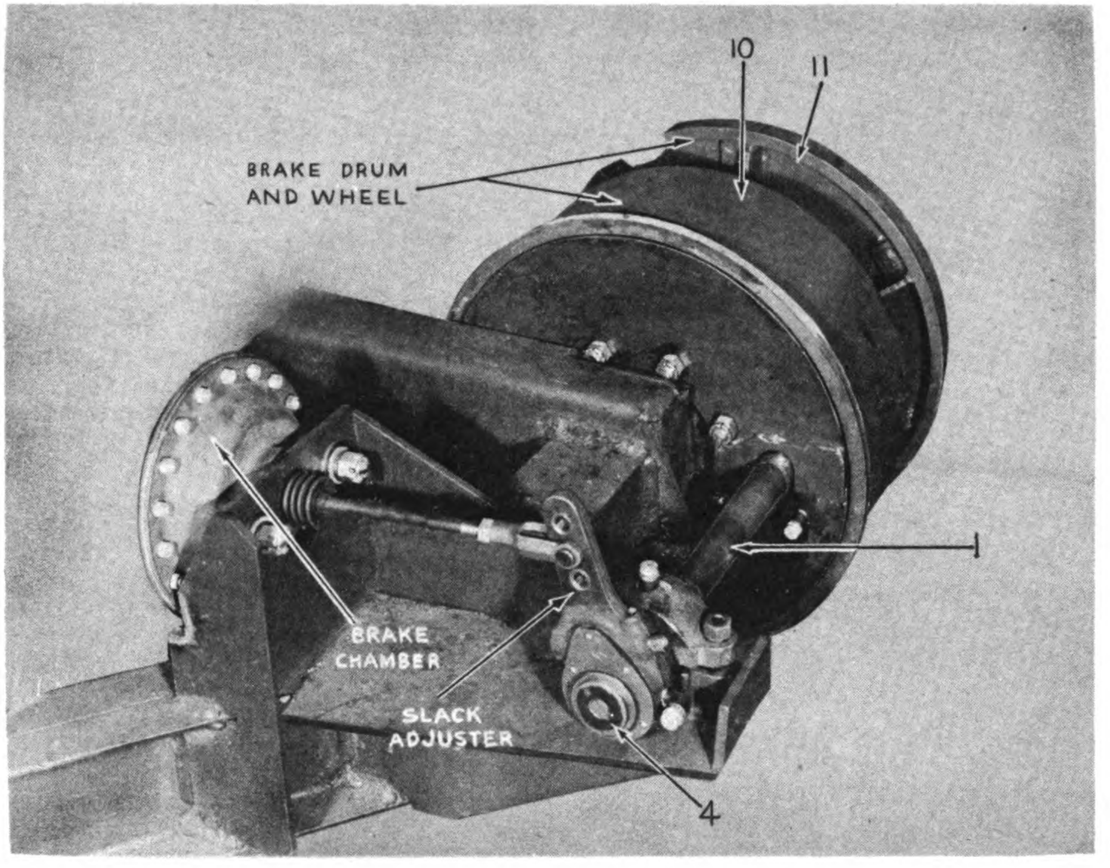


FIGURE 318

REAR WHEEL (ONE WHEEL) ELECTRIC WHEEL CO.

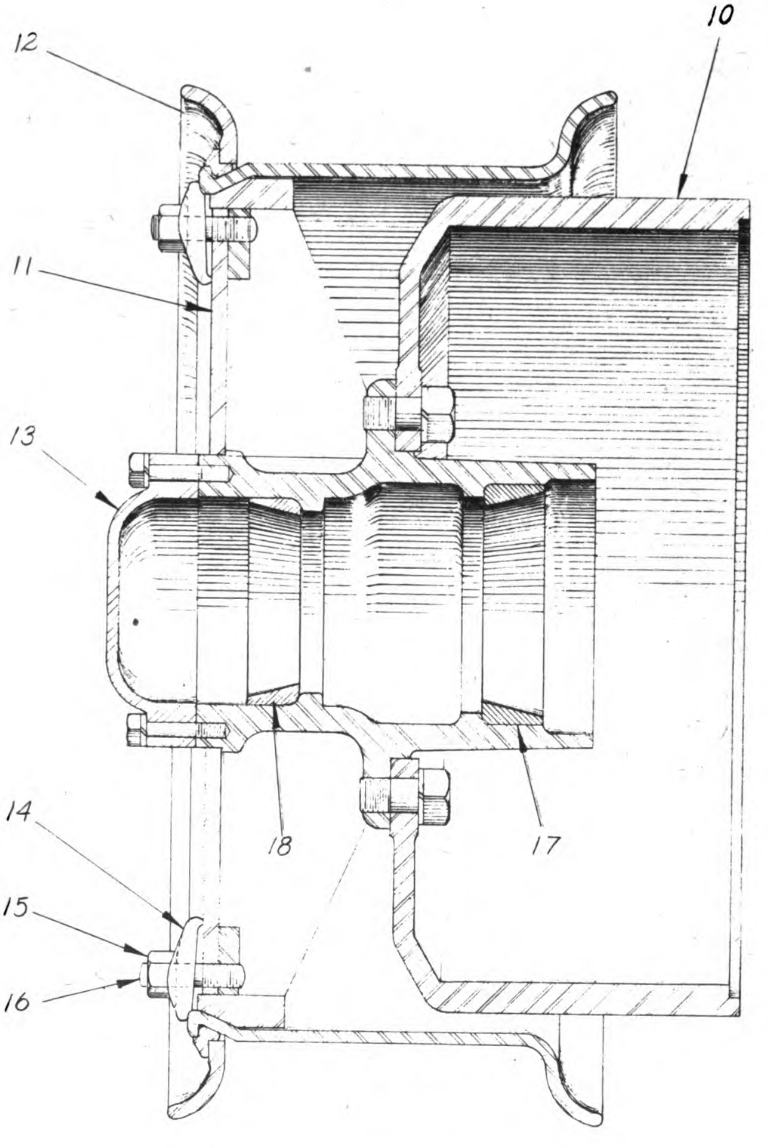


FIGURE 319

Barber-Greene Specification #WH-E-J3

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
10	1	G-3203	Brake Drum for 17-1/4" x 5" Brake
	4		3/8" x 1-3/4" Cap Screw
	6		3/4" x 1-1/4" Cap Screw
11	1	Q-328W	20" Electric Wheel
12	1	7.33V	20" - 9.10-K-28 Rim with Clincher Ring
13	1	L-560	Hub Cap
14	6	301	Rim Clamp (Goodyear)
15	6	65	Nut (Goodyear)
16	6	69	Stud (Goodyear)
17	1	5720	Timken Bearing (Cup only)
18	1	5520	Timken Bearing (Cup only)

BRAKE CHAMBER AND SLACK ADJUSTER

Specifications

Brake Chamber - Bendix-Westinghouse. Stud Type "B"

Slack Adjuster - Bendix-Westinghouse. Type "K"

Principle and Operation - Brake Chamber

The function of the brake Chamber is to convert the energy of compressed air into the mechanical force necessary to expand the brake shoes out against the brake drums. In this operation the push rod moves the slack adjuster toward position C (Figure 443) - applying the brakes - as the driver depresses the brake pedal, then moves the slack adjuster back to the regular position - releasing the brakes - as the driver releases the brake pedal.

The Brake Chamber consists of two dished metal plates, namely: the nonppressure plate and the pressure plate, separated by a diaphragm made of oil-proof rubber and fabric. In front of the diaphragm are the non-pressure plate, push rod 2 and push rod spring 1. Behind the diaphragm is airtight cavity A, into which is connected a tubing line from the relay emergency valve. When the Brake Chamber is installed, the yoke is connected directly to the slack adjuster lever arm.

As shown spring 1 holds the push rod plate against the diaphragm so that any movement of the diaphragm is immediately transferred to the push rod. Consequently, as air pressure from the relay emergency valve is admitted into cavity A, it forces the diaphragm and push rod forward, moving the slack adjuster toward position C, applying the brakes. When the air pressure is released from cavity A through the relay emergency valve, the diaphragm and push rod return to their normal positions, pulling the slack adjuster back to position B, releasing the brakes.

Due to the extreme sensitivity of the diaphragm, this arrangement permits push rod 2 to respond to the slightest variation of air pressure from the brake valve, and relay emergency valve, thus permitting the driver to apply or release the brake as rapidly or as gradually as the various road and operating conditions warrant.

BRAKE CHAMBER - Continued

OPERATION

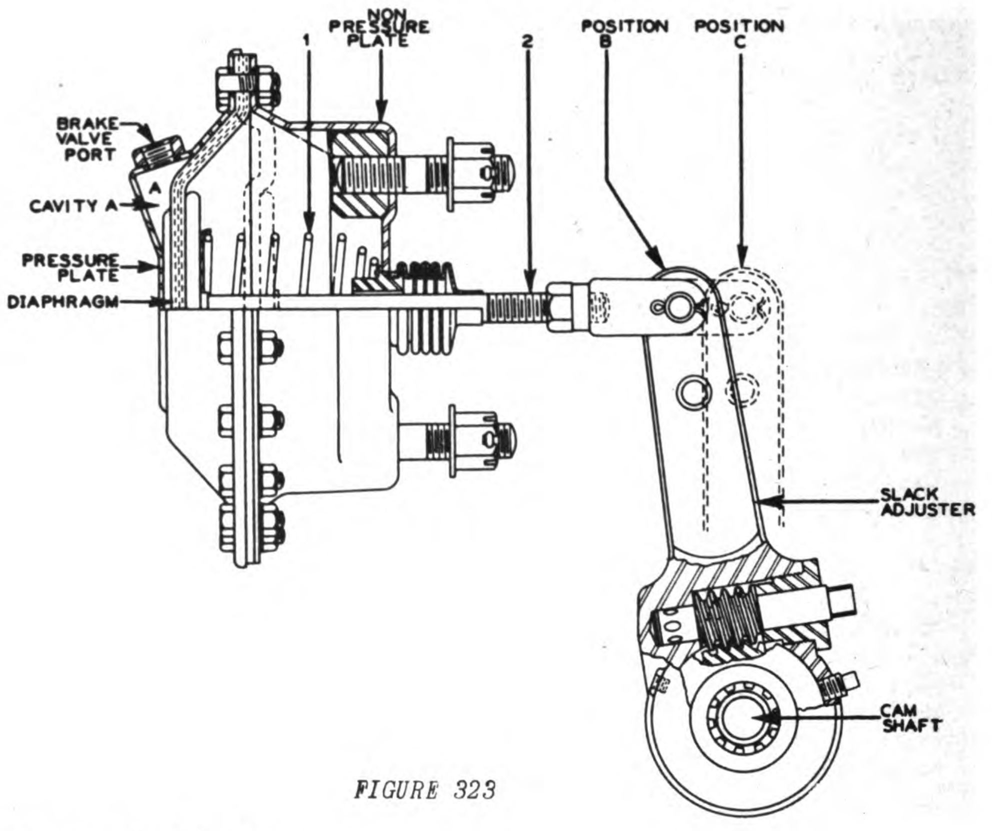


FIGURE 323

Maintenance - Brake Chamber

The following test should be made for leakage:

(1) With soap suds coat around the edges of the diaphragm and around bolt holes. No leakage is permissible. In case of leakage tighten bolts uniformly until leakage is eliminated. Do not make the bolts so tight that diaphragm is distorted.

(2) Check push rod travel by measuring the push rod with brakes released and then with brakes applied. If push rod travel is in excess of or is near to the maximum stroke of 1-3/4" adjust the brakes as per instructions under Slack Adjuster. It is essential to keep the diaphragm travel as short as possible inasmuch as excessive travel shortens the diaphragm's service life.

Only two parts of the Brake Chamber require any service. These parts are the diaphragm and the boot. The diaphragm should be replaced at least once each year, more often in hard service. The boot should be removed whenever it shows signs of cracking or breaking.

Principle and Operation - Slack Adjuster

The Slack Adjuster not only serves as a regular brake lever during normal brake applications but also provides a quick method of brake adjustment.

The Slack Adjuster spline is mounted firmly on the spline of the cam shaft and held by positive means. The brake chamber yoke is mounted to one of the holes in the lever arm.

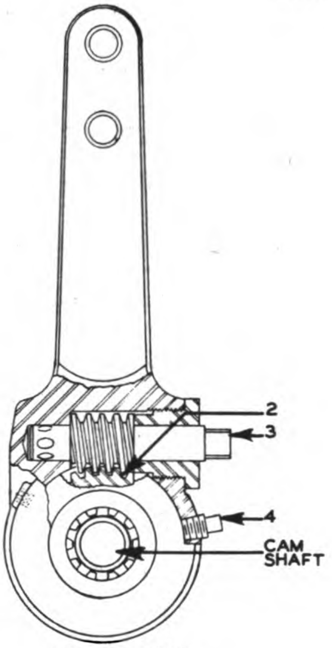


FIGURE 320

In normal braking the entire Slack Adjuster is held rigid as a unit and rotates bodily with the cam shaft as the brakes are applied or released.

The most efficient brake action obviously will be obtained when the Slack Adjuster arm travel is held to a minimum so that full length of the lever is used. The brake adjustments necessary to maintain proper Slack Adjuster arm travel are made by turning adjusting worm 3. This rotates worm gear 2 together with cam shaft and cam, expanding the brake shoes so that the slack caused by brake lining wear is taken up and the Slack Adjuster arm travel is returned to the minimum setting. These brake adjustments usually average less then 5 minutes to wheel.

Adjustment of Slack Adjuster

The Slack Adjuster enables the mechanic to make a complete and perfect adjustment of the brakes as the vehicle stands on the highway or the service floor. A regular open-end or adjustable wrench is the only tool required to complete the operation. This permits a substantial saving of time and labor.

The following steps are suggested in brake adjustments:

(1) Build up the reservoir pressure to at least 80 pounds and maintain at least 60 pounds while brakes are being adjusted.

(2) For first adjustment on a new unit it is suggested that you jack up each wheel and turn worm 3, which rotates the cam shaft, until the brake shoes are tight against the drum.

(3) Back off on the worm until the wheel is free and check to see that there is between .008 inch and .010 clearance at the toe end of the shoe. Apply the brakes; note and record brake chamber push rod travel. This information should be used on all future adjustments.

(4) The push rod travel should be the same for both brake chambers on the axle. Adjust to 3/4" minimum push rod travel. Brakes must be adjusted if travel exceeds 1-3/4 inches.

(5) The brakes should be adjusted every 1000 miles and checked more often in very severe service. This check may be made by applying the brakes and measuring the brake chamber push rod travel. If this is more than it was on the original adjustment, the brakes should be readjusted by turning the worm, decreasing this travel to the point where it was on the original adjustment.

Operators find several advantages in keeping push rod travel down to a minimum.

(1) Short travel greatly increases the life of the brake chamber diaphragm.

(2) The air consumption with the short push rod travel is greatly reduced.

(3) Brake performance is greatly improved.

Maintenance of Slack Adjuster

The body, worm gear and worm of the Slack Adjuster are made of heat-treated steel and are capable of meeting the most severe tests with a minimum of maintenance service.

Worm gear and worm should be kept well lubricated. This can be done by removing plug and filling the cavity with a good grade of chassis lubricant each time the vehicle is inspected.

The replaceable bronze bushings fitted into the holes in the Slack Adjuster arm should be inspected at each major vehicle inspection and replaced if necessary.

BRAKE CHAMBER --BENDIX-WESTINGHOUSE #216619 STUD TYPE "B"

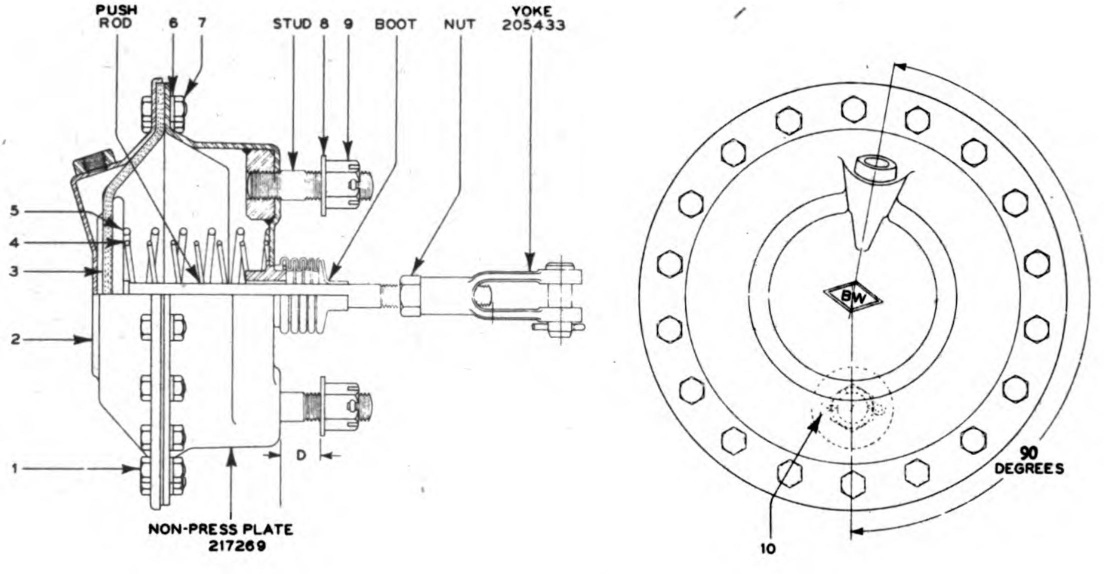


FIGURE 321
From Barber-Greene Specification #BK-BE-C!

REF. NO.	NO.REQ.	PART NO.	DESCRIPTION
		217269	Non-pressure Plate
	1	205433	Yoke
		216623	Push Rod
	2	202672	Stud
	1	201687	Boot
	1	203575	Nut
1	18	203151	Hex Head Bolt
2	1	202880	Pressure Plate
3	1	200001	Diaphragm
4	1	212294	Inner Spring
5	1	212295	Outer Spring
6	18	201318	Lock Washer
7	18	203145	Hex Nut
8	2	203173	Lock Washer
9	2	203172	Hex Nut
10	2	203156	Cotter Pin

SLACK ADJUSTER BENDIX WESTINGHOUSE #220269 TYPE K

Barber-Greene Specification #BK-BE-CI

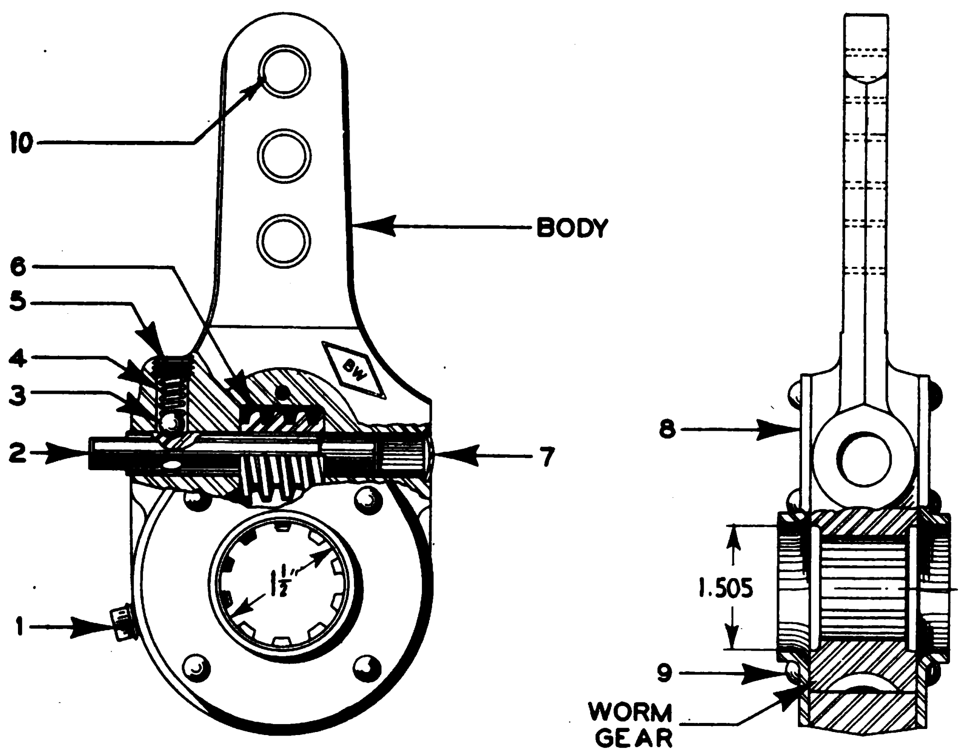


FIGURE 322

From Barber-Greene Specification #BK-BE-CI

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	1	213086	Body
	1	212629	Worm Gear
1.	1	203680	Pipe Plug
2.	1	212630	Worm Shaft
3.	1	201327	Lock Ball
4.	1	212633	Spring
5.	1	201326	Screw Plug
6.	1	212628	Worm
7.	1	212357	Welsh Plug
8.	2	212631	Cover
9.	4	212632	Rivet
10.	3	201225	Bushing

BRAKE FILTER

BENDIX WESTINGHOUSE #221022 TYPE E

FROM BARBER GREENE SPECIFICATION #BK-BE-C1

DESCRIPTION

This unit consists of a body, with intake and outlet ports, a replaceable strainer, and a dust chamber.

MAINTENANCE

Little attention is required other than cleaning of dust chamber and replacement of strainer.

Remove cap screws holding dirt chamber (5) to body (1) to clean dust chamber or replace strainer element (2). Use care not to damage gasket (4).

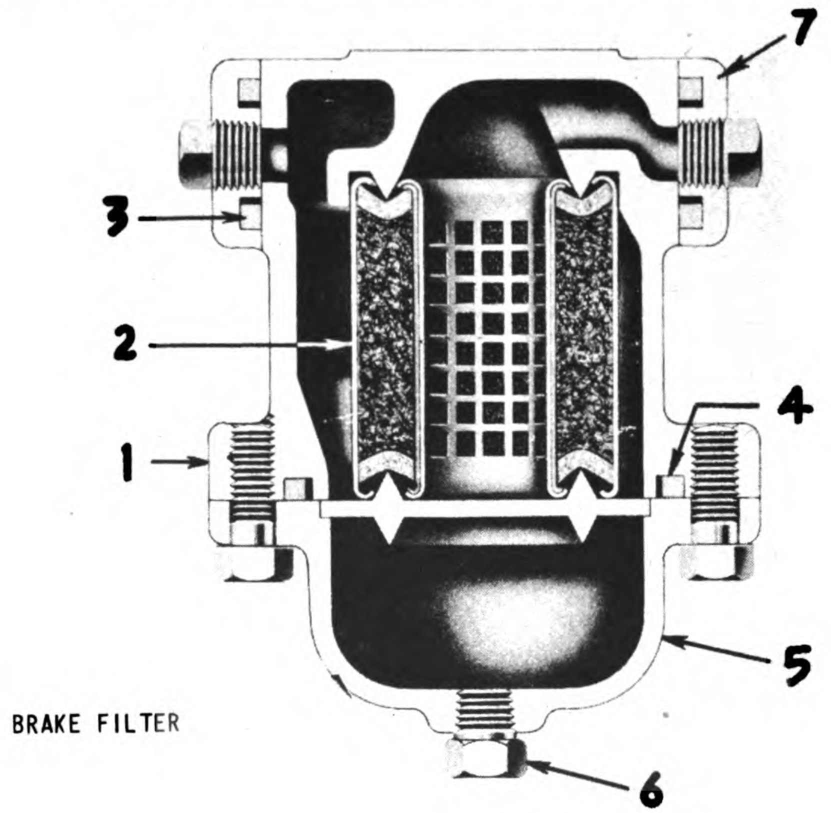


FIGURE 324

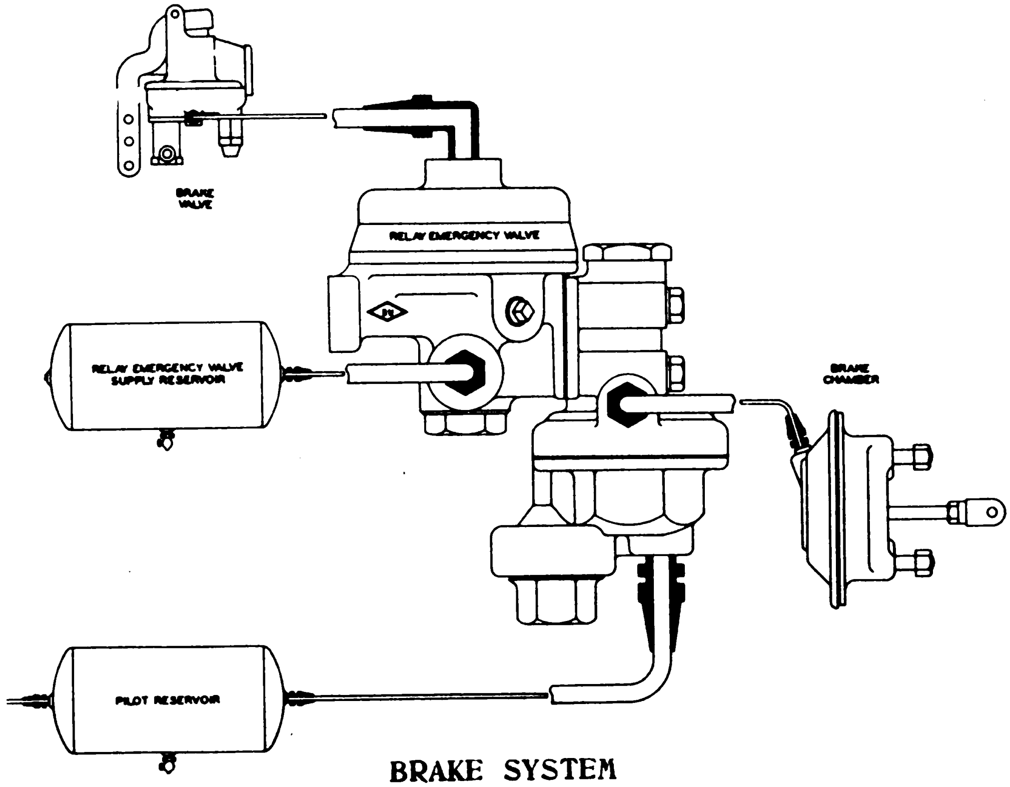
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	214169	Body
2.	1	221053	Strainer
3.	2	214174	Flange Gasket
4.	1	214173	Body Gasket
5.	1	214172	Dirt Chamber
6.	1	213530	Pipe Plug
7.	2	214134	Flange

NOTE:- When ordering parts give Model and Specification Number.

BENDIX WESTINGHOUSE #220353

Barber-Greene Specification "#BK-BE-B1

The Relay-Emergency Valve serves two purposes: It speeds up brake action on the trailer, and it provides a means of applying the brakes automatically in case of trailer breakaway.



BRAKE SYSTEM

FIGURE 325

The correct method of installing tubing or hose lines to the Relay-Emergency Valve is shown in Figure 447. Of the four pipe taps in the relay portion of the Relay-Emergency Valve, one of the lower ports is used for connecting the relay-emergency valve supply reservoir and the other three should be closed with pipe plugs. The exhaust port should never be closed. In shipping, the Relay-Emergency Valve has a pipe plug or thread protector in the exhaust port to prevent dirt getting into the valve while in transit. This plug or thread protector must be removed when the valve is placed in service.

OPERATION

The Relay-Emergency Valve operation falls into two classifications: the normal operation and the emergency operation. The normal operation is actuated by the driver and the regular action of the Air Brake System. The emergency operation is induced by anything (such as trailer breakaway) that would cause a sudden and abnormal drop of air pressure in the pilot reservoir.

The following paragraphs and pictures describe the valve movements necessary to attain each of the various operations illustrated by Figures 448, 449 and 450. Figure 448 shows the valve in the normal or full release position. Figure 449 shows the valve in full application position. Figure 450 shows the valve in full emergency position. By observing these figures in conjunction with the following descriptions, it is possible to obtain a complete picture of the valve's operation.

RELAY EMERGENCY VALVE (Continued)

Normal Position and Building Up of Air Pressure in Supply Reservoir

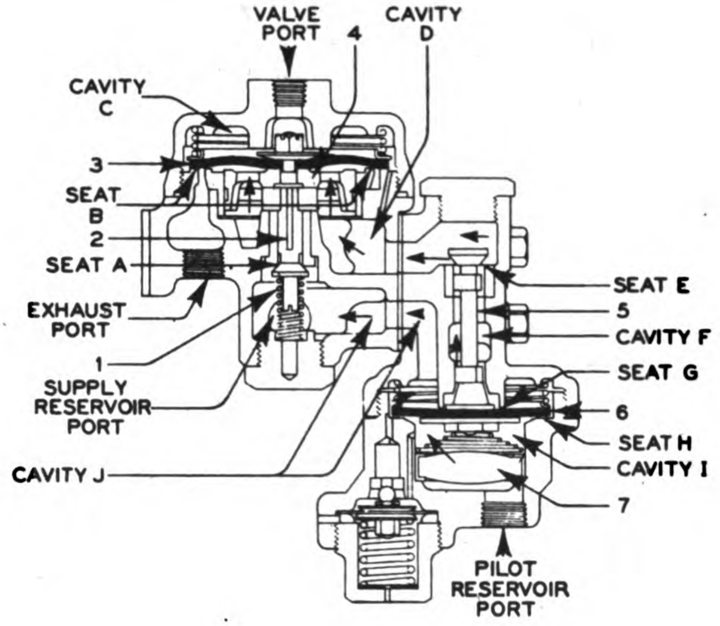


FIGURE 326

The air pressure built up in cavity I by the pilot reservoir holds the edges of diaphragm 6 above seat H, permitting the air pressure from the pilot reservoir and cavity I to pass into cavity J and out through a tubing line to the relay-emergency valve supply reservoir. By this method, full pilot reservoir pressure is constantly maintained in the supply reservoir and cavity J. The air pressure in cavity I also forces the center of diaphragm 6 up against seat G, sealing the lower end of cavity F against the air pressure held in cavity J. As the diaphragm is held sealed against seat G emergency valve 5, connected to the diaphragm, is held up off seat E so that a direct connection is established between cavity D and the brake chambers which are connected into cavity F.

NORMAL APPLICATION

When in regular brake application the driver depresses the brake pedal, the brake valve will deliver air pressure into cavity C where, due to the Relay-Emergency Valve's self-lapping feature, it causes the Relay-Emergency Valve to deliver to the brake chamber the same amount of air pressure applied by the brake valve. The air pressure entering cavity C forces diaphragm 3 down against seat B, closing off the exhaust port. The deflection of the diaphragm 3 also causes diaphragm guide 4, connected to the diaphragm, to contact supply valve 2 and move it away from seat A.

As the supply valve is opened the air pressure which has been restrained in cavity J is permitted to pass up into cavities D and F and out through tubing lines to the brake chambers. Supply valve 2 is held open until the air pressure in the brake chambers and cavity D has been built up to equal the pressure applied above the diaphragm by the brake valve, then the valve automatically laps itself. This means that air pressure in cavity D is strong enough to balance the pressure in cavity C and raise diaphragm 3 and diaphragm guide 4 sufficiently to permit spring 1 to close supply valve 2, but not enough to open the exhaust port. This self-lapped position holding the air pressure in cavity D and brake chambers constant, is maintained until brake valve pressure in cavity C is either increased or decreased. If the brake valve pressure is increased, the performance is repeated until a higher

Relay Emergency Valve (Continued)

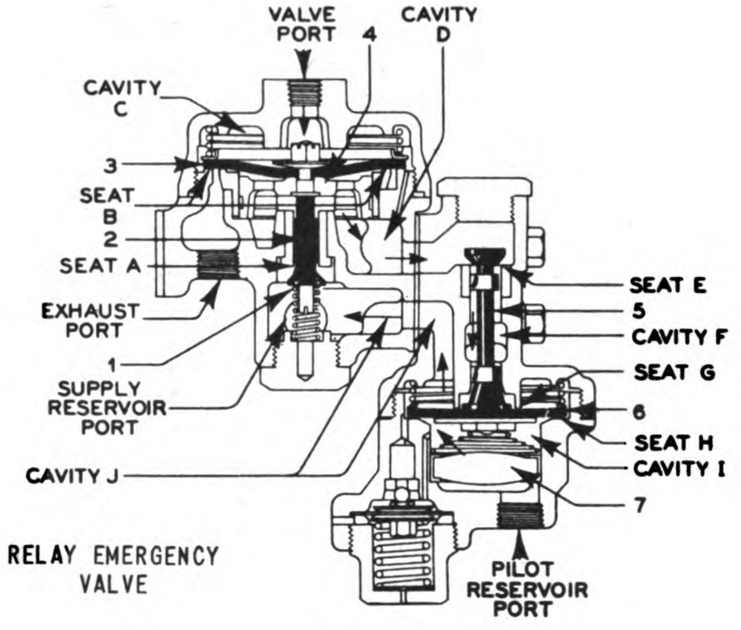


Figure 327

balance pressure is attained. If the brake valve pressure is decreased, pressure in cavity D is strong enough to lift the diaphragm off points B, permitting the air pressure to exhaust to atmosphere through the exhaust port until a lower balance pressure is attained. If all the brake valve pressure is released, the exhaust port is held open until all the air pressure is exhausted from the brake chamber and cavity D.

Emergency Application

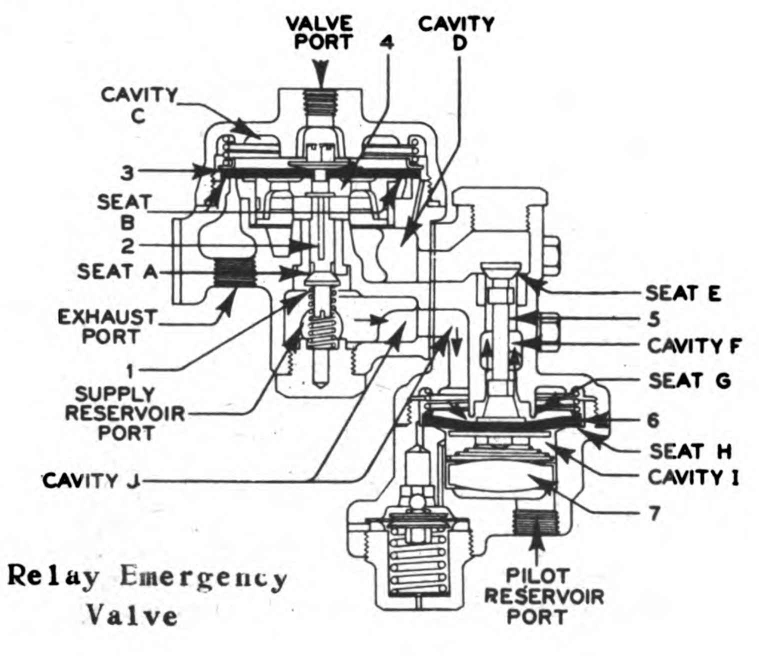


Figure 328

The emergency application occurs only in case an accident (such as trailer breakaway) should cause a sudden and abnormal drop of pressure in the line between the pilot reservoir and the Relay-Emergency Valve.

This sudden drop of air pressure in cavity I causes the pressure that has been built up in the supply reservoir and cavity J to force diaphragm 6 down against seat H, so that the air pressure in cavity J cannot escape through cavity I. The downward movement of the diaphragm causes emergency valve 5, connected to diaphragm 6, to move down against seat E, closing the upper end of cavity F so that no pressure can escape through cavity D to the exhaust port. The downward movement also pulls the diaphragm away from points G, opening the lower end of cavity F and permitting air pressure from the supply reservoir and cavity J to pass directly through cavity F to the brake chambers.

On the valve there is a pressure regulating valve built into the emergency valve cap which allows the trailer reservoir to feed back into the tractor reservoir until the pressure in the trailer reservoir equals approximately 70 lbs. to 80 lbs. per square inch, then shuts off and when the trailer reservoir continues to drop a brake application will occur on the trailer when the pressure in the tractor reservoir has reduced to approximately 45 lbs. to 50 lbs. per square inch. But in cases of a sudden drop in the emergency line, such as a broken line between the tractor reservoir and the relay emergency valve, an emergency brake application will occur on the trailer.

It is very important that this equipment be tested daily and is well maintained to insure the performance for which the equipment is designed.

Releasing Brakes After Emergency Application

Two methods may be used to release the brakes after an emergency application has occurred. The recommended method is to repair and reconnect the air brakes so that all connection lines and equipment are in their original condition and then to operate the compressor to build up air pressure. As the air pressure in cavity I is built up to equal the pressure in cavities F and J, it presses up diaphragm 6 so that the valve resumes its normal operating position. In this position the diaphragm pressing against points G seals the lower end of cavity F against the air pressure in cavity J. Likewise, emergency valve 5 is held up off seat E opening the upper end of cavity F into cavity D, so that the air pressure in cavity F and the brake chambers is released through cavity D and the exhaust port to atmosphere. The other method is to drain the air pressure from the relay-emergency valve supply reservoir.

Length of Emergency Application

The length of time that the brakes will maintain an emergency application depends upon the care the equipment has been given. Without proper maintenance, the valve and various connections may be leaking freely and the emergency application time will be comparatively short. However, if the equipment has been carefully maintained, with all connections properly sealed against leakage and the emergency valve leakage held to the minimum, the emergency application will be held for a much longer time.

INSPECTION

The Relay-Emergency Valve should be inspected and tested each time before put into use. The following leakage tests will give an accurate check on the valve's condition. In case leakage in any one of these tests causes

Relay Emergency Valve (Continued)

a 3-inch soap bubble in 3 seconds, the entire valve should be removed and cleaned or replaced with a reconditioned unit if necessary.

Regular Leakage Tests

(1) With brakes released, cover exhaust port with soap suds. Leakage is caused by supply valve 2 not seating properly.

(2) With brakes applied, cover exhaust port with soap suds. Leakage is caused by diaphragm 3 not seating properly.

Emergency Tests

(3) Be sure there is pressure in the trailer reservoir. Disconnect emergency hose between truck and trailer; trailer brakes should apply automatically. This is the safety feature which applies the brakes automatically in case of trailer breakaway and should be tested daily to insure proper functioning of the devices in case of an emergency.

(4) Cover emergency hose or connections on trailer with soap suds. Leakage is caused by diaphragm 6 not seating properly.

(5) Cover exhaust port with soap suds. Leakage in excess of that evident in test 1 is caused by valve 5 leaking.

MAINTENANCE SERVICE

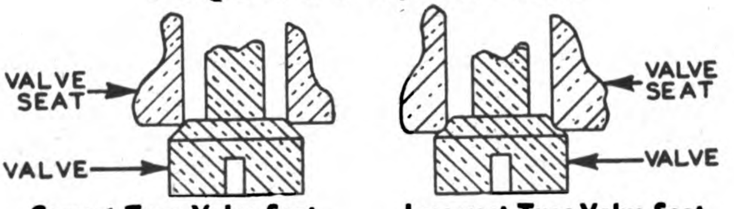
Three parts of the Relay-Emergency Valve require periodical maintenance service:

Strainer (7) should be removed about once every six weeks, cleaned thoroughly with gasoline, and replaced.

Diaphragms (3) and (6) should be replaced once each year; more often if operating conditions warrant.

When the Relay-Emergency Valve does not meet the inspection test leakage requirements, it will sometimes be found that the trouble is caused by dirt

Enlarged View of Taper-Seat Valve



Correct Type Valve Seat **Incorrect Type Valve Seat**

Rounded Seat will not seal. When valve seat is worn, scored or pitted, a correct and efficient seal cannot be obtained.

Figure 329

on the valve or diaphragm seat. This condition can be remedied by removing the leaking valve or diaphragm, cleaning the valve and valve seat with kerosene, and then regrinding the valve.

If the leakage is caused by a badly worn valve, it will be necessary to replace the worn valve with a new one. In this case, generally it will be found that the valve and both diaphragms are badly worn and the operator will likely find it more economical and satisfactory to replace the entire Relay-Emergency Valve with a genuine factory-reconditioned unit.

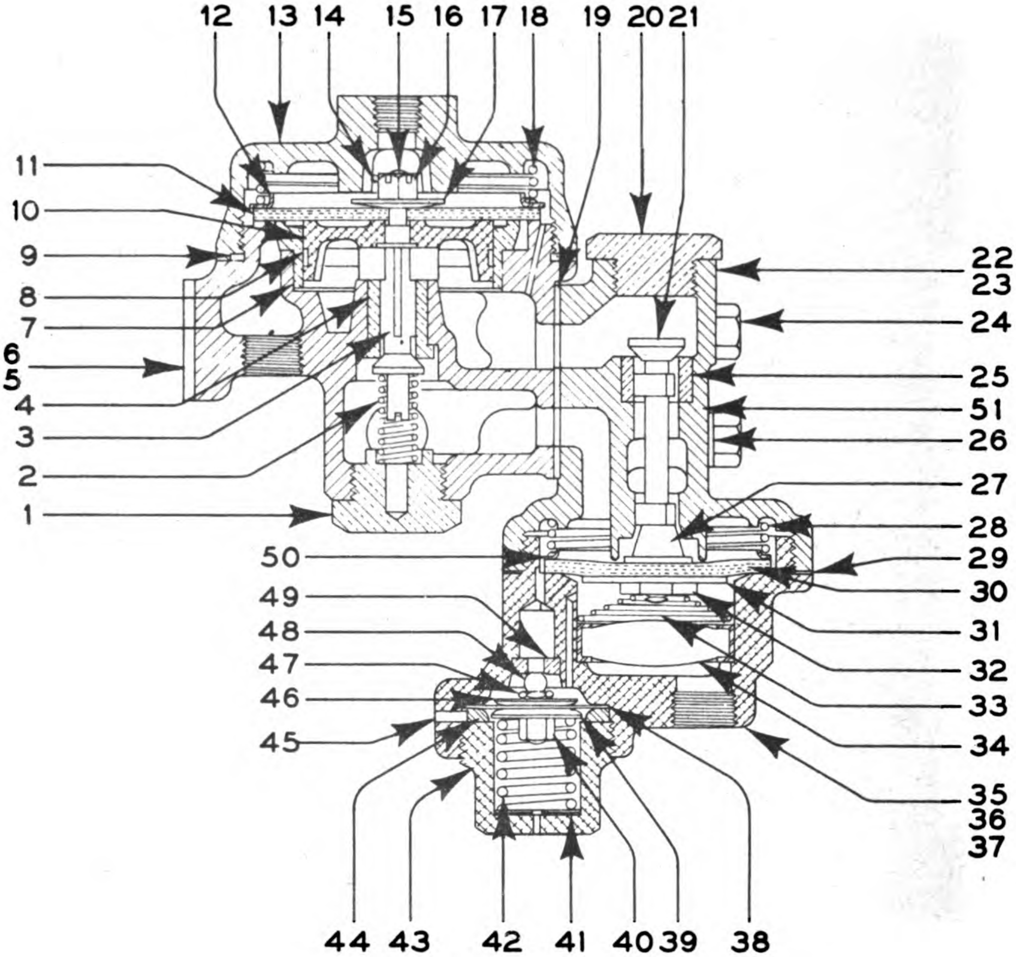


Figure 330

Bendix Westinghouse #220353

From Barber-Greene Specification #BK-BE-CI

Emergency Valve Relay (Continued)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1.	1	202692	Cap Nut
2.	1	202699	Spring
3.	1	202693	Intake Valve
4.	1	202690	Valve Seat
5.	1	216071	Body Complete Includes items 4, 6, & 7 Item #7 cannot be replaced in the field
6.	1	204568	Body
7.	1	212135	Diaphragm Guide Bushing
8.	1	202869	Diaphragm Guide Ring
9.	1	211367	Cover Gasket
10.	1	204650	Diaphragm Guide
11.	1	202695	Diaphragm
12.	1	202697	Spring Seat
13.	1	202691	Cover
14.	1	203016	Cotter Pin
15.	1	204651	Diaphragm Screw
16.	1	203227	Diaphragm Nut
17.	1	202696	Diaphragm Washer
18.	1	202698	Spring
19.	1	202735	Gasket
20.	1	202741	Cap Nut
21.	1	203379	Valve Stem
22.	1	215204	Emergency Assembly - Includes items 23 & 25
23.	1	202746	Emergency Valve Body
24.	4	203388	Hex Head Bolt
25.	1	202736	Valve Seat
26.	4	202982	Lock Washer
27.	1	202743	Diaphragm Support
28.	1	202738	Spring
29.	1	202747	Cover Gasket
30.	1	202744	Diaphragm (Emergency)
31.	1	213387	Washer
32.	1	200029	Lock Nut
33.	1	204056	Spring
34.	1	204055	Strainer
35.	1	220305	Diaphragm Cover Assembly - Includes items 36 through 49
36.	1	220304	Diaphragm Cover Complete - Includes items 37, 45, and 49
37.	1	213225	Diaphragm Cover Body
38.	1	213227	Diaphragm
39.	1	211541	Lower Diaphragm Follower
40.	1	211542	Stem Lock Nut
41.	1	213229	Shim
42.	1	213228	Spring
43.	1	213230	Cap
44.	1	213226	Ring
45.	1	213224	Pin
46.	1	211595	Upper Diaphragm Follower
47.	1	211538	Stem
48.	1	211539	Ball
49.	1	211537	Seat
50.	1	202737	Upper Spring Seat
51.	1	220829	Emergency Valve Assembly - Includes items 20 through 50
	1	221135	Diaphragm assembly, includes items 38, 39, 40, 46, 47 and 48.

ENGINE SECTION

TABLE OF CONTENTS

(Continued on next page)

TABLE OF CONTENTS - Continued

I. GENERAL INFORMATION

A. SPECIFICATIONS

MODEL - Buda HP-351

TYPE - 6 Cylinder, Gasoline, Water cooled

POWER - 62 HP @ 1400 RPM (normal operating speed)

BORE AND STROKE - 3-13/16" and 5-1/8"

DISPLACEMENT - 351 Cubic Inches

ROTATION - Clockwise, viewing front or fan end of engine

WEIGHT - Net - 1164 Pounds

Shipping - 1315 Pounds

Export - 1605 Pounds

CUBAGE - 51 Cubic Feet

CAPACITIES - Gas Tank - 55 U. S. Gallons

Crankcase Oil Capacity - 6 Quarts

Air Cleaner Oil Capacity - 1 Quart

Cooling System - 5-1/3 Gallons

CONSUMPTION - Gasoline - 6 Gallons per Hour (Maximum)

Oil - 35 Quarts per 100 hours
(Air cleaner and crankcase)

B. ACCESSORIES

DESCRIPTION	BUDA CO. NUMBER	MANUFACTURER'S NUMBER	MANUFACTURER'S NAME
1 - Air Cleaner	A-6557	A-6605	Donaldson Company, Inc. St. Paul, Minnesota
2 - Pre-Cleaner	A-6565	X-1537-A	Donaldson Company, Inc. St. Paul, Minnesota
3 - Starter	1733	718-R	Delco-Remy Corporation Anderson, Indiana
4 - Generator	H-12175	1101671	Delco-Remy Corporation Anderson, Indiana
5 - Voltage Control Unit	5864	5864	Delco-Remy Corporation Anderson, Indiana
6 - Push Button Switch	DE-44122	1385	Delco-Remy Corporation Anderson, Indiana
7 - Magnetic Switch	AP-6297	1549	Delco-Remy Corporation Anderson, Indiana
8 - Lubricating Oil Filter	H-11677	CSB-41-302M	DeLuxe Products, Corp. LaPorte, Indiana
9 - Governor	K-40167	A-1729-B	Pierce Governor Company Anderson, Indiana

DESCRIPTION	BUDA CO. NUMBER	MANUFACTURER'S NUMBER	MANUFACTURER'S NAME
10 - Carburetor	H-12550	Model #455-2 Outline #0-8411 Fuel Valve Assem. #55	Zenith Carburetor Div. Bendix Aviation Corp. Detroit, Michigan
11 - Distributor	4757	643-X	Delco-Remy Corp. Anderson, Indiana
12 - AC Spark Plugs	H-11629	#87-S 18 mm	A. C. Spark Plug Company Flint, Michigan
13 - Fuel Pump	2903	855758	A. C. Spark Plug Company Flint, Michigan
14 - Ignition Switch	3998	50704	Briggs & Stratton
15 - Ignition Coil	1755	528-C	Delco Remy Corp. Anderson, Indiana

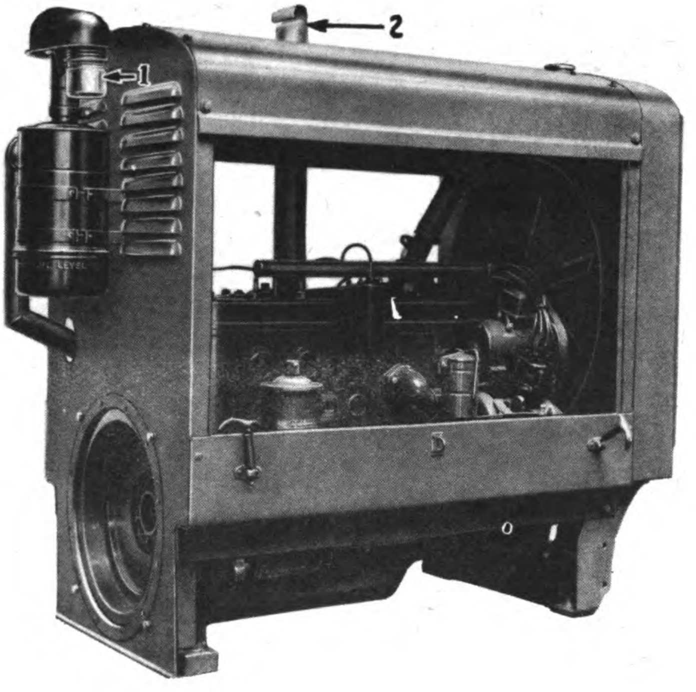


FIGURE A
Right Side of Power Unit

1. Collector Pre-cleaner
2. Exhaust outlet

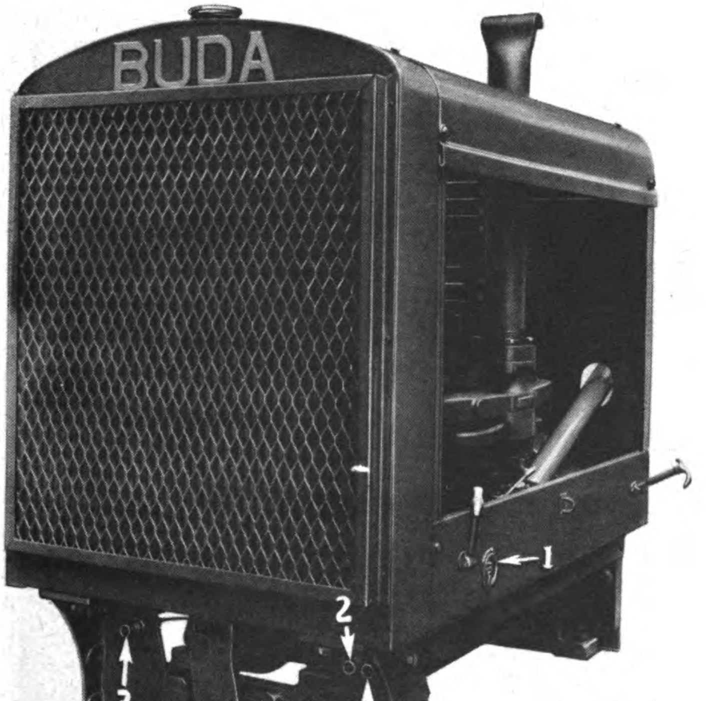


FIGURE B
Left Side of Power Unit

1. Oil pressure gauge
2. Throttle control
3. Spark control
4. Choke control

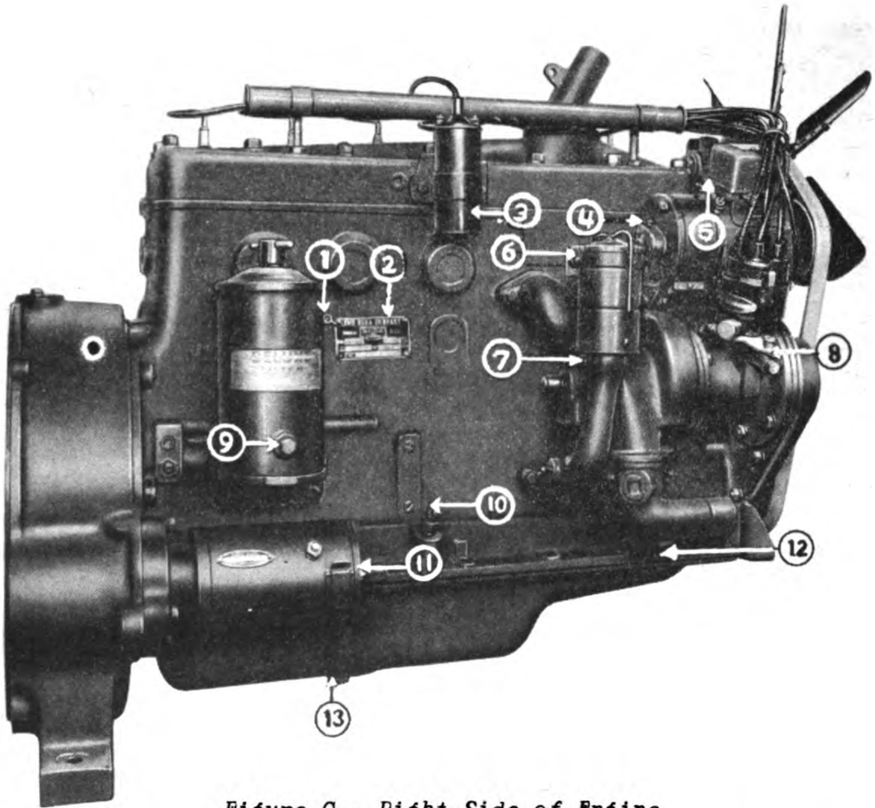


Figure C - Right Side of Engine

1. *Block Drain*
2. *Identification Plate*
3. *Ignition Coil*
4. *Generator Oil Cup*
5. *Generator Control*
6. *Oil Filter and Breather*
7. *Water Pump Oil Cup*
8. *Distributor Spark Advance*
9. *Oil Filter Drain Plug*
10. *Oil Level Gauge*
11. *Starter Oil Cup*
12. *Water Pump Drain*
13. *Oil Pan Drain*

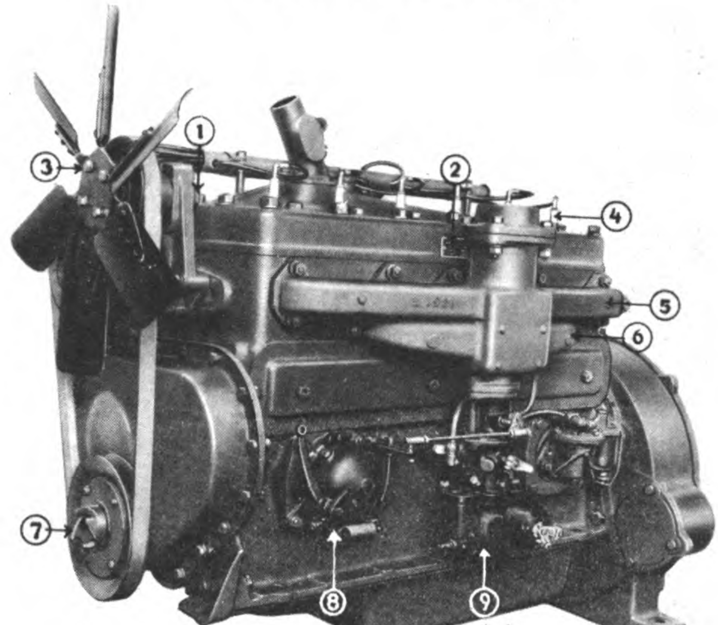


Figure D - Left Side of Engine

1. *Fan Adjustment*
2. *Tappet Clearance Plate*
3. *Fan Blade Assembly Screws*
4. *Spark Plug*
5. *Exhaust Manifold*
6. *Intake Manifold*
7. *Crank Jaw*
8. *Governor*
9. *Carburetor*

II. OPERATION

A. OPERATING SUGGESTIONS

Time spent on the inspection and care of the engine will be many times repaid in long life and trouble free operation.

Do not operate engine for any length of time with one or more cylinders weak or missing. Keep the engine in good operating condition. If trouble develops, stop and correct it before it becomes serious.

Keep the engine clean. An operator while cleaning the engine discovers trouble in the making, caused by loose fastenings, leaky connections, etc. Oil should never be allowed to collect on wires or electrical equipment.

Keep the radiator filled with clean lime free water and do not run the engine without water in the cooling system, or add cold water to an over-heated engine. If the radiator leaks, have it repaired. Do not use radiator cements that are applied internally, as they hinder the cooling action of the radiator.

Check oil level with bayonet gauge. Use the carburetor choke no more than necessary, as this allows raw gasoline to enter the cylinders, pass the pistons and dilute the oil.

In starting a cold engine allow time for the engine to warm up slowly. Never race a cold engine.

The service life of an engine can be greatly prolonged by a careful breaking-in period.

Don't stop the engine immediately after it has been working hard. Allow it to idle a few minutes to allow the water to circulate and carry away the intense heat. Slower and more even temperature changes aid greatly in preventing warping of valves and distortion of cylinder heads and manifold assemblies.

Don't allow the engine to labor unnecessarily at low speed. A good operator will shift to a lower gear just before an engine starts to lug at low speed.

Use a good grade of lubricating oil manufactured by a reliable refinery. See "Lubricating Instructions" for oil recommendations.

B. STARTING THE ENGINE

When starting any new engine, or an engine that has been standing idle for some time, make the following check-up: -

1. See that there is fuel in the fuel tank.
2. See that the cooling system is full of clean water.
3. See that oil is up to the proper level in crankcase.
4. Open the valve in the gasoline line and allow the carburetor float chamber to fill.
5. Set the throttle lever about one-quarter open.
6. The engine should now be ready to start. With the ignition switch in the OFF position, the throttle closed, pull the choke control

out as far as possible and crank the engine over two or three half turns. Push the choke control about three-quarters of the way in and pull throttle one-quarter of the way out. Turn the ignition switch to the ON position and press starter button. As soon as engine fires release starter button. Use choke only as necessary to keep engine running until it warms up.

7. CAUTION -- Never operate the engine after it is warm with the choke control pulled out, as this will cause an excess of raw fuel to be drawn into the cylinders, resulting in dilution of the crankcase oil or possibly stopping the engine due to an over-rich mixture.

   If the engine does not start immediately, push in the choke and continue cranking until the engine fires.

   In extremely cold weather, when starting is sometimes difficult, crank the engine with the choke control pulled out for a few revolutions, or it may be necessary to pour a small quantity of gasoline into each cylinder through the spark plug holes. Wait a few moments for the gasoline to evaporate, turn on the switch and proceed as before.

C. COLD WEATHER HINTS

A good hot spark from clean correctly adjusted spark plugs is essential in cold weather. The ignition system should be checked at the start of the season.

Be sure the lubricating oil is correct for the prevailing temperatures. See page 11-C for oil recommendations.

DRAIN COOLING SYSTEM. Unless antifreeze solution is used, always drain the Cooling System at freezing temperatures. Open radiator water pump and water jacket drain cocks.

To start an engine in cold weather, crank one or two revolutions with the choke closed before turning on the ignition switch. Push in the choke half way and open throttle about one-quarter and turn on the ignition switch to start. This prevents extreme flooding. As soon as possible push the choke in to running position. Do not apply load with the choke closed --- wait until the engine warms up.

In extremely cold weather, after stopping the engine at the end of the day, it is advisable to drain the oil into a clean container, this oil to be kept in a warm place or heated before being poured into the engine. This will insure easy starting and proper lubrication at once.

This method will also permit the use of summer oil recommendations in winter when load conditions are severe.

DO NOT RACE A COLD ENGINE.

It is especially important in cold weather to test the specific gravity of the battery. A battery freezes between the temperatures 20 degrees above zero and 50 degrees below zero depending on the state of its charge. Do not add water after shutting down for the night. It will freeze quickly. See that it gets a charge after adding water.

D. FREEZING MIXTURES

Denatured Alcohol and Water

Freezing temperature degrees fahrenheit	Amount of alcohol to add to each gallon of water
20	2 Pts.
0	4 Pts.
-20	6 Pts.
-40	10 Pts.
-60	19 Pts.

For example, for each gallon of water placed in the radiator when the temperature draws near 20° below zero, add six pints of denatured alcohol.

Ethyl Glycol (Prestone) and Water

Freezing temperature degrees fahrenheit	Amount of ethyl glycol to add to each gallon of water
16	2 Pts.
0	4 Pts.
-19	6 Pts.
-34	8 Pts.
-49	10 Pts.
-62	12 Pts.

E. CARE OF THE ENGINE

A GENERAL inspection of the engine should be made at regular intervals, to insure long life and to prevent breakdowns while on the road. One hour a week spent on this inspection will save time and money in the end.

Keep your engine clean. There is nothing that will better promote freedom from engine trouble than cultivating the habit of keeping the engine clean. A dirty engine often covers minor defects or maladjustments that would not become serious if given immediate attention.

1. New Engine after 8 Hours Operation and First 100 Hours.

(a) Tighten cylinder head studs and check all other studs, clamps and connections for loose fittings and leaks.

(b) Clean carburetor gasoline fuel screen and gasoline tanks strainer and sediment bulb.

2. Every 8 to 10 Hours Operation (Daily)

(a) Visual Inspection -
- a. See that ignition and other electrical connections are tight.
- b. See that water, gasoline and oil lines are tight.
- c. Check fan belt (tighten if necessary).
- d. Check oil pressure gauge. The indicator should return to zero if not sprung.

(b) Check oil level in crankcase. If necessary to add oil see recommendations under "Lubricating Instructions".

(c) Check water in radiator.

(d) Clean air filter and refill with fresh oil. Use same grade oil as in crankcase.

(e) Remove air pre-cleaner, inspect center tube and clean, if necessary, with cloth on stick. Clean and empty jar on pre-cleaner.

3. Every 50 Hours Operation.

(a) Repeat instructions on 8 to 10 hour operation.

(b) Change oil in crankcase with recommended oil. See page 412. (Drain oil only when engine is hot).

(c) Remove oil filter element, drain and clean filter housing and install new filter element.

(d) Fill oil cup on water pump with same grade of oil as in crankcase.

(e) Oil generator and starter with a few drops of oil. Use same grade oil as in crankcase.

(f) Clean carburetor gasoline fuel screen, and gasoline tank, strainer and sediment bulb.

(g) Check battery water level.

4. Every 100 Hours Operation

(a) Repeat 50 hours operation instructions.

(b) Drain oil while engine is hot and flush out oil pan with one gallon of cheap light oil (SAE #10). Do not use kerosene. While flushing oil in crankcase, run engine at idling speed for two minutes. Drain this flushing oil and refill with 6 quarts of fresh oil to the proper level. Oil recommendations under "Lubricating Instructions".

(c) Check valve tappet adjustment using a feeler gauge and two wrenches as shown in the picture page 420. The valve tappet clearances are given on the plate attached to the engine, intake .006, exhaust .009.

(d) Inspect and remove the carbon deposits from the spark plugs. Examine the porcelain. If it is cracked or chipped either inside or outside, replace the plug. The gap between the electrodes should be .025 of an inch. Adjust the side electrode - never the center one.

(e) Inspect the commutator and the brushes on starter and generator: If the commutator is dirty, clean with No. 00 sandpaper. Check brush spring tension. Blow or brush dust and dirt out of starter and generator at the commutator end, with dry compressed air or hand bellows to prevent short circuits, grounding and sticking brushes. See page 440 on starter, page 446 on generator.

(f) Check specific gravity of each battery cell with a hydrometer. A reading of 1.250 to 1.285 indicates fully charged, 1.230 half charged, and 1.150 dead. Never take a reading shortly after adding water. See page 453.

(g) Remove cover and check distributor interrupter points. See page 445. Turn down grease cup 1/2 turn.

(h) A few drops of oil on governor link joints, governor throttle shaft and carburetor shaft.

(i) Remove plug and apply oil to fan hub of same grade as used in crankcase.

(j) Remove crankcase breather and wash with gasoline.

5. Every 1000 Hours

(a) Repeat 100 hour operation instructions.

(b) Clean the outside of engine by washing with kerosene, distillate or grease solvent (if the dirt is thick allow it to soak for ten minutes), then wash off dirt with water.

(c) Remove cylinder head, clean carbon, and grind and adjust valves. Always replace cylinder head gasket with a new one. See maintenance section, page 417.

(d) Remove oil pan, wash out sludge, if any, and clean oil pump screen. While pan is off, inspect inside of engine to see if oil suction screen bracket is tight, cotter pins and locks in connecting rods and main bearing in place, and make sure all connecting rod bolt nuts and main bearing capscrews are tight. Replace oil pan gasket.

(e) Remove air cleaner and dissassemble unit for a thorough cleaning. Wash unit inner screen with gasoline. See page 435.

(f) Install new spark plugs. Check points to .025 inch clearance.

(g) Flush radiator with flushing solution as per recommendation page 431.

(h) Inspect spark plug cables, battery cables and all electric wiring.

(i) Inspect cut-out relay on control unit as per instructions page 450. Adjust as needed.

(j) Check for air leaks in oil circulating system (see instructions paragraph #3, page 426.)

(k) Test the compression by cranking the engine over slowly at each compression stroke. If one or two cylinders only lack compression, inspect the valve and tappet clearances on these cylinders before removing the head. Insufficient valve clearance will cause burned valves and lack of compression. Should the engine show poor compression on all cylinders the valves should be re-ground.

6. Every 2000 Hours, Major Overhaul

(a) Repeat 1000 hour operation instruction.

(b) Completely disassemble engine and inspect all parts for wear, replace parts where necessary.

(c) Clean carbon out of ring grooves of pistons and install new rings.

(d) See maintenance section page 417.

F. LUBRICATING INSTRUCTIONS

1. LUBRICATING RECOMMENDATIONS

The most essential requirement for any successful engine operation is oil. Lack of oil or the use of poor oil is responsible for most engine failures. Use a good quality of oil manufactured by a reliable refinery. The best oil will be found to be the cheapest over a long period of engine operation. We recommend S.A.E. 40 for operating temperatures over 90 degrees Fah., S.A.E. 30 for temperatures from 32 to 90 degrees Fah., and S.A.E. 20 for temperatures from 0 degrees to 32 degrees Fah., and S.A.E. 10 for temperatures below 0 degrees. For special high temperatures use S.A.E. grade #50. These numbers correspond to the grades of oil sold by first class service stations.

The use of SAE #50 is not recommended with the exception that it may be indicated for hot climatic and heavy load conditions. Care must be exercised in using this heavy body oil, as the power loss due to using an oil of this weight will result in an increase in oil pan temperature more than offsetting any possible gain in lubricating value.

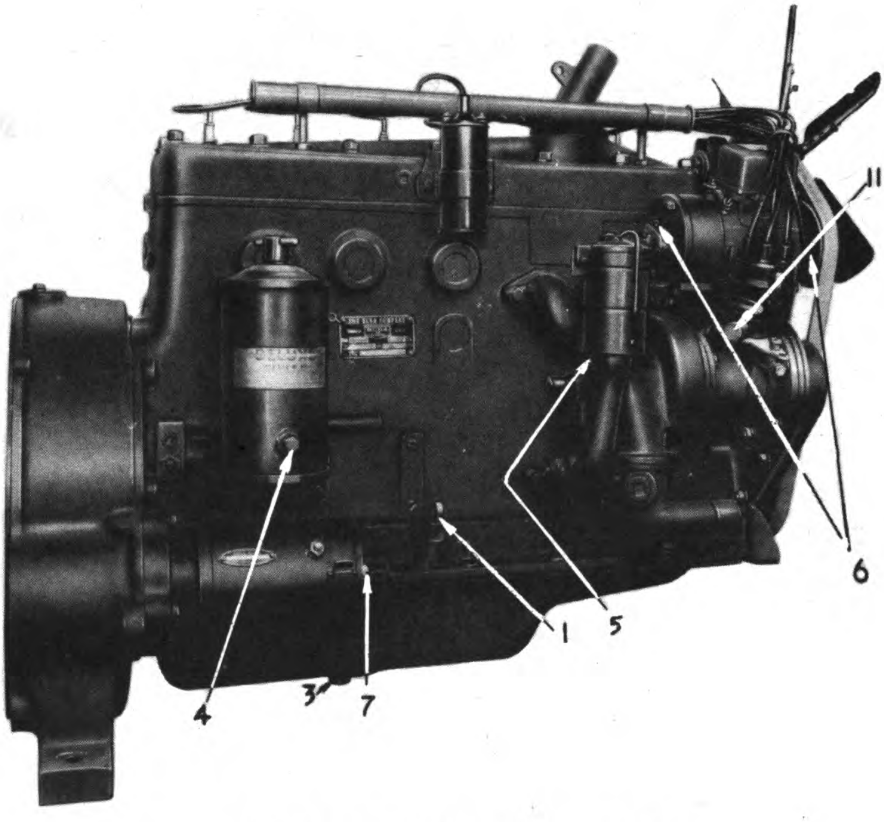


Figure Ca - Right Side of Engine

1. *Crankcase Oil Level Gauge*
3. *Crankcase drain*
4. *Oil Filter Drain*
5. *Water Pump Oil Cup*
6. *Generator Oil Cups*
7. *Starter Oil Cup*
11. *Distributor Grease Cup*

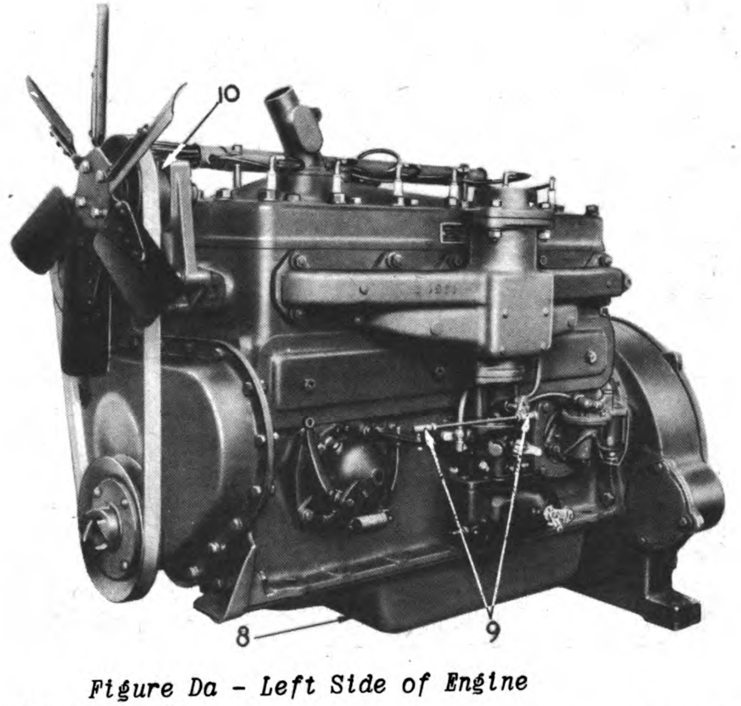


Figure Da - Left Side of Engine

8. *Crankcase Pan*
9. *Governor, Throttle Shaft, and Carburetor Shaft Links*
10. *Fan Grease Plug*

2. ENGINE LUBRICATION AT 10, 50 AND 100 HOURS OPERATION

See Illustrations Ca and Da on preceding page.

Daily - 8 to 10 Hours of Operation

1. Crankcase Oil Level Gauge. Check and add recommended Oil as needed if below "Full" mark.

2. Air Filter. Clean and refill with fresh oil of same grade used in crankcase.

Every 50 Hours of Operation

3. Crankcase. Drain while engine is hot and refill with 6 quarts of recommended oil.

4. Oil Filter. Drain, remove element, clean filter housing, and install new filter element.

5. Water Pump. Fill oil cup with same grade oil as used in crankcase.

6. Generator. Add 6 to 8 drops of oil of same grade as used in crankcase.

7. Starter. Add 6 to 8 drops of oil of same grade as used in crankcase.

Every 100 Hours of Operation

8. Crankcase. Drain while engine is hot. Add one gallon of cheap light oil (SAE #10) to flush crankcase. Do Not Use Kerosene. With flushing oil in crankcase, run engine at idling speed for two minutes. Drain the flushing oil and add 6 quarts of oil of recommended grade.

9. Governor, Throttle Shaft, and Carburetor Shaft. Add few drops of oil on governor link joints, governor throttle shaft and carburetor shaft.

10. Fan. Remove plug and fill with oil of same grade as used in engine crankcase.

11. Distributor - Turn grease cup down 1/2 turn.

    Add a drop of oil to the breaker cam and put a few drops of oil on the wick on the camshaft under the rotor.

G. TROUBLE CHART

Troubles	Possible Causes
Loss of Power	Valves need grinding or adjusting. Rings worn. Cylinders worn. Rings stick in grooves. Thin or rich mixture. Poor plugs; points; or adjustment needed. Distributor points need filing and adjustment Gas line or pump over-heated.
Engine Knocks	Low water. Distributor advanced. Thin mixture. Hot fuel pump or lines. Carbon. Poor gasoline. Rod or main bearings worn. Loose flywheel. Lack of oil.
Faulty Carburetion	Flooding or starving. Water in fuel. Dirty strainer. Lack of gasoline. Faulty fuel pump.
Excessive Smoke	Carbon trouble. Dilution. Worn cylinders and rings. Improper oil.
Back-Fire in Muffler	Cam gears out of time. Ignition setting. Sticky valve stems. Broken valve springs.
Back-Fire at Carburetor	Thin mixture. Out of gasoline. Sticky inlet valves. Broken valve spring. Cam gear out of time. Ignition setting. Air leak in manifold.
Hard to Start	Weak battery, Defective points. Defective coil. Poor gas. Fouled plugs. Too much choke. Out of time. Water in gas. Oil too heavy.
Engine Misses	Faulty ignition. Plugs and points. Loose wires. Dirt in jets. Leaky gaskets. Too close valve adjustment. Sticky valves. Broken valve springs.

Troubles	Possible Causes
Engine over-heats	Lack of water. Lack of oil. Late ignition. Radiator clogged. Poor hose fittings. Water pump trouble. Lime in cylinders. Carburetor choke partly closed. Loose fan belt. Thin mixture due to over-heated fuel lines and fuel pump. Water pump suction partially closed by obstruction or collapsed hose. Water pump impeller loose on shaft. Thermostat faulty.

H. IMPORTANT PRECAUTIONS

1. **Do not tamper with the engine governor if you are not thoroughly familiar with it. The governor is correctly set when it leaves the factory. Do not adjust the rod leading from the governor lever to the carburetor lever.**

2. **Absolute CLEANLINESS should be the rule at all times, and especially when engine parts are exposed.**

3. **Do not fail to investigate the cause of backfiring and misfiring.**

4. **Do not leave the engine out in the weather if it can possibly be avoided Always protect the end of the exhaust pipe from rain, if the engine is standing idle.**

HIGH ALTITUDE OPERATION

Gasoline engine power is reduced when operating at high altitudes. The reduced density of the air causes a loss of compression, and the lowered oxygen content reduces combustion efficiency. The power loss is approximately 3 to 3-1/2 percent for each 1000 foot increase in elevation.

Up to an elevation of about 3000 feet, the power loss is due primarily to the decrease in cylinder compression and may be regained by increasing the compression. Up to this altitude the oxygen content of the air is probably sufficient for efficient combustion.

For instance, an engine may be equipped with a high compression head for delivery of normal power output at an elevation of 3000 feet. However, if the engine so equipped is used at higher elevations, the power loss will again be 3 to 3-1/2 percent for each 1000 foot increase in elevation.

If the carburetor is set for operation at normal levels, the fuel mixture will become increasingly rich as the altitude of operation is increased, due to the reduced air density and consequent loss of oxygen. This causes inefficient combustion and carbon deposits. In general, a carburetor set for operation at normal levels will perform satisfactorily up to an elevation of 3000 feet. Above this, the fuel jet should be adjusted or changed to provide the proper ratio of fuel to air for efficient combustion.

III. MAINTENANCE

A. ENGINE PROPER

1. THE CYLINDER AND CRANKCASE ASSEMBLY

The cylinder and crankcase housings are cast integral. All oil leads are drilled passages in the crankcase. Pistons and connecting rods are removable from the top of the engine. One piece removable push rod covers are of ample size to permit ready inspection or replacement of the valve push rod mechanism.

2. MAIN BEARINGS

The main bearings (#12 in illustration E below) are of precision type and can be replaced individually. No scraping or fitting is required. Replacement can be easily made by simply pushing the old shell around and installing the new without disturbing the crankshaft. The upper shells are not dowelled, the lower shells (#12) are dowelled in the caps to hold them in place. No shims are required. There are seven main bearings. Crankshaft thrust is carried by the rear main lug.

After extended service should the crankshaft be found to become worn out of round .003" or more, it should be removed and reground to a standard undersize. Replacement bearings can be furnished .010", .020", .030", and .040" diameter undersize.

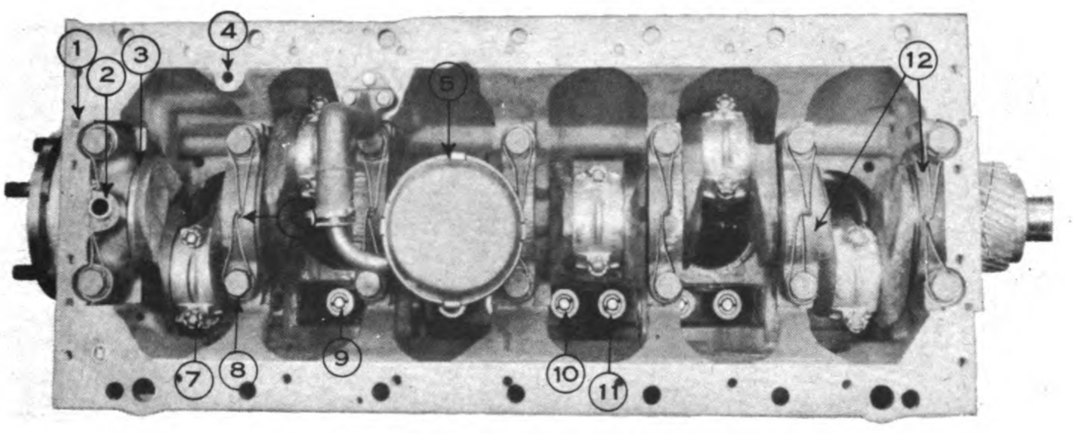


Figure E - Lower Crankcase View

1. *Side Cap Seals*
2. *Rear Brg. Drain Tube*
3. *Thrust Main*
4. *Excess Oil Return Hole*
5. *Floto Screen*
6. *Main Bearing Bolt Safety Wire*
7. *Cyl. Number 6 Rod*
8. *Cyl. Number 6 Main Bearing Caps*
9. *Valve Stem (With Cam Removed)*
10. *Retainer Lock.*
11. *Retainer Cup*
12. *Main Bearings*

3. REAR BEARING CAP

The rear bearing cap has an oil return tube (2) in it which drains below the oil level in order to assist in preventing oil leak through the rear main bearings. Illustration E shows the cap with the tube in place.

4. REAR BEARING OIL SEAL

The rear bearing oil seal (Figure F) is a combination oil slinger (6) and felt oil seal (4). The slinger is machined integral with the crankshaft. The oil thrown off the slinger drains down into a reservoir (7) cast integral in the rear bearing cap. The oil then passes through the drain tube and into the oil pan.

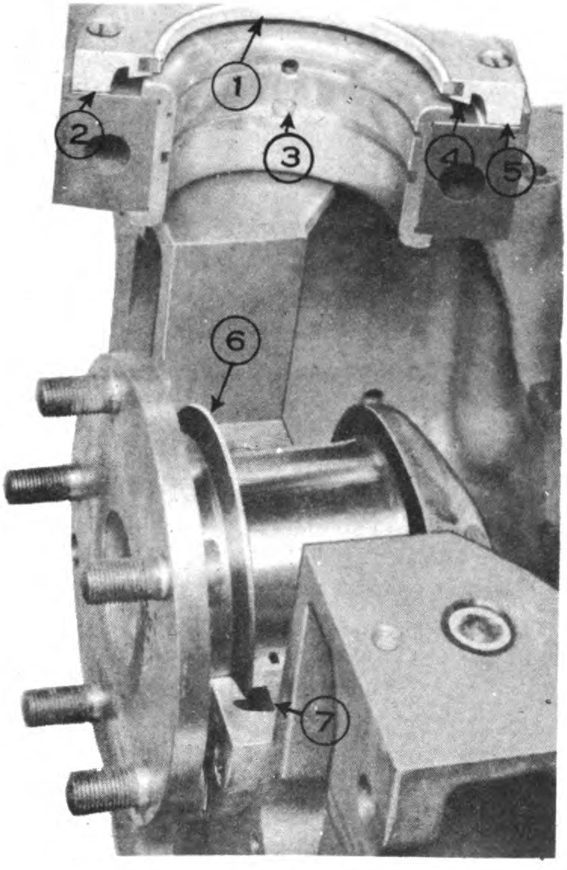


Figure F
Rear Bearing Cap and Seal

1. *Graphite & Oil Coated Surface*
2. *Upper Retainer in Place*
3. *Lower Bearing Dowel*
4. *Shellac Stiffened Felt Seal*
5. *Selected Gasket Thickness*
6. *Oil Slinger*
7. *Oil Slinger Cavity*

The rear bearing felt oil seal retainer (2) is a split disc type with a groove on the inside diameter to hold the felt (1). The retainer is mounted back of the oil slinger with the felt contacting the crankshaft diameter which is a little larger than the main bearing diameter.

To replace the felt seal, put enough shellac in the groove so the felt will soak up the shellac as the seal is worked into the groove. Allow the shellac to dry with the felt in place before trimming flush with the end of the retainer. The shellac is to prevent the felt from turning with the shaft.

To replace the retainer, select a (retainer to case) gasket so the clearance between the oil slinger and the retainer will be .015 - .020 inches, when the crank is forward.

Use care whenever replacing front or rear cap. Whenever the front or rear bearing needs attention, care must be exercised when the cap is replaced to make sure that the oil retainers which fit into the milled slots in the caps have the proper seal installed to prevent an oil leak through these slots or between the cap and the case proper.

If the standard fillers are not available these grooves can be sealed with woolen yarn, which should be firmly calked into place by means of a small drift and hammer, pounding the yarn gradually up into the grooves until they are packed full.

5. PISTON AND CONNECTING RODS

The cast iron piston has three compression rings and slotted type oil control ring. See Fig. G.

The piston pins (3) are the full-floating type and are made to rotate in either the piston or the connecting rod bushing. The pins are held in place by means of snap rings (4) which lock in a groove in the outer end of the piston boss which prevents the piston pin (3) from coming in contact with the cylinder walls. The piston pins have the ends ground flat and polished to prevent their cutting through the lock rings. Replacement pins can be furnished in standard .005", .010", .015" and .020" oversize.

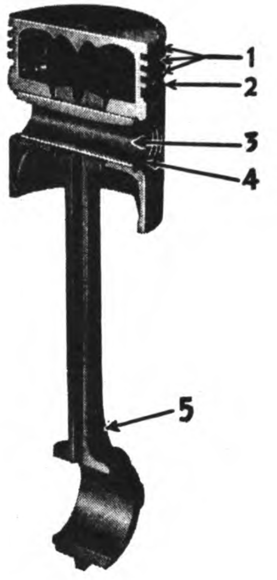


FIGURE G
Cutaway Section of Piston and Rod

1. *Compression Ring Grooves*
2. *Oil Ring Groove*
3. *Piston Pin*
4. *Piston Pin Snap Ring*
5. *Connecting Rod Arm*

With cast iron pistons the pin should be fitted tighter in the pistons than in the upper end of the rod. It should be possible to push the pin through the rod bushing without exerting any considerable force, but the pins should be tight enough in the pistons to enable the mechanic to drive the pin in with the palm of his hand.

The connecting rod (5) is fitted with bronze piston pin bushings and the babbitt type crank pin bearing which is spun in the connecting rod. The connecting rods are rifle drilled for pressure lubrication to the piston pins. Figure G shows the sectional view through the connecting rod and piston assembly. The side clearance between the connecting rod and the crankshaft cheeks should be maintained at .004" - .006".

The babbitted type connecting rod can be furnished in standard undersizes the same as the main bearings. If the crankshaft is out of round it should be removed and reground to a standard stock size as outlined under main bearings. After the cylinder head is removed the connecting rod and piston assembly can be removed from the top. In reassembling the cap to the rod, be sure that the numbers on the cap and the rod are on the same side. This should be done to be sure that the cap is installed on the rod in the same position as originally assembled.

Cylinders may be checked for wear with an inside micrometer, taking cross measurements the whole length of each cylinder. Most of the cylinder wear comes near the top of the cylinder in the ring travel. If the cylinders are found to taper more than .005", or if the cylinder is found to be out of round, it should be reground. All cylinders should be reground the same size, following S.A.E. practice, grinding them either to .010", .020", .030", .040" oversize. Pistons are carried in stock in these sizes. Semi-finished pistons are also available. If cylinders are not reground it is recommended that they be smoothed up with fine emery cloth or fine cylinder hone.

6. VALVES AND TAPPETS

Before taking the valves to the valve grinding bench, be sure that all the carbon has been removed from the cylinder block, and from the valves as carbon deposits frequently cause difficulty in the valve grinding operation.

All of the valve adjustments are to be made while the engine is hot. To make the valve tappet adjustment use a feeler gauge and two wrenches as shown in the picture. The valve tappet clearances are given on the plate attached to the engine, intake .006, exhaust .009. See valve diagram. After the tappet clearance has been adjusted hold the adjusting screw securely and lock in place with the check nut. Check again and see that the clearance did not change when the lock nut was tightened.

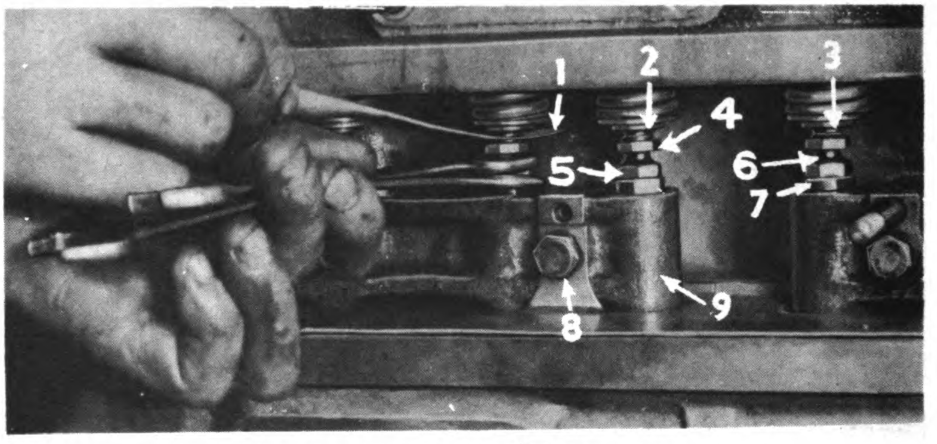


Figure H - Tappet Adjustmen.

1. *Feeler Gauge*	6. *Adj. Screw*
2. *Retainer Cups*	7. *Tappet Body*
3. *Retainer Lock*	8. *Tappet Cluster Mounting Bolt*
4. *Adjusting Nut*	9. *Valve Tappet Cluster*
5. *Lock Nut*	

The valve tappet clusters (9) are bolted to the cylinder block. By removing the capscrews (8) the entire structure can be removed from the engine. The tappet adjusting screw lock nut (5) will prevent the tappet from dropping out of the bracket. If any difficulty is experienced in removing the bracket after the capscrews have been removed, turn the engine over part way which will rotate the camshaft and relieve the tappet from the strain put upon it, due to a valve being held partially open by the cam.

NOTE: Dowels are used to properly align the valve tappet bracket assembly in the block, and these MUST be in place when reassembling.

CAUTION: The opening for the screws holding this assembly in place opens into the cylinder bores, so if for any reason any of these capscrews are replaced, ones of IDENTICAL LENGTH MUST BE USED.

7. REMOVING VALVE AND SPRING

Cylinder head must be removed before springs can be taken out. Compress the spring with a "c" or plier type compressor. Then remove split locks from valve stem. Release spring, remove lifter, and pull valve out through the top of the block. The spring can then be pried out with screw driver.

Reinstallation

Put spacer, spring and retainer in their proper positions and slip them together in valve chamber. Drop valve through from the top of the block. Compress spring and put the retainer locks in their groove on the valve stem. Grease applied to the inside of the lock will hold them in position while spring is being released.

8. REMOVING AND REPLACING OF CYLINDER HEAD

To properly tighten the cylinder head, the center row of nuts should be drawn down very tightly, starting from the center and working to the front and back, alternately. The outside rows should then be drawn down firmly by alternating from one side to the other and working alternately from the center to both ends. In this way the gasket is worked out towards the sides, as it is compressed and will then draw down evenly. When all of the nuts have been drawn down for the first time, they should be gone over again following the same rotation. A little judgment will have to be used to know when the cylinder head is tight. A little cup grease may be used on both sides of the gasket before the cylinder head is put down on the studs, but do not use snellac or any other similar gasket cement.

When the engine is warmed up after fitting the cylinder head, all the cylinder head stud nuts should be drawn down once more as described before.

9. TIMING GEARS
(See Illustration I)

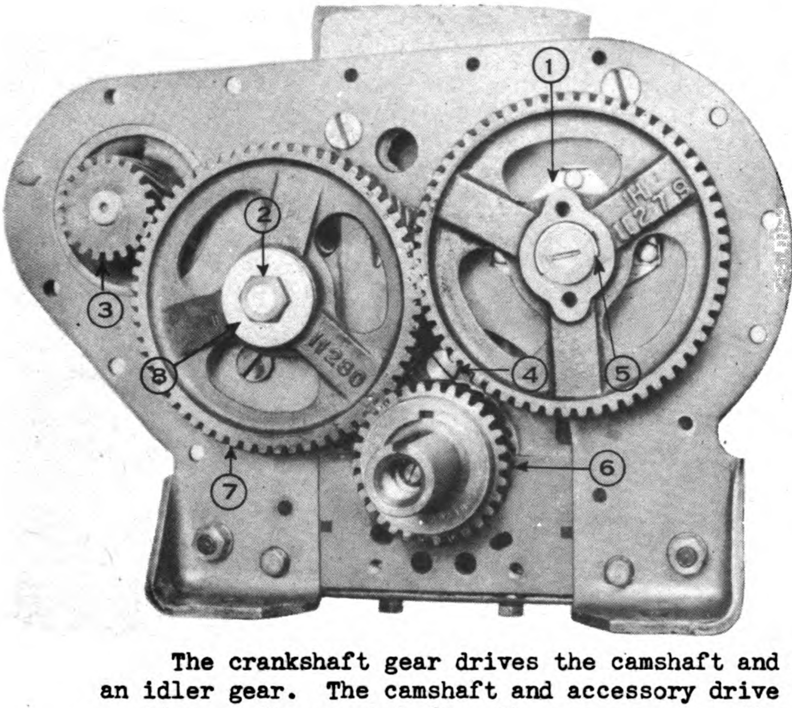


Figure I - Timing Gear

1. *Cam Retainer Lock*
2. *Left Hand Threaded Bolt*
3. *Accessory Gear*
4. *Front Main Bearing Locating Screw*
5. *Cam Gear Retainer Clip*
6. *Crank Gear*
7. *Idler Gear*
8. *Idler Gear Thrust Washer*

The crankshaft gear drives the camshaft and accessory drive gear through an idler gear. The camshaft and accessory drive shaft turn in the same direction as the crankshaft. The gears are on fixed centers and adjustment is made by selecting oversize or undersize gears.

Each gear is marked with a number within either a circle (indicating oversize) or a letter U (indicating undersize). The surrounding symbol denotes oversize or undersize respectively and the number within gives the deviation from the standard in thousandths of an inch. Thus: 2, gear is .002 oversized; or 3, gear is .003 undersized. When a letter S is used it denotes an even dimension gear. The figures given represent radial and not diametrical variation.

Crankshaft, idler and camshaft gears should be fitted with .002 backlash, while the accessory drive gear can have appreciably more backlash. When ordering one gear for replacement use the size marking of the old gear with allowance for wear on the others.

The idler gear (7) rotates on a stub shaft which is pressed into the crankcase. The shaft is secured in position by means of a lockscrew which screws into the right hand side of the crankcase. In assembling this shaft the screw hole in the shaft must line up with the corresponding hole in the crankcase. Oil is fed to the base of the hollow shaft which supplies a stream of oil to the gear housing. Because oil is fed to the base of the stub shaft an acorn lock nut is screwed over the protruding end of the lockscrew and sealed against the crankcase with a copper asbestos gasket.

The idler gear bushing is the thin wall type which is pressed in place and broached after assembly and prior to the cutting of the gear teeth, therefore, the idler gear and bushing must be replaced as one part. (See Figure I on page 521.) The end play is limited by the thrust washer (8) on the end of the shaft and should be .006" clearance. The thrust washer (8) is pinned to the shaft to prevent turning. The thrust washer is held in place by a capscrew (2). To prevent working loose the capscrew (2) has a left hand thread which will be kept tight by the engine rotation.

The camshaft runs in four precision type bearings. At the flywheel end it drives the oil pump through a pin and fork coupling. The thrust is taken at the timing gear end by a thrust plate attached to the front end of the crankcase. This thrust collar fits in a groove formed at the junction of the front camshaft bearing load and the rear of the camshaft gear hub.

The camshaft gear is pressed on the shaft and held in place by a spring wire lock, which snaps in a groove in the end of the shaft. When assembling a new gear, allow .004" to .008" end play.

10. TIMING THE CAMSHAFT

The base circle clearance is .006", therefore, before timing the engine, tappet adjustment between the tappet adjusting screw and the valve should be set to .006" clearance.

A. Adjust the intake valve lifter of No. 1 cylinder (second lifter from timing gear end) to the proper clearance as outlined above.

B. Turn the crankshaft until the marking on the flywheel, No. 1 cylinder I.O. (intake open), is in the center of the inspection hole in the flywheel housing.

C. Turn the camshaft in the direction of rotation (same direction as crankshaft) until No. 1 cylinder intake valve lifter takes up the slack between the lifter and the valve stem. This point can be determined by rotating the lifter with your fingers. A slight drag indicates the proper point. Slip idler gear into mesh with cam and crankshaft gears. It is not necessary to time water pump gear. See instruction for ignition timing, page 445.

D. To check valve timing, turn engine in direction of its rotation slowly. At the same time, feel No. 1 cylinder intake tappet. When a slight drag is felt, the timing mark I.O. (Intake Open) on flywheel should be in center of inspection hole in flywheel housing.

E. Unless the gears have been replaced after the engine leaves the factory it will not be necessary to resort to the above as the teeth are marked on the crank, cam and idler gears.

11. FLYWHEEL AND HOUSING

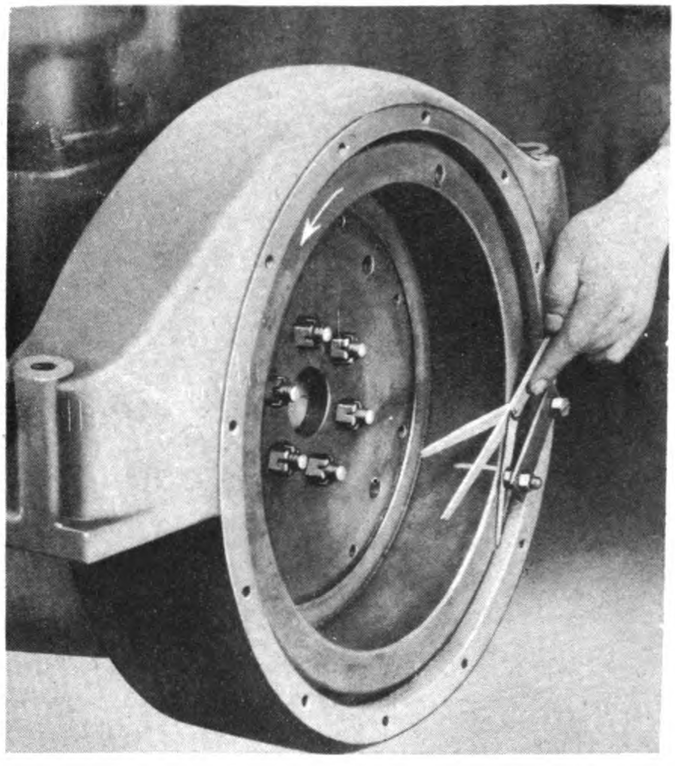


Figure J
Method for checking Trueness of Flywheel.

Whenever replacing the flywheel, care must be taken to insure its running true without excessive wabble. An easy method of checking the trueness of the flywheel is shown in the illustration below. Feelers are used in order to determine the maximum runout, and this should not exceed ten-thousandths of an inch. If a toolmaker's indicator is available, this can be used by bolting into the flywheel housing and permitting the stem to rub against the flywheel. The engine should be turned slowly and the high and low sides of the flywheel noted. If the flywheel runs out of true more than ten-thousandths it should be removed and the crankshaft flange recess inspected for dirt or other foreign matter.

12. NOMINAL CLEARANCES

The clearances given in the following table are for the desired fits. Fits should never be made tighter than the low limit values given in the table. Where engines are being reassembled with old gears the high limits specified for the gear fits may be larger than the values given in the table.

Piston to Cylinder Clearance:
  Fit snug on a .003 x ½ feeler ribbon.
Compression ring gap:
  .015 gap.
Oil ring gap:
  .008 gap.
All ring to groove clearances:
  .0005 to .0015.
Piston pin in piston:
  Size to size or light tap fit with wood or leather mallet.
Piston pin to rod bushing:
  .00075 to .001.
  Care should be exercised in making these fits.
Crankshaft end play:
  .004 to .008.
Main bearing clearances:
  .002 to .004.

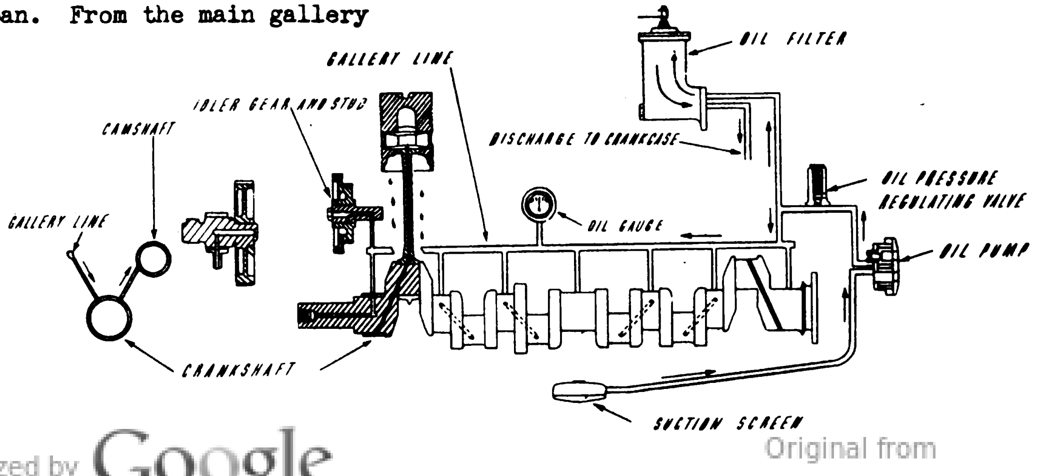
Connecting rod side clearance:
.004 to .006.
Connecting rod bearing clearance:
.002 to .004.
Camshaft bearing clearances:
.002 to .0035.
Camshaft end play:
.005 to .008.
Idler gear end play:
.005 to .008.
Accessory gear end play:
.005 to .008.
All gear back lash:
Idler gear .002
Accessory gear .005.
Valve stem to guide, intake and exhaust:
.002 to .004.
Tappet adjustment (set hot):
Intake .006", Exhaust .009".
Valve lifter or tappet fit to guide:
.0005 to .001.
Water pump shaft to bushing:
.002 to .003.
Oil pump gears back lash:
Not over .002.
Oil pump gears to case:
Not over .002 on a side.
Oil pump gears to case flange:
To be flush.
Spark plug gap:
Approximately .025.
Distributor points:
.018 to .024.
Side clearance between connecting rod and crankshaft cheeks:
.004 to .006.

B. LUBRICATING SYSTEM

1. OIL CIRCULATION

The engine is lubricated by means of the conventional pressure feed system. See Figure K. The oil is drawn from the pan through a suction screen to the oil pump. From the pressure side of the pump, it enters a drilled passage in the crankcase casting to the oil pressure relief valve. Here excess oil is by-passed to the oil pan. From the main gallery

Figure K
Lubricating Oil Diagram



line, side passages are drilled to the main bearings and idler gear stud. From the main bearing the oil is delivered to the crank bearings by means of the drilled crankshaft. The piston pin receives its oil from the crank pin bearings through the rifle drilled connecting rods. The cylinders are lubricated by oil thrown from the crank pin bearings.

From the main bearings, side passages lead to the camshaft bearings. A supply of oil is delivered to the idler gear hub through the drilled idler gear shaft. Oil from the hubs of this gear is thrown out spraying the entire gear train. A portion of the oil is forced thru the oil filter to remove impurities.

2. OIL PUMP

The oil pump assembly fits in a recess in the flywheel end of the crankcase and is held in place by four cap screws. See Fig. L. Connections to the pressure and suction passages in the crankcase are made by hollow dowels sealed against oil leaks by copper asbestos gaskets. The oil pump itself is bolted to the rear of the crankcase as pictured in the illustration. The four screws (3) which mount the oil pump to the crankcase are clearly shown in the picture. To remove the oil pump assembly it is necessary to remove only the four cap screws which fasten the oil pump to the crankcase.

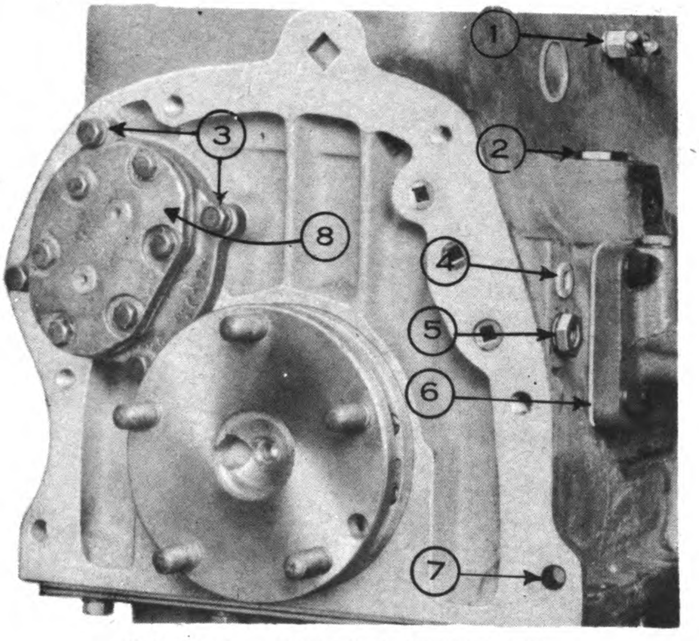


Figure L - Rear Crankcase View

1. *Block Drain*
2. *Oil Pressure Relief Cover*
3. *Oil Pump Mounting Bolt*
4. *Priming Hole*
5. *Pressure Connection*
6. *Filter Pad*
7. *Dowel Bolt Hole*
8. *Oil Pump*

Illustration Number M shows the front and rear view of the oil pump along with the view of the component parts. The oil pump body has a hydraulic relief (1) machined in the casting. The oil which would otherwise be trapped between the teeth is allowed to return through the hydraulic relief to the pressure side of the pump. There are no removable parts in this type of relief. The idler gear (2) and the drive gear (6) have bushings which were machined in the gear blanks before the teeth were cut. The gears and bushings should be replaced as units. The plug (13) is used as oil seal at the end of the idler shaft. This plug should not be removed from the oil pump body. The oil inlet (12) and the oil outlet (11) passages are through the two locating sleeve dowels.

To assemble the oil pump, put the drive gear (6) and the idler gear (2) in the housing. Place the gasket (4) in place in the housing. Set the cover in place starting the idler shaft (3) in the idler gear (2) and then

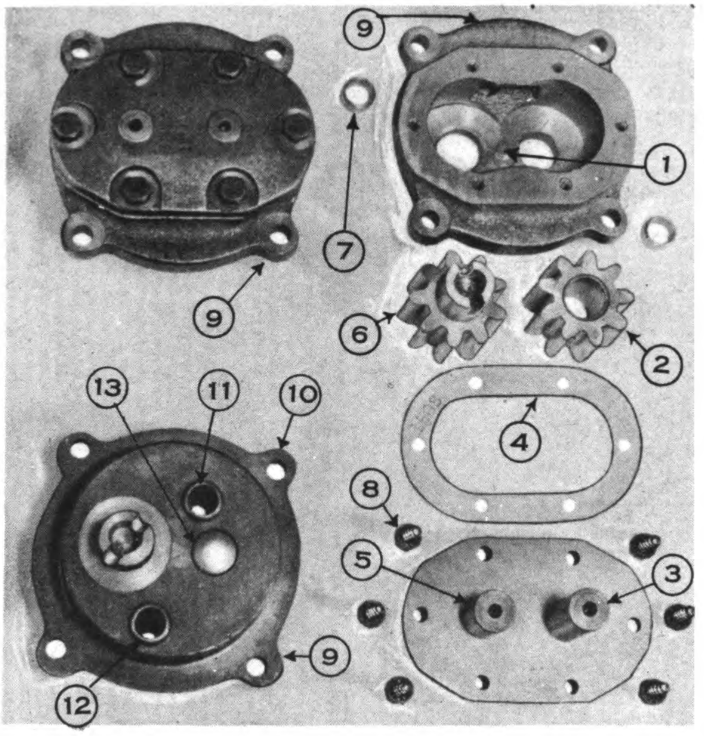


Figure M - Exploded View of Oil Pump

1. *Hydraulic Relief*
2. *Idler Gear with Bushing*
3. *Idler Gear Shaft Pressed into Cover*
4. *Cover Gasket*
5. *Drive Gear Shaft Pressed into Cover*
6. *Gear with Integral Slotted Drive*
7. *Pump Mounting Dowels*
8. *Cover screw and shakeproof washer*
9. *Front View of Assembly*
10. *Rear View of Assembly*
11. *Oil Outlet Hole*
12. *Oil Inlet Hole*
13. *Idler Shaft Oil Seal Plug*

the drive gear shaft (5) in the drive gear (6). Make sure the holes of the gasket (4) are in alignment with the cover and body capscrew holes before installing and tightening the six capscrews (8). Make sure the two sleeve dowels (3) are in place.

To prime the pump, see Figure L, remove the plug (4) marked "prime." This plug is located near the oil pressure relief valve on the side of the crankcase. This priming hole opens into the suction passage leading to the oil pump. Priming must be done while the engine is running and can be most easily done by means of a hand oil pump or gun. However, the same results can be obtained by connecting a piece of tubing to the oil priming connection and raising the oil level above the level of the pump, forcing a quantity of oil into the suction passage while the engine is running.

Do not run the engine more than a few seconds without oil pressure. The priming hole should be covered as quickly as possible, using your thumb until the oil circulates. Afterwards the engine can be shut down and the plug replaced. If this does not correct the trouble, check the oil pressure relief valve for a weak spring, broken spring, defective seat, or a check ball held open by foreign matter. Check or replace the oil pressure gauge.

3. LOCATING AIR LEAKS

Air pressure applied to the suction side, or the upper plug on the right-hand side of the engine, should indicate the location of an air leak, and while air pressure applied to the discharge or lower plug on the right-hand side of the engine will sometimes disclose the location of pressure leak, this condition is more readily discovered by fastening to this opening a copper tube which is attached to an oil reservoir which is strong enough to permit air pressure being applied to it. This air pressure will force the oil through the bearings and any loose bearings can be easily discovered by means of the excess oil flowing through the bearings.

4. OIL PRESSURE RELIEF VALVE

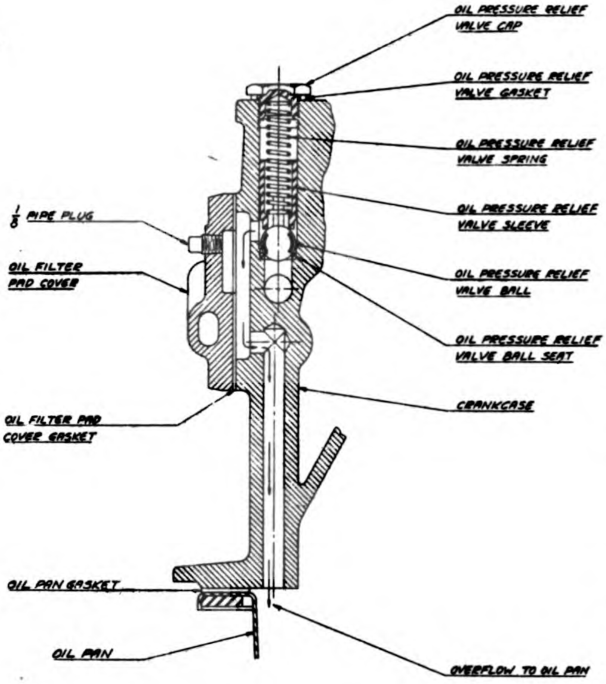


Figure N
Oil Pressure Release Valve

The oil pressure relief valve, (see Figure N), is designed to maintain an operating pressure of approximately 30 lbs. at normal speed and temperatures. No adjustment is provided. The spring furnished is of the proper weight and length. A temporary adjustment can be made by stretching or compressing the spring, however a new spring should be obtained as a stretched spring soon loses its tension.

The oil pressure relief valve spring and ball are accessible by removing the large hexagon nut located just back of the filter.

5. OIL FILTER

This oil filter is located on the right side of the engine near the flywheel housing. See Figure A. The DeLuxe lubricating oil filter has a removable cartridge. Figure NN shows a sectional view through the filter. The unfiltered oil enters the inlet passage from the pressure side of the engine lubricating system and flows upward through the center tube until about half way up where it is released through two holes to spray against the side of the cone. The oil washes down, keeping the surface of the cone clean and allowing any heavier than oil particles to fall into the sump from where they can be drained off as the sump in the filter is never agitated. The pressure within the filter then forces the oil upward through the cartridge.

The pressure within the filter is controlled by a valve built into the base of the cover handle. The cover is also fitted with a perforated cap which holds the cartridge in a rigid position.

The cartridge which actually does the cleaning is constructed of specially prepared, long thread cotton, so supported that it cannot compress under pressure. This construction permits the oil to reach all parts of the filter medium for efficient cleaning. The clean oil flows back to the engine crankcase from the outlet on the top.

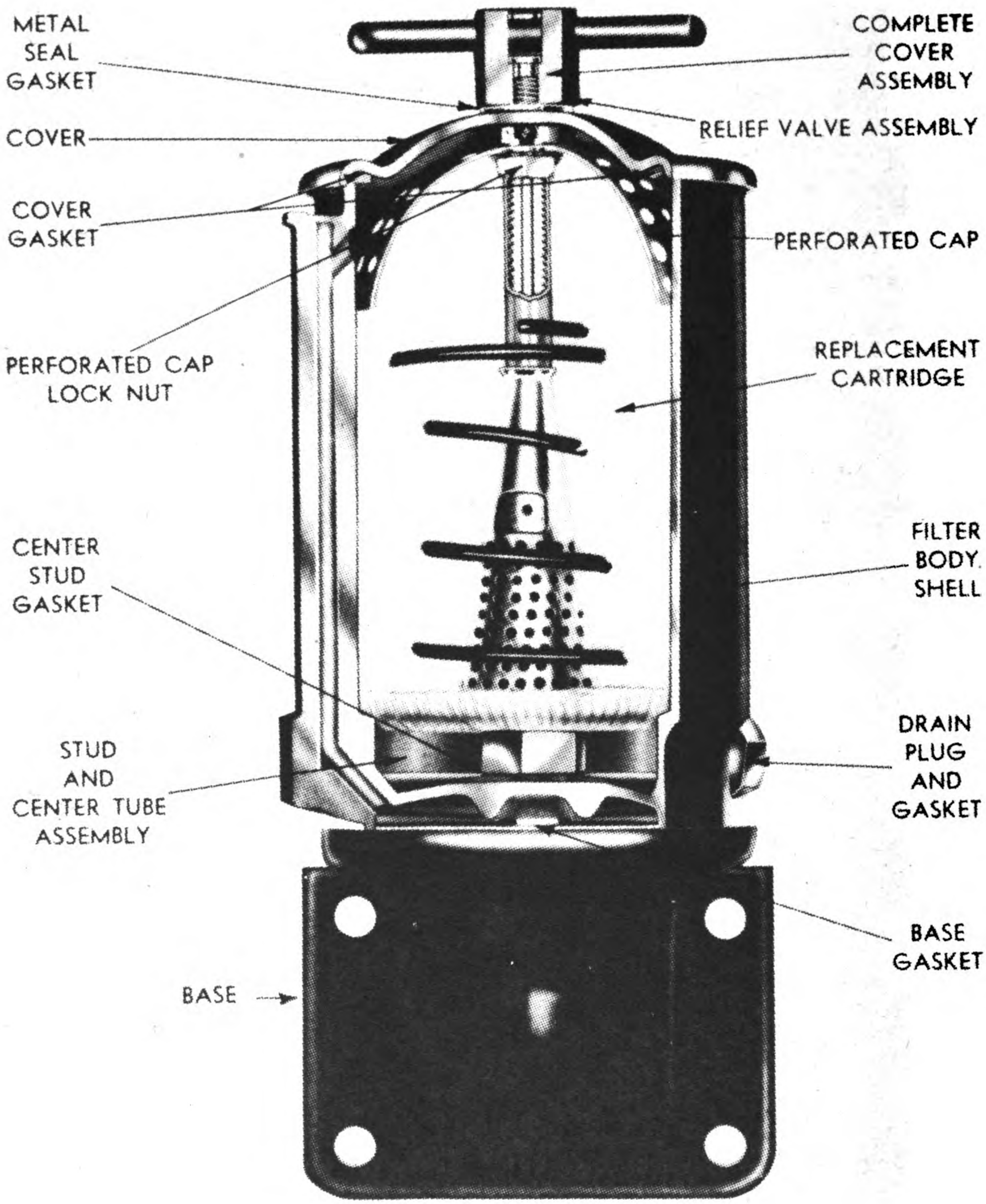


Figure NN
Oil Filter.

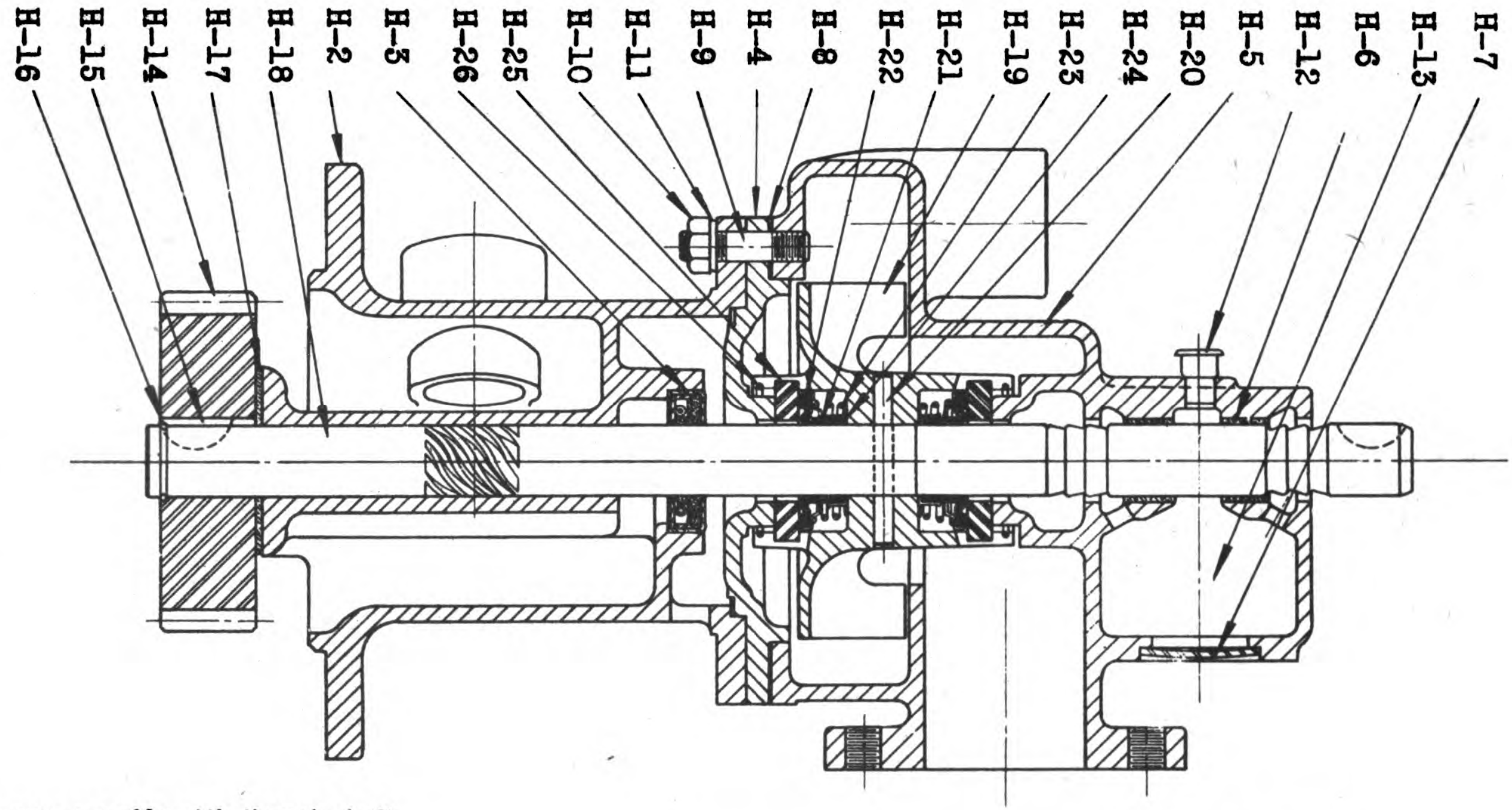


Figure 0

WATER PUMP

Water pump assembly with through shaft
(Includes indented items)
H-2 Water pump drive bearing sleeve
H-3 Water pump drive oil seal
H-4 Water pump seal plate
H-5 Water pump body
H-6 Water pump body bushing
H-7 Water pump body expansion plug 1-1/4"
H-8 Water pump body to drive gasket
H-9 Water pump body to drive stud
H-10 Water pump body to drive stud nut 5/16"-24"
H-11 Water pump body to drive stud copper washer
H-12 Water pump body oil pump cup
H-13 Water pump body wool packing
H-14 Water pump drive gear
H-15 Water pump drive gear woodruff key
H-16 Water pump drive gear snap wire
H-17 Water pump drive gear thrust washer
H-18 Water pump drive shaft
H-19 Water pump impeller
H-20 Water pump impeller pin

Water pump seal assembly
(Includes the following 6 items)
H-21 Water pump flexible seal
H-22 Water pump seal clamp ring
H-23 Water pump seal spring
H-24 Water pump seal spring guide
H-25 Water pump seal carbon washer
H-26 Water pump seal retainer snap wire

C. COOLING SYSTEM

The engine is water cooled with a belt-driven fan blowing air through a radiator. The cooling system is similar to that used in any automobile. Water from the radiator is forced through a water pump by the rotation of the impeller. After leaving the water pump the water passes around and between all cylinder barrels and valves and to the outlet passage in the head. A thermostat is located in the outlet hose between radiator and cylinder head. It controls the operating temperature of the engine. The thermostat is adjustable by means of a handwheel, on which instructions are given. As the warm water flows through the radiator, the water is cooled by the air forced through the radiator by the fan. The engine should be operated at a temperature of 180°, can be checked by removing radiator cap and inserting thermometer in water.

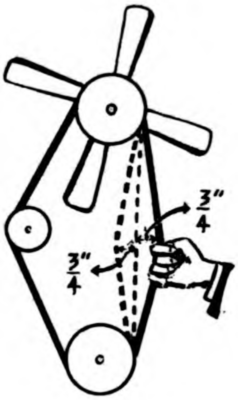


Figure P

Showing Fan Belt Adjustment

The water circulating system should be kept clean and free from scale deposits. The fan belt should be tight, but with not too much tension as to cause excessive wear. See Figure P. Do not allow dust, bugs, leaves, etc., to accumulate in the air passages between the tubes of the radiator coil. At frequent intervals, all debris should be blown out.

1. WATER PUMP

The water pump, see Figure O, is the impeller type pump with the spring gland packless seal. The driven end of the pump shaft is lubricated by crankcase oil. The other end of the shaft is lubricated by an oil soaked packing (H13). The packing should be kept filled with a light weight engine oil which is to be added through the oil cup (H12). With the carbon washer seals (H25) no adjustment is necessary or possible. The construction of the pump is shown in the drawing. The enlarged section (Figure Q) shows the seal construction of water pump.

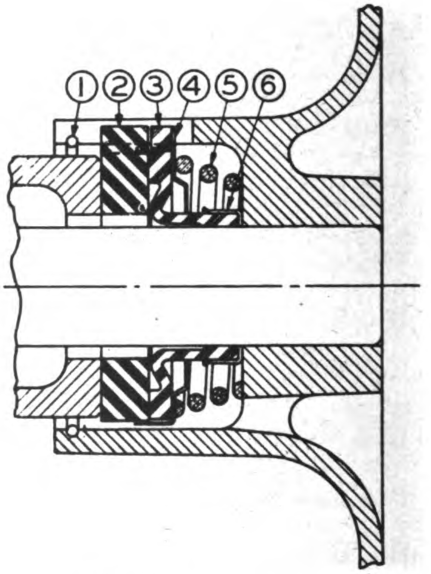


Figure Q - Enlarged Section shows Seal Construction

A. Carbon washer (2) is located between the flexible seal (3) and the pump body. Lugs on the washer fit into milled slots in the impeller and the entire assembly revolves with the shaft.

A spring (5) loaded flexible seal (3) holds the carbon washer against the face of the pump body preventing leaks. Brass shields (4) and (6) protect the seal and washer. The retainer wire (1) holds the seal in place during assembly. The water pump drive gear is keyed and secured on the shaft by a spring wire retainer in a groove in the end of the shaft. If necessary to dismantle the water pump be sure to remove the burrs on the ends of the shaft to prevent damage to the bushings. The body is secured to the drive housing by four nuts. Removing the body will expose one seal and removing the drive gear, and then the shaft, will permit complete disassembly.

When reassembling be sure the oil retainer is in proper position in the drive housing, using care in pushing the shaft in position to avoid breaking the carbon disc. Do not push in farther than necessary to assemble the gear to avoid damage to the seal.

The water pumps have provision for driving a magneto or generator, or other accessories from the rear end of the water pump shaft by means of a flexible coupling. It is extremely important that the alignment of the accessory be carefully made, since mis-alignment gives rise to excessive wear on water pump bushings.

RADIATOR FAN

The fan runs on anti-friction bearings and needs no attention except for greasing and to keep belt tight. Do not tighten excessively. Vee type belts must run with some slack.

To adjust fan belt, see Figure P, loosen clamp nut on fan spindle at the back of the bracket. Loosen lock nut on adjusting screw. Tighten or loosen the belt by turning the handwheel of the adjusting screw. Check fan belt tension by pulling the longest straight side for a slack of 3/4 of an inch in either direction, or a total of 1-1/2 inches.

RADIATOR

Clean, lime free water should always be used in the radiator system if it is at all possible to procure it. The use of hard water will cause scale to form in the engine jackets and in the radiator and tend to clog up the circulation system. Dirt, of course, performs the same damage.

The radiator and engine system should be drained and thoroughly flushed out every three months and refilled with clean water as deposits of dirt and foreign matter will accumulate and obstruct the circulation and also the heat transfer values of the radiator and cooling system. If anti-freeze solutions have been in use, it is well to put on new hose connections upper and lower, each year. Anti-freeze solutions have a tendency to cause disintegration of rubber hoses and if this progresses to an acute stage the rubber which crumbles away will pass into the system and fill up water passages, etc., and will also tend to swell up and stop circulation through the water system. Examine hoses carefully at least twice a year and replace when necessary.

Should the water system become clogged, particularly the radiator, one of the first things to do is to remove the connections upper and lower and plug the upper connection, then put a hose on the bottom of the radiator and put on 20 or 30 pounds of water pressure. This reverses the flow and will tend to carry any dirt which has been lodged down in the tubes back upward and out through the top of the radiator. While doing this, allow the radiator to overflow through the top. If the radiator is so badly clogged that this does not serve to free the circulation then the following solutions are to be recommended for cleaning:

1. A solution of one part of muriatic acid to three parts of water in sufficient quantity to fill up the radiator.

2. A solution made up with three or four cans of commercial lye added to a sufficient quantity of water to fill up the cooling system will work very well.

In either case the solution should be heated to luke warm before pouring into the system and should be allowed to stand in the system for three or four hours. After the removal the radiator and engine should be flushed thoroughly with clean water and the system again filled up with clean water.

Cold Weather Hints for freezing mixture. See Operation, Section C,

D. THE FUEL SYSTEM

1. PRINCIPLE OF OPERATION

The fuel system prepares and serves the "food" to the engine. The necessary units to perform this task are a carburetor, gasoline strainer, an air-cleaner, and a governor.

The fuel is gravity fed from the fuel tank thru the gasoline strainer, to the carburetor. There the raw gasoline is vaporized by the action of the air drawn into the carburetor by the vacuum-suction of the piston action. The air passed into the carburetor is thoroughly cleaned by an oil bath air cleaner and a collector type pre-cleaning unit, the latter unit prevents large particles of matter from entering the air cleaner, and the oil bath cleaner stops the finer dust and dirt from entering the carburetor. In the carburetor, the proper amount of air is mixed with the fuel to provide the right amount of gas and air mixture for efficient combustion.

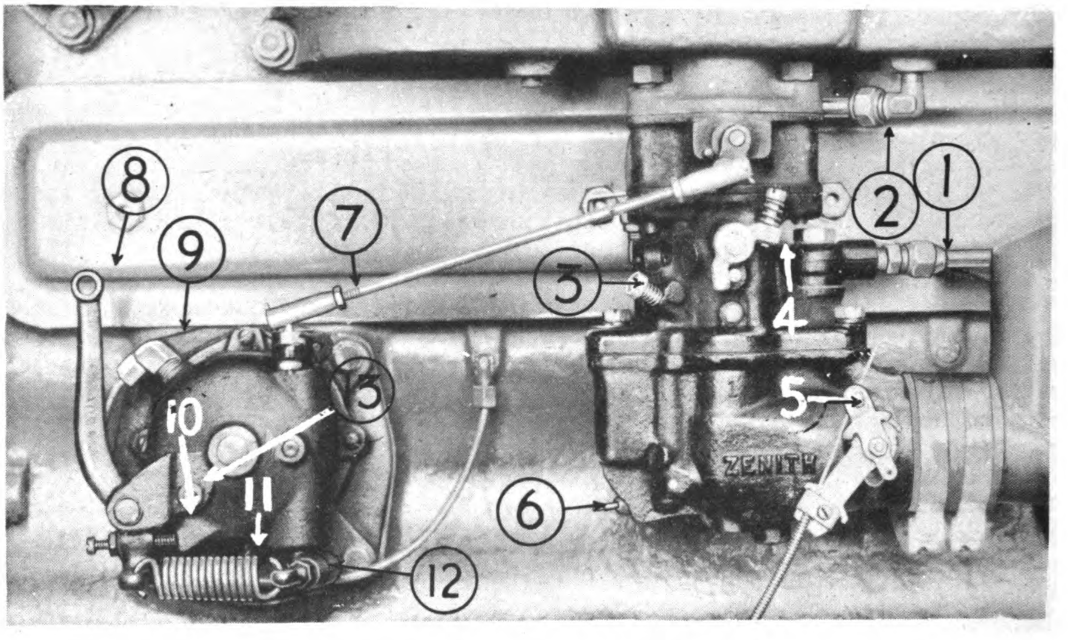


Figure R - Close-up of Governor and Carburetor.

1. Fuel Supply Line
2. Equalizer Air Line
3. Idle Jet Adjustment
4. Idling Adjusting Screw
5. Choke Control
6. Power Jet Adjustment
7. Adjustable Control Rod
8. Governor Lever
9. Governor Oil Line
10. First Speed Stop
11. Governor Spring
12. Regulation Adjustment
13. Surge Spring Adjusting Screw

The speed of the engine is controlled by the rate of flow of the fuel into the engine. A lever for increasing or decreasing engine speed is connected to a carburetor throttle valve.

The adjustable speed governor automatically regulates the speed of the engine. When the load on the engine increases, the governor opens the throttle, but will not allow the engine to operate beyond its maximum safe speed. This adjustable speed governor maintains the rate of operation at a constant level, increasing engine power when necessary or decreasing it to the minimum requirements. A 20% variation in speed is possible without changing weights or springs.

The fuel system should be kept clean and free from both air and gasoline leaks. Detailed instructions for servicing and repairing the fuel system is given under each unit heading.

2. CARBURETOR

The Zenith carburetor is of the plain tube type with an adjustable main jet, an accelerating pump and an economizing device.

The main jet determines the maximum amount of fuel which may be obtained for high speed operations. The main jet adjustment reduces this amount if it is turned toward its seat. Ordinarily the main jet adjustment has no effect after it is two turns open.

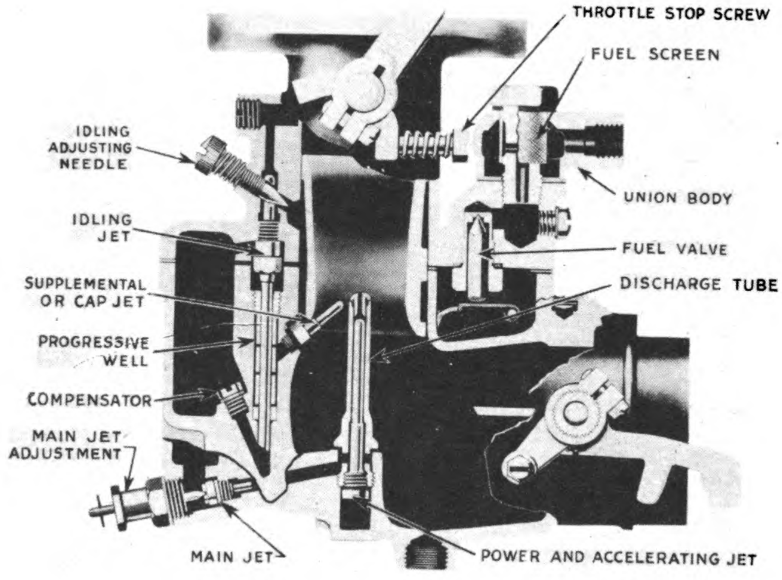
To set this adjustment, open the throttle to approximately 1/4 open. Turn the adjustment clockwise, shutting off the fuel until the engine speed decreases due to too lean mixture. Now open the adjustment until the engine speed decreases due to too much fuel. The adjustment should be set at a position half way between these two extremes.

OPERATION

The Zenith Compound Nozzle System of carburetion consists of two jets-- the Main Jet, directly connecting fuel in the bowl with the air stream in the carburetor barrel through the Main Jet Discharge Tube; and the Compensating Jet flowing into an open well and connected with the air stream through the Supplemental Jet. See Figure S.

Figure S

Zenith Carburetor



The Main Jet flow varies with suction, delivering more fuel as the engine speed increases, thus its tendency is to richness at top engine speed. The Compensating Jet is not affected by suction, thus flows the same at all speeds and has a tendency to leanness at top engine speed. In combination, the rich and lean jets give an average mixture of correct proportions.

IDLING

The idling system functions only on starting and idling. When the throttle is opened past the idling position, the fuel goes the other way through the discharge tubes and the idling system is automatically out of operation.

It consists of an Idling Jet and tube to supply the fuel, and the Idling Needle Valve to correct the idling mixture, and a channel to carry the mixture into the carburetor barrel at the edge of the throttle.

The desired idling speed is set by the stop screw on the throttle lever.

FULL POWER AND ACCELERATION: Full power, either for top speed or hard pulling, requires a richer mixture than part throttle operation. So does acceleration.

This additional richness of mixture is provided by combined accelerating and economizing systems operated by the vacuum above the throttle valve.

There is a plunger pump to force fuel into the air stream; a check-valve to prevent fuel from being forced back into the fuel bowl; and an economizer valve to control the additional fuel flow. The suction above the throttle holds the pump at the top of the pump well when the throttle is partially closed. As the throttle is opened the suction decreases, releasing the pump which drops to the bottom of the well, forcing fuel ahead of it.

The economizer valve is opened as the pump nears the bottom of the well. This opens a passage for the accelerating charge and, if the throttle is held open, for the additional ration of fuel necessary for full speed or power.

ECONOMY:

As the throttle is closed or the load lightens, the pump is lifted by the increased suction, so the fuel flow is reduced for anything less than full-load operation.

This vacuum type accelerating and economizing system may be used to advantage with a governor. In this case the carburetor throttle valve is usually wide open, the speed being controlled by the governor valve. By "bridging" the governor with a suction line the pump is actuated by the suction above the controlling governor valve and economizer action is thus retained.

STARTING:

The Idling System acts as a priming device because when the engine is at rest the idling jet is submerged in the fuel that fills the well. The throttle should be slightly opened as this results in a very strong suction on the idling jet. The fuel passing at high velocity over the edge of the throttle plate is finely atomized and the high vacuum instantly vaporizes and mixes it with the air. This will assure the first few explosions.

MAINTENANCE OF CARBURETOR

Clean gasoline strainer in carburetor, every 50 hours.

Trouble Shooting

The most common troubles are worn fuel valves, dirty screen, and a "sticky" float. The worn fuel valve and sticky float allow gasoline to continue flowing into carburetor after the carburetor is full causing the gasoline to flood. Replace worn parts. In the case of the sticky float which is usually caused by a bent bracket, bend bracket into its correct position--if this does not correct the trouble, replace with new bracket.

The dirty screen causes misfiring. Remove the dirt from the screen.

3. AIR CLEANER

Abrasive dust is the chief cause of engine wear. The function of an air cleaner is to prevent the entrance of dirt laden air into the engine cylinders. In order to remove the dirt efficiently, the air cleaner must be properly serviced. Service air cleaner daily or more often under severe dust conditions. (See Maintenance Suggestions.)

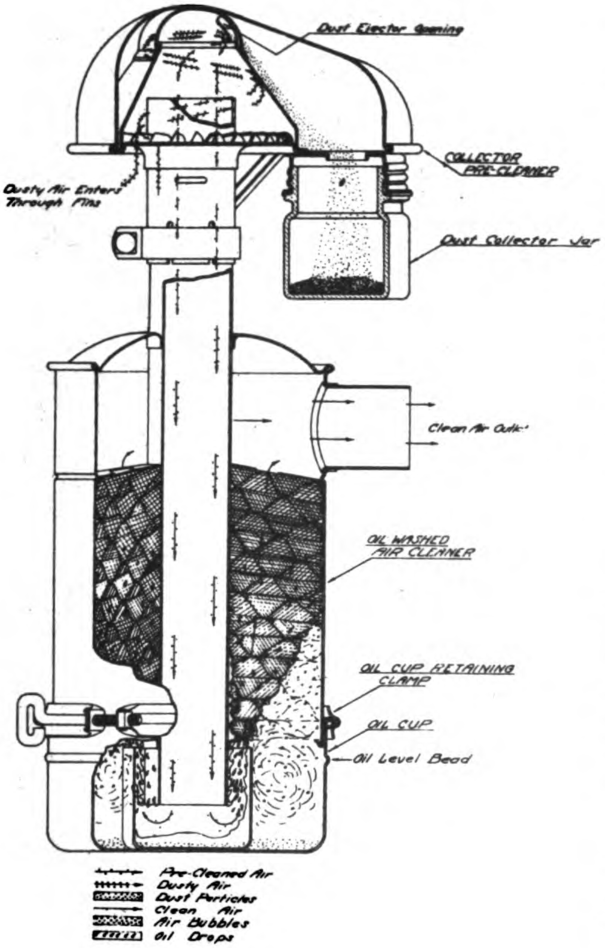


Figure T
Donaldson Air Cleaner

To obtain maximum efficiency from an oil washed air cleaner, the cup should be filled to the indicator level with a good grade oil. (See Figure T.) Raising the oil level <u>does not</u> increase efficiency.

As a rule, it is quite satisfactory to use the same oil as that used in the engine crankcase. Except in extreme heat or cold--below 10° dilute S.A.E. 10 with 1/3 kerosene, above 90° use S.A.E. 40.

MAINTENANCE OF AIR CLEANER

Every 8 to 10 hours (Daily)

1. Clean air filter cup and refill with fresh oil to proper level. Empty dust collection jar. CAUTION: Inspect all joints between the air cleaner and the carburetor. Make sure these joints are air tight. Ram a cloth through center inlet tube to remove any dust.

Every 1,000 Hours

1. Remove air cleaner for a thorough cleaning. Repeat steps in Every 8 Hours Maintenance and also do the following: Wash inner screen in gasoline

4. GOVERNOR

The automatic control of engine speed is regulated by a Pierce Centrifugal Governor--horizontal type, see Figure R.

The governor is enclosed in the housing. The shaft is driven by a gear off the camshaft. On the shaft is a weight holder or spider which supports two governor weights.

As the governor shaft rotates, the centrifugal energy developed in the two weights causes these two weights to swing outward on their pivots. The centrifugal energy of the weights is counterbalanced by a spring, the tension of which can be regulated.

When the centrifugal energy of the weights overcomes the spring tension, a thrust bearing is forced against the rocker yoke to which the governor control lever is attached.

The movement of the rocker yoke lever causes the control lever to move which in turn opens and closes the throttle valve.

MAINTENANCE

The only lubrication necessary is to put a few drops of oil every 100 hours on the governor link ball joints. The inside working parts are lubricated by pressure from the engine oiling system and need no other form of lubrication.

ADJUSTMENTS

If engine speed is unstable at top engine speed, running without load, loosen lock nut (13 in Figure R) and screw in very slowly until surging stops, do not screw in far enough to increase engine speed. This is the only adjustment operator will ever have to make.

If it is ever necessary to replace ball joints of the governor link rod, make certain the rod is adjusted so that when engine is not running the governor link rod holds the governor throttle in a wide open position. See Figure R.

E. ELECTRICAL SYSTEM

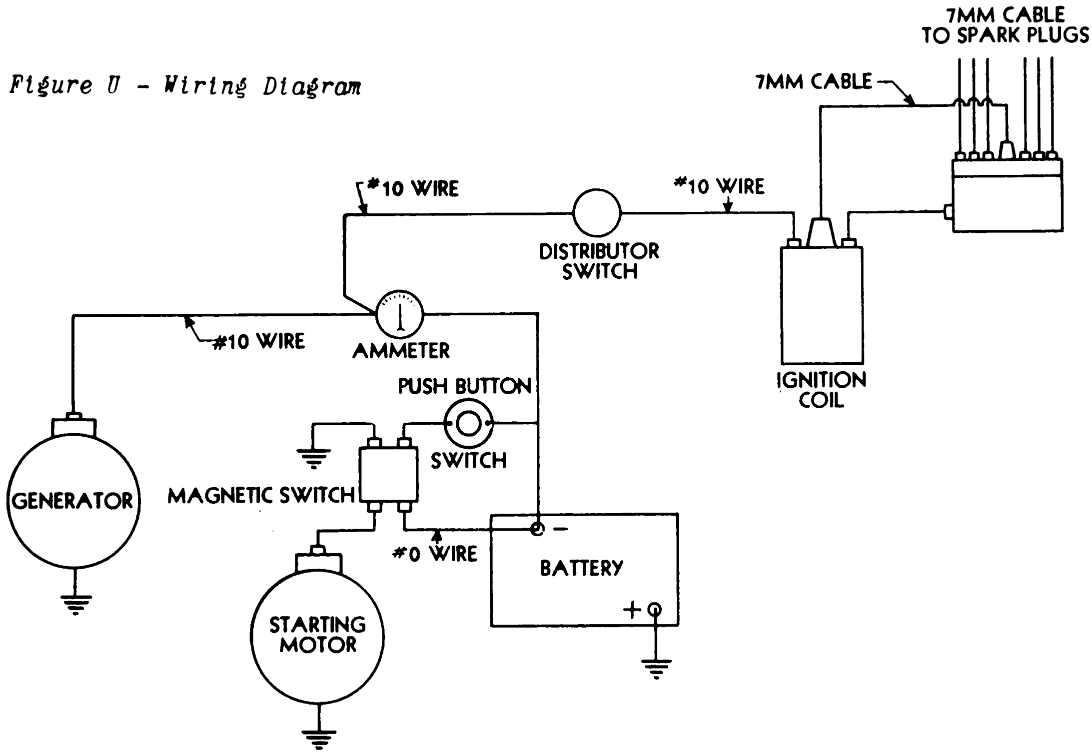
1. GENERAL DESCRIPTION AND SPECIFICATIONS

DESCRIPTION

Electrical equipment is costly. To prolong its life reduce replacement expense and lost time, reasonable care and periodic inspection is required. The following instructions are the result of actual field operations. If these instructions are followed, economical and trouble-free performance will be obtained.

The ignition, or electrical, system of this engine is made up of the following: starter, distributor, ignition coil, spark plugs, generator, voltage control unit, switches, battery, and ammeter.

Figure U - Wiring Diagram



DISTRIBUTOR IGNITION

The battery ignition system employs a distributor and coil. The distributor is so timed to the engine that the spark for the respective cylinders is delivered at the instant it is required. The condenser and coil together produce a high tension spark.

In the distributor housing is a pair of interrupter points operated by a six-lobe cam, a condenser and an automatic spark advance device. See Figure W. The interrupter points charge the coil by completing the circuit with the battery. (See the Wiring Diagram.) The condenser assists the coil in producing the high tension spark. The automatic spark advance works on the fly-ball principle; as the speed of the engine increases, the weights fly outward and advance the spark.

The starter is controlled by a magnetic switch which is operated by a remote control push button switch. The distributor has a key locked ignition switch; and the generator's charging of the battery is automatically regulated to increase or decrease, and stop by a voltage control unit. Under each unit of the electrical system will be found a detailed description and instructions for maintenance and repair.

The following specifications for each unit are here given for quick reference. See the descriptive matter for interpretation of specifications and instructions for maintenance and adjustments.

SPECIFICATIONS

STARTER

The starter is a Delco-Remy Model 718-R, Cranking Motor, 4 pole, 4 field, 6 volt unit, Bendix drive. The armature rotates in a grey iron bearing at commutator end and an oilless bushing in pinion housing.

Rotation: clockwise viewing drive end.

Brush Spring Tension: 24 to 28 ounces.

No Load: 6000 r.p.m. - 65 amperes - 5.0 volts.

Lock Torque: 15 lbs. - 570 amperes - 3.5 volts.

IGNITION COIL

The coil is a 6 volt Delco-Remy #528-C induction type.

SPARK PLUGS

AC #87. Gap setting approximate .025 inch.

GENERATOR

The generator is a Delco-Remy Model 1101671, 6 volt, 4-7/16 inch frame diameter, third brush unit, ball bearing in drive end, bronze bushing in the commutator end.

Rotation: clockwise viewing driving end.

Brush Spring Tension: 14-18 ounces.

Cold Output: 19 to 21 amperes at 8.35 to 8.50 volts at 1800 r.p.m.

Hot Output: 9 to 12 amperes at 7.35 to 7.65 volts at 2000 r.p.m.

Field Current (third brush lifted): 4.0 to 6.1 amperes at 6 volts.

VOLTAGE CONTROL UNIT

This control unit is a Delco-Remy Model 5864. It has two elements: the cut-out relay and the step voltage control.

CUT-OUT RELAY ELEMENT

Air Gap: .015 inch (points closed).

Point Opening: .020 inch.

Closing voltage: 6.3 to 6.0 volts.

STEP-VOLTAGE CONTROL ELEMENT

Air Gap: .035 inch.

Point Opening: .010 inch.

Contact Spring Tension: .5 to 1.1 ounce.

Armature Travel: .035 inch.

Points Open: 6.95 to 7.35 volts at 150° F.

Points Closed: 6.0 volts maximum at 150° F.

SWITCHES

For the cranking motor system:

One Delco-Remy 1549 Magnetic Switch

Maximum voltage to close switch: 4.7 volts

Current draw: 3.1 to 3.7 at 4.0 volts.

One Delco-Remy Model 1385 Push-button Switch.

Ignition Switch for Distributor:

One Briggs & Stratton Universal 2 post lock switch, key removable in off position only, Model 50704.

BATTERY

This is a 17 plate, 6.3 volt battery.

DISTRIBUTOR

The Delco-Remy Model 643-X ignition distributor has the following specifications:

Counter-clockwise rotation, viewing driving end.

Cam angle - 35°.

Contact point pressure - 17 to 21 ounces.

Contact point opening - .018 to .024 inches.

Manual adjustment - 15°.

Centrifugal advance starts - 2° Engine at 600 r.p.m.

Intermediate advance - 15° Engine at 1600 r.p.m.

Maximum advance - 24.0° Engine at 2550 r.p.m.

2. STARTER

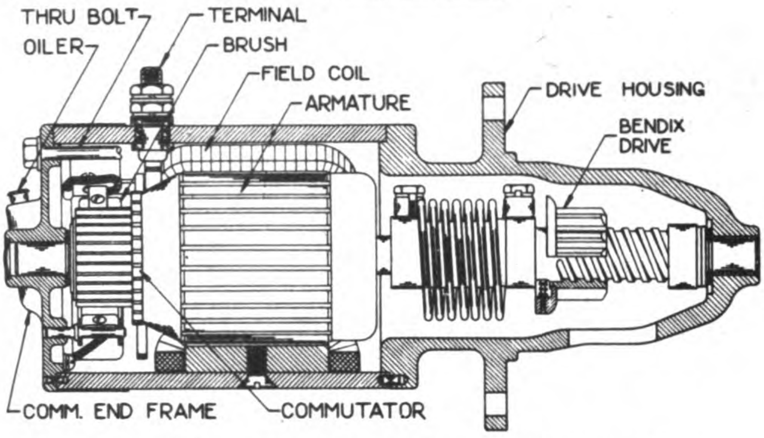


Figure V - Delco-Remy Starting Motor

The starter motor is mounted on the flywheel housing by a #1 S.A.E. flange. The Bendix drive, keyed to the armature shaft, automatically engages the cranking pinion with the flywheel gear when the armature begins to revolve as the magnetic switch is closed, thereby completing the circuit to the battery. When the engine fires, the overrunning effect of the flywheel on the pinion disengages it from the flywheel. See Figure V above.

STARTER MOTOR MAINTENANCE

With reasonable care at given intervals, the life of the starter motor can be prolonged indefinitely with trouble-free performance. Because operating conditions vary, the operator must use his good judgment as to the periods of normal maintenance when operating conditions are dusty or dirty, extremely hot, continuous, etc. The following, however, for most operating conditions, can be safely adhered to:

Every 50 Hours of Operation

Lubricate the bearings at the commutator end with 6 to 8 drops of light engine oil through the hinge cap oilers.

Inspect the brushes and commutator. Cover band must be removed for the inspection. If commutator is dirty, clean it with No. 00 sandpaper. Never use emery cloth. If commutator is rough, out of round, or has high mica, it should be turned down in a lathe and the mica undercut 1/32 inch. Worn brushes should be replaced. (See Generator Brushes, as same instruction for Generator brushes applies to starter motor brushes.) If brushes wear rapidly, check for excessive brush spring tension, roughness or high mica on the commutator. See spring tension specifications for starter motor on Page 438.

Every 2000 Hours of Operation

The starter motor should be disassembled for a thorough cleaning and inspection of all parts. The Bendix drive should be cleaned and oiled with a penetrating oil, as any accumulation of dirt on the drive restricts the free movement of the pinion. Never clean the armature or fields in any degreasing tank, or with grease dissolving material, since these may damage the insulation. The commutator should be trued in a lathe and mica undercut if necessary. Replace all worn parts. Check wiring and connections. Do not use acid flux in soldering electrical connections--only rosin flux must be used. Submit reassembled unit to No-Load and Torque Tests. See specifications of starter motor on Page 338. See instructions for No-Load and Torque Test included under Checking Starter Failure.

CHECKING STARTER FAILURE

If the cranking motor does not develop rated torque and cranks the engine slowly or not at all, check the battery, battery terminals and connections, and battery cables. Corroded, frayed, or broken cables should be replaced and loose or dirty connections corrected. Do not replace cables with new ones of smaller diameter as this cuts down the amount of energy to the starting motor thus reducing cranking power. The cranking motor switch should be checked for burned contacts and the switch contacts cleaned or replaced if necessary.

If all these are in order, remove the cover band of the cranking motor and inspect the brushes and commutator. The brushes should form good contact with the correct brush spring tension. A dirty commutator can be cleaned with a strip of No. 00 sandpaper held against the commutator with a stick while the cranking motor operates. NEVER USE EMERY CLOTH TO CLEAN COMMUTATOR. If the commutator is very dirty, or burned, or has high mica, remove the armature from the cranking motor and take a cut off the commutator in a lathe. The mica should be undercut to a depth of 1/32".

If there are burned bars on the commutator, it may indicate open circuited armature coils which will prevent proper cranking. Inspect the soldered connections at the commutator riser bars. An open armature will show excessive arcing at the commutator bar which is open, on the no-load test.

Tight or dirty bearings will reduce armature speed or prevent the armature from turning. A worn bearing, bent shaft, or loose field pole screws will allow the armature to drag on the pole shoes, causing slow speed or failure of the armature to revolve. Check for these conditions.

If the brushes, brush spring tension and commutator appear in good condition, the battery and external circuit found satisfactory, and the cranking motor still does not operate correctly, it will be necessary to remove the cranking motor for no-load and torque checks.

NO-LOAD TEST

Connect the cranking motor in series with a battery of the specified voltage and an ammeter capable of reading several hundred amperes. If an r.p.m. indicator is available, read the armature r.p.m. in addition to the current draw.

TORQUE TEST

For a torque test, a high capacity, direct current ammeter, volt meter, storage battery, cable, torque arm, and a spring balance are needed.

Fasten torque arm securely to starter motor shaft. Motor should be clamped rigid to a work bench. Hook spring balance scale to torque arm exactly twelve inches from the center of the motor shaft. Connect the high capacity ammeter in series with the motor, battery, and the volt meter, from the starter terminal to the ground. A single pole knife switch for the convenience of closing the circuit may be used. With circuit closed (current flows through starter motor) a reading can be obtained from the spring balance in pounds, and the current draw from the ammeter, and the voltage from the volt meter. Compare these readings of the test with the specifications.

Caution: Do not continue test longer than necessary, as the motor heats up rapidly on this test.

INTERPRETING RESULTS OF NO-LOAD AND TORQUE TESTS

1. Rated torque, current draw and no-load speed indicates normal condition of cranking motor.

2. Low free speed and high current draw with low developed torque may result from:

   a. Tight, dirty, or worn bearings, bent armature shaft or loose field pole screws which would allow the armature to drag.

   b. Shorted armature. Check armature further on growler.

   c. A grounded armature or field. Check by raising the grounded brushes and insulating them from the commutator with cardboard and then checking with a test lamp between the insulated terminal and the frame. If test lamp lights, raise other brushes from commutator and check fields and commutator separately to determine whether it is the fields or armature that is grounded.

3. Failure to operate with high current draw:

   a. A direct ground in the switch, terminal or fields.

   b. Frozen shaft bearings which prevent the armature from turning.

4. Failure to operate with no current draw:

   a. Open field circuit. Inspect internal connections and trace circuit with a test lamp.

   b. Open armature coils. Inspect the commutator for badly burned bars. Running free speed, an open armature will show excessive arcing at the commutator bar which is open.

   c. Broken or weakened brush springs, worn brushes, high mica on the commutator, or other causes which would prevent good contact between the brushes and commutator. Any of these conditions will cause burned commutator bars.

5. Low no-load speed, with low torque and low current draw indicates:

   a. An open field winding. Raise and insulate ungrounded brushes from commutator and check fields with test lamp.

   b. High internal resistance due to poor connections, defective leads, dirty commutator and causes listed under 4.c. above.

6. High free speed with low developed torque and high current draw indicates shorted fields. There is no easy way to detect shorted fields, since the field resistance is already low. If shorted fields are suspected, replace the fields and check for improvement in performance.

3. DISTRIBUTOR

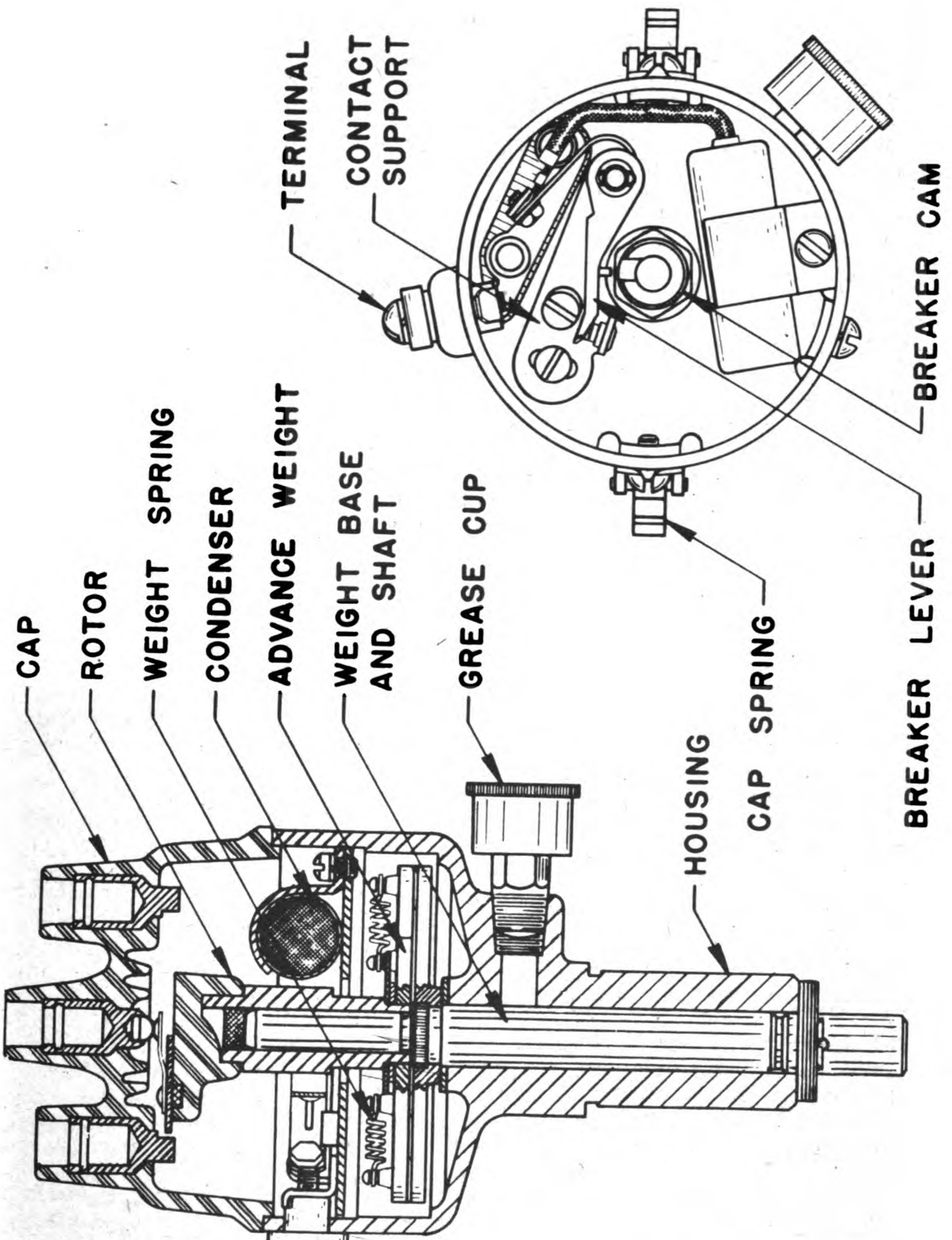


Figure W

Distributor (Continued)

With periodic inspection and reasonable care, the life of this distributor will be long and trouble-free. As has been indicated, operating conditions vary, therefore periods of inspection and maintenance must be left to the operator's judgment. However the following intervals are suggested:

Every 100 Hours

Keep the grease cup filled with wheel bearing grease.

Add a drop of oil to the breaker cam and put a few drops of oil on the wick in the camshaft under the rotor. Also inspect the contact points, rotor, and cap. See Figures W. Replace the cap or rotor if they are cracked or show carbonized paths indicating the secondary current is leaking to a ground over the surface of the Bakelite. If the contact points are burned or pitted, they should be replaced or dressed with a clean, fine cut contact file. The file should not be used on other metals and should not be allowed to become greasy or dirty. NEVER USE EMERY CLOTH TO CLEAN CONTACT POINTS. Contact surfaces, after considerable use, may not appear bright and smooth but this is not necessarily an indication that they are not functioning satisfactorily.

Oxidized contact points may be caused by high resistance, or loose connections in the condenser circuit, oil or foreign materials on the contact surfaces - most commonly, high voltage in the primary circuit is the cause. Check for these conditions where burned contacts are experienced.

CHECKING IGNITION FAILURE

In the case of defective ignition, it must be first determined whether the fault is in the distributor or elsewhere. In general, when only one cylinder misfires, the fault is in the spark plug. See information under Spark Plugs.

Misfiring of one cylinder may be due to a chafed or broken cable or loose cable connection. The metal terminals of the cable must not come in contact with any metal parts of the engine except those connections for which they are designated. If the cable and plugs are in good condition, the trouble is probably with the distributor, coil, or condenser.

3 SERVICE ADJUSTMENTS

Checking and Adjusting the Contact Point Opening

The contact point opening must be set to the proper limits. Points set too closely may tend to burn and pit rapidly. Points with excessive separation tend to cause a weak spark at high speed. The point opening of new points may be checked with a feeler gauge. However, do not use a feeler gauge on used points, since the roughness of used points make it impossible to set the point opening correctly by this method. To check the point opening of used points, use a dial indicator or a contact angle meter. The cam or contact angle is the angle in degrees of cam rotation through which the points remain closed. This angle increases with decreased point opening. As the rubbing block of a new breaker arm wears in rounding the corners of the rubbing surface, contact angle increases. Therefore, with a new arm, set the contact angle about 3° less than with an arm worn by many hours of operation. The angle given in the test specifications is subject to a variation of 2°, plus or minus, depending upon these conditions.

The contact point pressure must fall within the limits given. Weak tension will cause point chatter and ignition miss at high speed, while excessive tension will cause undue wear of the contact points, cam, and rubbing block.

NOTE: The use of the synchroscope is recommended for with it you can accurately check cam angle, spark advance, and synchronization on distributors removed from the engine. The synchroscope will also show excessive distributor shaft eccentricity as indicated by variation in synchronization.

After a distributor has been repaired, the calibration of the centrifugal automatic mechanism should be checked. Proper engine performance cannot be obtained unless the centrifugal curve is within the limits specified for the engine.

Checking the Condenser

Four factors affect condenser performance and each factor must be considered in making any condenser test.

BREAKDOWN results in the failure of the insulating material, a direct short between metallic elements of the condenser. This prevents any condenser action.

LOW INSULATION RESISTANCE or leakage prevents the condenser from holding a charge. A condenser with low insulation resistance is said to be weak. All condensers are subject to leakage which up to a certain limit is not objectionable. When it is considered that the ignition condenser performs its function in approximately 1/12,000 of a second, it can be said that leakage can be large without detrimental effects. Nevertheless, leakage must be considered in any condenser test.

HIGH SERIES RESISTANCE is excessive resistance in the condenser circuit due to broken strands in the condenser lead or to defective connections. This will cause burned contact points and ignition failure upon initial start and at high speeds.

CAPACITY is built into the condenser and is determined by the area of the metallic elements and the insulating and impregnating materials.

NOTE: For a complete check of the condenser, it is desirable to use a tester which will check for the above four conditions. The United Motors Service Four-Way Condenser Tester is one instrument which will check condensers for each of these four factors.

To test the condenser without an instrument, 110 volt alternating current and a test light is required. To charge the condenser, place one test prong on the condenser lead, and the other on the case. Then short circuit or discharge the condenser by touching the condenser lead to the case A small blue spark will occur between the condenser case and the condenser lead if the condenser is in good condition. Due to the characteristics of alternating current, it may be necessary to repeat the procedure several times before the spark occurs. If no spark occurs, the condenser should be replaced, or if the light glows when charging the condenser, the condenser is shoryed and must be replaced.

TIming the Distributor

Turn the engine with hand crank until the piston in cylinder No. 1 moves upward on the compression stroke so that the top dead center line on the flywheel is centered in the timing hole of the flywheel housing.

Set the distributor so that the points just start to open. Tighten the distributor bracket so the distributor cannot turn in the bracket.

4. Coil

The best way to check the coil without instruments is to remove one spark plug wire from the plug while the engine is running, and hold the terminal close to the cylinder head. A coil in good condition will produce a spark that will jump a gap 3/8 of an inch. The spark should be "fat" and blue - not "stringy" and yellow.

5. SPARK PLUGS

The most common spark plug difficulties are: gap too wide and plug short circuited.

The proper distance between the electrodes is .025 inch. Too wide a gap increases its resistance and interferes with the operation of the engine at low speeds causing engine to miss and difficult to start. Always adjust the outside electrode, never the center one.

The spark has a tendency to burn the electrode, thereby gradually increasing the gap. Therefore it is important to check the spark plug gaps every 60 hours of operation.

A short circuit in the plug is usually caused by a cracked or porous insulator, or by fouling of the electrode or insulator. Any of these conditions will cause misfiring by permitting the current to stray from its intended path.

6. GENERATOR

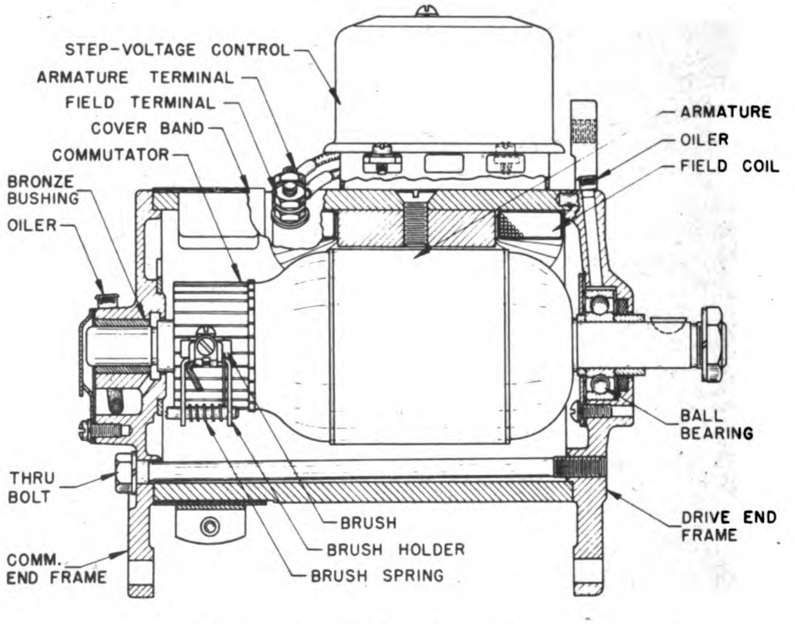


Figure Y - Delco-Remy Generator

GENERATOR MAINTENANCE AND INSPECTION

In order that normal service may be obtained from the generator with a minimum of trouble, a regular inspection and maintenance procedure should be followed.

Because operating conditions vary, the operator must use his good judgment when these periods of inspection and maintenance should occur. The following periods are suggested. (See Figure Y.)

Every 50 Hours of Operation

The two hinge cap oilers should be supplied with 6 to 8 drops of light engine oil. Do not oil excessively.

Remove cover band and inspect commutator and brushes. If commutator is dirty, clean with No. 00 sandpaper. NEVER USE EMERY CLOTH. All dust must be blown from generator. If commutator is rough or out of round or has high mica (the insulation material between the copper bars), remove the generator from engine and disassemble the armature from the generator. Turn commutator down in a lathe, removing only sufficient material to true up commutator and remove roughness and high mica. Undercut the mica 1/32 inch. (See reinstallation caution.)

Check the brush spring tension. Excessive spring tension causes commutator and brushes to wear rapidly. Low spring tension will cause reduced generator output, and arcing and burning of commutator and brushes. Check pigtail lead connections at the brushes to see that they are tight. A poor connection in the charging circuit will cause generator to build up excessive voltage which may result in burned field or armature windings. To replace worn brushes, see information under Generator Brushes.

Every 2,000 Hours of Operation

The generator should be removed from engine and disassembled for a thorough cleaning and inspection of all parts. Never clean the armature or fields in any degreasing tank. The ball bearings should be cleaned and repacked with a good grade of ball bearing grease. All worn parts replaced. If necessary, the commutator should be trued in a lathe and the mica undercut. Check all wiring and connections. Use only rosin flux in making all soldered connections. Acid flux must never be used on electrical connections.

REINSTALLATION CAUTION

After the generator is reinstalled on the engine, or at any time after leads have been disconnected and then reconnected to the generator, a jumper lead should be connected momentarily between the BATTERY and ARMATURE terminals of the regulator before starting the engine. This allows a momentary surge of current from the battery to the generator which correctly polarizes the generator with respect to the battery it is to charge.

CHECKING GENERATOR FAILURE

1. No Output. Remove cover bands and check for sticking or worn brushes and burned commutator bars. Burned bars, with other bars fairly clean, indicate open circuited coils. If brushes are making good contact with commutator, and commutator looks okay, use test leads and light, and check as follows:

a. Raise grounded brush (brush with wire connected to generator case). Check with test points from armature terminal ("A") to frame. Testing light should not glow. If it does, the generator is grounded; to locate ground, raise other brush or brushes from commutator and with one test lead on frame, check with the other test lead, first, the field terminal ("F"); second, the commutator; third, the brush holder. Testing light should not glow. NOTE: During the foregoing procedure, make certain the voltage control points in control unit are closed, so circuit is not open. Do not run or test generator on open circuit. To do so may destroy regulator or generator.

Ground field terminal. Place one test lead on the brush not grounded (one without the wire to generator case), the other test lead on the negative (-) pole of battery. Testing lamp should glow.

c. If the field is not open, check for shorted field. Repeat same hook-up as in Paragraph b, but instead of testing lamp, use an accurate ammeter. Field draw at 12 volts should be 1.25 to 1.45 amperes. Excessive current draw indicates shorted field. If an ammeter is not available, during step (b) the short will be indicated by testing light glowing very brightly.

d. If trouble has not been located, remove generator from engine and take out armature and check with growler for short circuit.

2. Unsteady or Low Output:

a. Check drive belt tension.

b. Check brush spring tension and brushes for sticking.

c. Inspect commutator for roughness, grease and dirt, dirt in slots, high mica, out of round, burned bars. With any of these conditions, the commutator must be turned down in a lathe and the mica undercut. In addition, with burned bars which indicate open circuit, the open circuit condition must be eliminated or the armature replaced.

3. Excessive Output. Excessive output usually results from a grounded generator field--grounded either internally or in the regulator (control unit). Opening the field circuit (disconnecting lead from field terminal of regulator or generator) with generator operating at a medium speed will determine which unit is at fault. If the output drops off, the voltage control unit is causing the condition. If output remains high, the field is grounded in the generator, either at the pole shoes, leads, or at the field terminal.

4. Noisy Generator. Noisy generator may be caused by loose mounting or drive pulley, or worn, dry or dirty bearings, or improperly seated brushes. (See Brush Replacement.)

GENERATOR BRUSHES

The positions of the brushes should remain as originally set at the factory where careful test runs are made and brush positions are correctly determined. These positions should not be disturbed because the current and voltage regulator automatically adjusts increase or decrease flow of the current, except where there is a third brush. If it is necessary to remove brush rigging for replacement, mark its position before removing.

Good brush contact is necessary for efficient generator performance. Keep commutator clean with No. 00 sandpaper--never use emery cloth. Brushes must move freely in their holders with proper spring pressure. When brushes are new and full length, they are usually under enough spring pressure if the spring is in the first notch of brush lever. As brushes wear shorter, it may be necessary to move the spring one or two notches. Excessive arcing at the brushes can be due to improper spring pressure, brushes sticking in holder, extremely short brushes, rough or eccentric commutator, overloaded generator and an overloaded high speed condition. Any or all such causes should be corrected, to avoid the melting of solder from the commutator which may cause an open circuit in the armature winding or damage brush holder and bracket.

BRUSH REPLACEMENT PROCEDURE

After cover band has been removed, remove screws to which brush pigtails are attached. Remove the worn brushes and clean commutator with No. 00 sandpaper--do not use emery cloth. Place the new brushes in their holders and connect brush pigtails. To seat brushes properly, cut a strip of No. 00 sandpaper slightly wider than the brush. Slip under one brush at a time. (Where there is a third brush, this and the adjacent main brush can be seated at the same time.) With the abrasive side against the brush and the brush at its proper spring tension, draw the paper back and forth in downward motions about twelve times, making certain that the entire face of brush is being ground. Do not grind excessively! Blow out the dust and examine both edges of the brush to see that they are touching the commutator properly.

Before replacing cover band, fold brush "pigtail" wires down so that they will not touch the band. They must not touch any metal except that of the brush holder to which they are attached. This precaution prevents a short or ground at the generator. The connection screws attaching the brush pigtails to the holders must be tight.

GENERATOR THIRD BRUSH ADJUSTMENT

The output of this generator may be increased or decreased by adjusting the third brush. The generator should be hot when adjustment is made. The hot output setting should not exceed 12 amperes at 2000 r.p.m.--the normal operating r.p.m. is 1400 to 1500 r.p.m., so at these speeds the ammeter readings will be slightly lower.

To increase output, move the third brush in direction of the armature rotation; to lower output, move brush in opposite direction. The generator output should be checked and adjusted to the specified setting with an accurate ammeter. Battery should be fully charged (Hydrometer reading 1.250 or over) for checking. If not fully charged, a 1/4 ohm variable resistance should be inserted into circuit. If battery is fully charged ammeter should be inserted between armature terminal and battery lead. If battery is low (1.250 to 1.230), the 1/4 ohm variable resistance should be inserted between the ammeter and battery lead with the ammeter hooked in at the armature terminal. NOTE: Make certain that the contact points in the Step-Voltage control are closed so circuit is grounded; else circuit is open and no adjustment can be made. See heading "Step-Voltage Control".

7. VOLTAGE CONTROL UNIT

Mounted on the generator enclosed in the same case cover are two elements of the control unit performing different functions. See Figure Z below.

The cut-out relay prevents the battery from discharging back through the generator whenever engine is stopped or is not running fast enough for the generator to charge. It is entirely automatic in action.

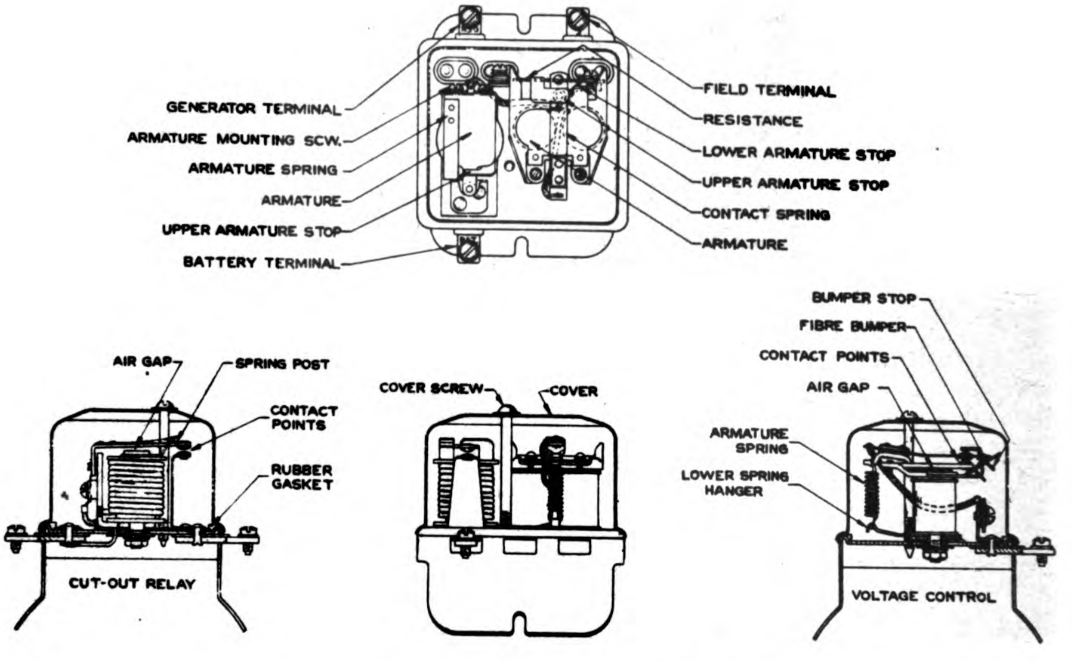


Figure Z - Step-Voltage Control Unit

Likewise is the step-voltage control automatic in permitting full generator output (as set by adjusting the third brush), when the battery is low and cutting down the output to a low value so battery overcharge can be avoided.

MAINTENANCE

The cut-out relay should have an inspection every 1,000 hours to see that contact points are clean and properly adjusted. (See Specifications and Figure Z.) If adjustment is necessary:

(1) Set air gap between armature and core to .015". Then set the contact point opening to .020" by bending the armature stop.

(2) Connect a voltmeter between the generator terminal of the control unit and ground.

(3) Adjust the relay so the points will close when the generator voltage reaches 6.3 to 6.9 volts by raising or lowering the spring post. Raising the spring post increases the closing voltage.

(4) With an accurate ammeter in the charging circuit, the relay points should open when the ammeter reads between 0-3.0.

The step-voltage control should also be inspected every 1,000 hours of operation for clean points and proper adjustment.

Check the opening and closing of the contacts. With the voltage control at operating temperature (150°F.), connect a test voltmeter between the "BAT" terminal and the voltage control base. Connect a 1/4 ohm variable resistance into the charging circuit at the same terminal. Slowly increase generator speed. If step-voltage control points do not open, cut in resistance. Voltage at which points open should be 6.95 to 7.35 volts at 150°F. Cut-out resistance or reduce generator speed. Voltage at which points close should be 6.0 volts at 150°F.

Closing voltage adjustment. Adjust closing voltage by adjusting air gap. Bend the lower armature stop down to decrease the air gap and lower the closing voltage. Bend up to raise the closing voltage. The foregoing can be called electrical checks and adjustments because the necessary test equipment measures the electrical energy.

CHECKS AND ADJUSTMENTS (Mechanical):

The contact point pressure should be .5 to 1.1 ounces and is measured with a spring gauge hooked to the flat spring which carries the upper contact, at the contact point. Check pull required to separate points. Adjust by bending flat spring.

The air gap is checked by pushing the armature down against the lower armature stop and measuring between the armature and core. Adjust by bending the lower armature stop.

The armature travel is checked between the armature and the lower armature stop and is adjusted by bending the upper armature stop.

The point opening check is made with the armature held down against the lower armature stop and is adjusted by bending the contact spring post.

No maintenance other than inspecting and cleaning of contacts is necessary.

8. MAGNETIC SWITCH

The Magnetic Switch is a 6-volt unit used in the cranking motor to battery circuit. It is operated by a remote control push button which, when the contacts are closed, energizes the magnetic switch and closes the switch contacts. See Figure AA below, and Specifications, page 439.

The switch mounting should be well grounded. If mounting is made on an insulated surface, a ground lead should be connected from one of the mounting screws to a convenient ground.

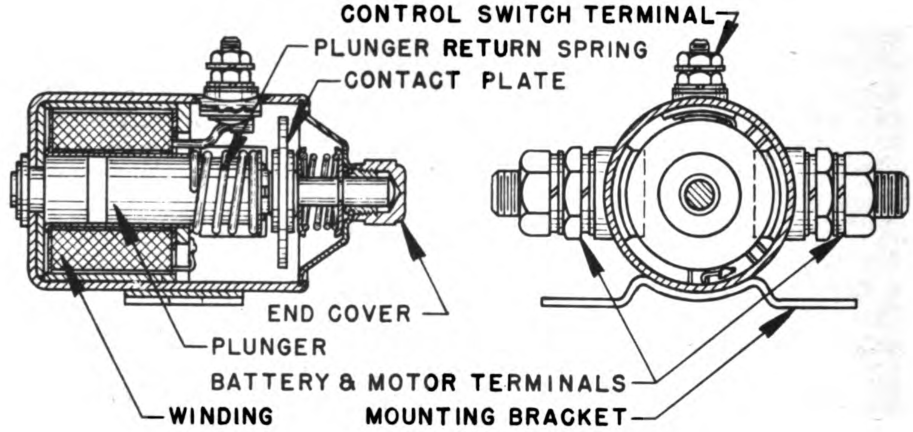


Figure AA - Magnetic Switch

9. REMOTE CONTROL PUSH BUTTON

The Model 1385 Delco-Remy Remote Control Push Button requires no attention other than checking the terminal connections occasionally to make sure they are tight and clean. See Figure BB below.

Figure BB

Push Button

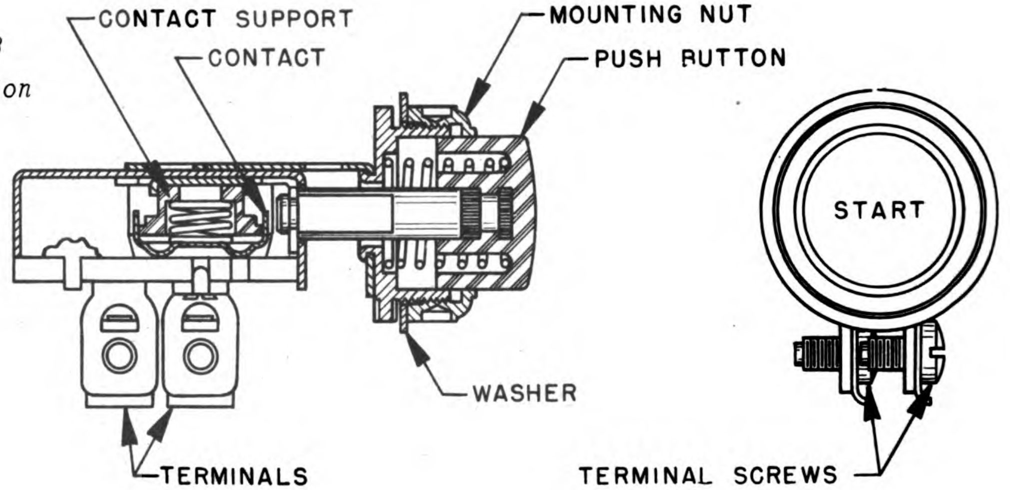
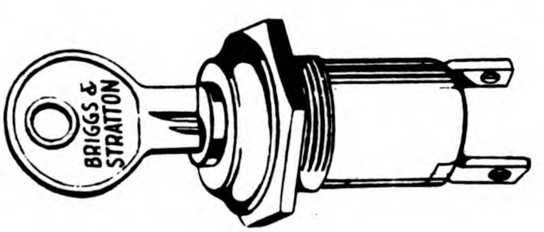


Figure CC

Ignition Switch



10. STORAGE BATTERY

The storage battery requires frequent and systematic attention. Its neglect is costly. In general, follow the instructions from the battery manufacturer for best results.

INSPECTION AND CARE OF STORAGE BATTERY

Inspect the battery every 100 operating hours. Do not allow the surface of the electrolyte to get below the top of the separators. Keep it above by regularly adding sufficient clean distilled water as often as is necessary. Do not fill higher than just below the bottom of the filling tube. Never add acid to the battery.

Keep terminals tight and clean. If they show tendency to corrode, clean and apply a thin coat of vaseline to protect them from the acid. Keep the outside of the batteries clean. Neutralize any electrolyte that may be on the metal surfaces with a cloth saturated with ammonia or bicarbonate of soda solution (one pound of soda to one gallon of water), then wash off with water and dry.

At least once a month test the specific gravity of each cell with a hydrometer. A reading of 1.250 to 1.285 indicates fully charged, 1.230 half charged, and 1.150 dead. Never take a reading shortly after adding water. CAUTION: Do not allow battery to stand in the discharged state. It may become ruined by sulphation.

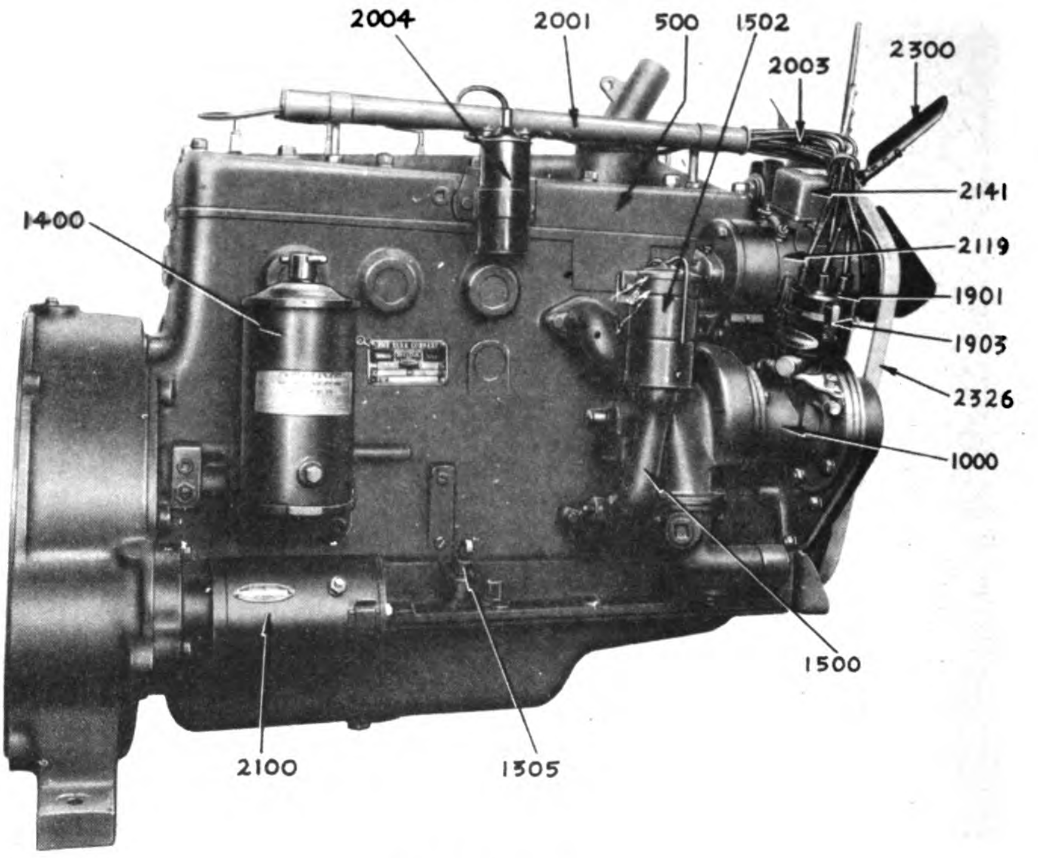
If the battery requires frequent addition of water and is gassing excessively have it tested. If in good condition, it is undoubtedly due to overcharging. Decrease the charging rate to avoid damage to the battery. If one or more cells continually require more water than others, it is an indication of a damaged cell which should be checked by the local battery service station.

COLD WEATHER CARE

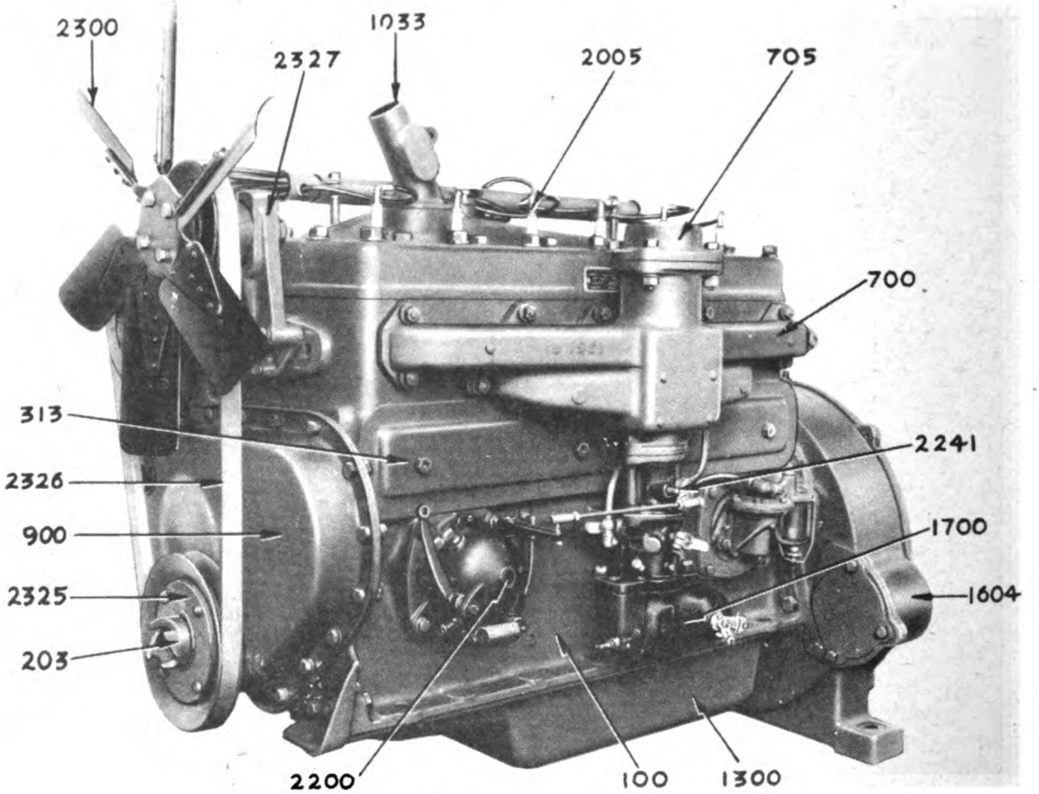
It is especially important in cold weather to test the specific gravity. A battery freezes between the temperatures 20 degrees above zero and 50 degrees below zero depending on the state of its charge. Do not add water after shutting down for the night. It will freeze quickly. See that it gets a charge after adding water.

ENGINE PARTS LIST

PARTS LIST
GRAPHIC INDEX



Right Side



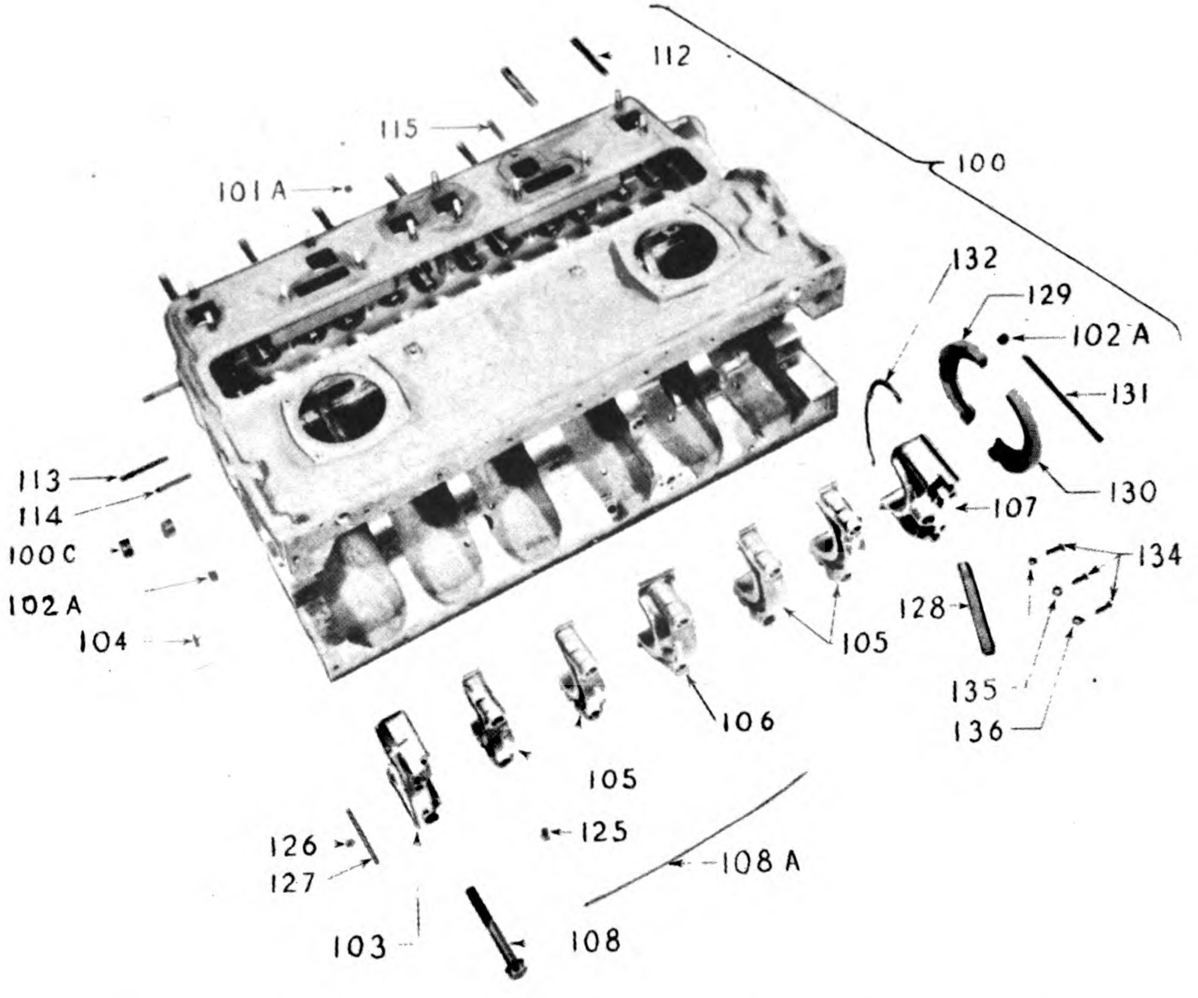
Left Side

INDEX

Buda Engine HP-351

B-G Specification EN-B-N9

CYLINDER AND CRANKCASE



NOTE: **Main bearings can be furnished in standard or the undersize listed below. Be sure to specify the size required. Unless otherwise stated standard main bearings will be furnished.**

When cylinder and crankcase assemblies are sent in for reboring BE SURE TO REMOVE ALL MAIN BEARINGS, VALVES, etc. before shipping. We will not be responsible for their loss or damage. All rebored cylinders will be returned without main bearings or valve and lifter assemblies, but will be fitted with new pistons rings and piston pins, and camshaft bearings.


101

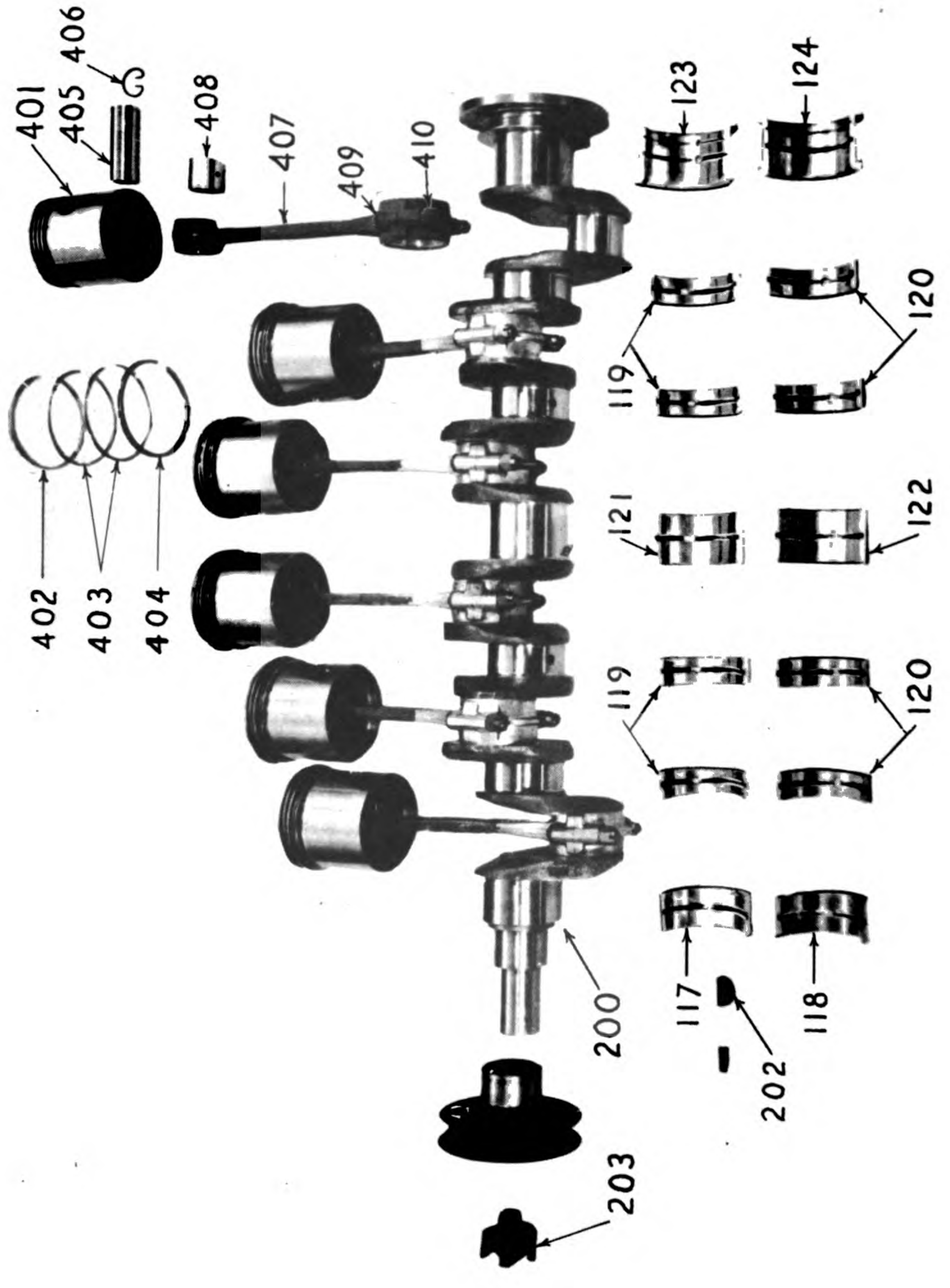

102


109


110


111

(See Reference Numbers on next page)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117
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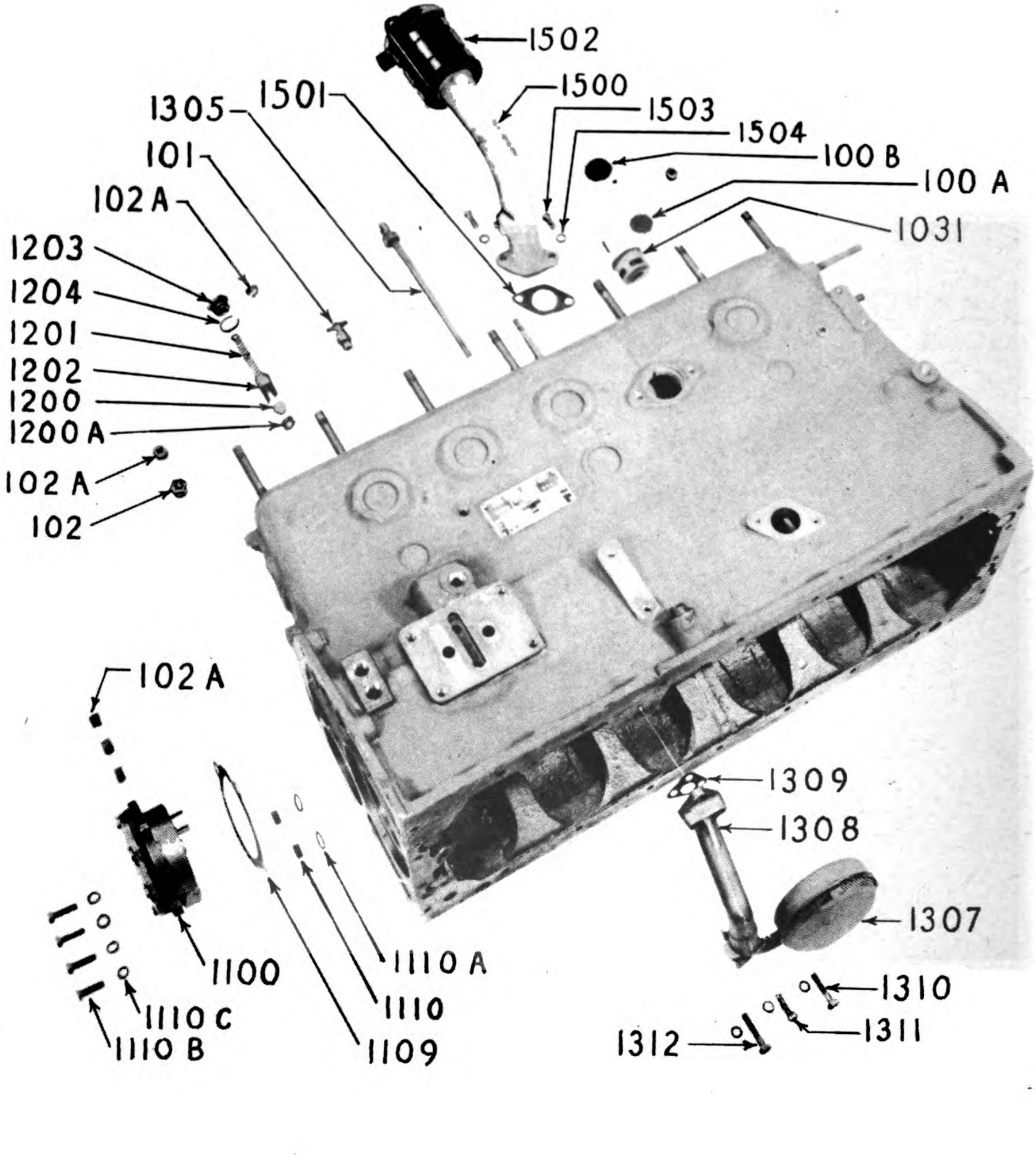
202
203

CRANKCASE OIL

CIRCULATING PARTS



CYLINDER AND CRANKCASE (Continued)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
100	1	H-12398	Cylinder and crankcase assembly (Includes all items thru Ref. No. 116)
100-A	5	103895	Cylinder expansion plug 1-1/4"
100-B	1	103896	Cylinder expansion plug 1-1/2"
100-C	2	103875	Water jacket pipe plug 3/4"
101	1	H-11175	Water jacket drain cock
	1	103877	Oil pressure gauge pipe plug 1/8"
102	1	1034	Oil pressure gauge connection
102-A	8	DE-4870	Cylinder pipe plug 3/8"
103	1	H-12288	Front bearing cap
104	1	2034	Front bearing retainer screw
105	4	1005	Intermediate bearing cap
106	1	1004	Center bearing cap
107	1	H-11951	Rear bearing cap
108	14	1018	Main bearing cap capscrew
108-A	7	DE-5476	Main bearing cap capscrew lockwire
109	1	DE-51302	Camshaft front bearing
110	2	DE-56103	Camshaft intermediate bearing
111	1	H-12295	Camshaft rear bearing
112	22	1083	Cylinder head stud
113	2	1655	Fan bracket stud - long
114	1	1656	Fan bracket stud - short
115	14	3943	Intake and exhaust manifold stud
116	4	1357	Valve cover stud
	1	5654	Fan bracket stud
	1	H-11704	Complete set of engine gaskets

117

119

121

123

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124

NOTE: All main bearings as listed below are sold in pairs only consisting of upper and lower halves.

117&118	1	1022-23	Front bearing-upper and lower -Standard
117&118	1	1022-23A	Front bearing-upper and lower-.010" Undersize
117&118	1	1022-23B	Front bearing-upper and lower-.020" Undersize
117&118	1	1022-23C	Front bearing-upper and lower-.030" Undersize
117&118	1	1022-23D	Front bearing-upper and lower-.040" Undersize
119&120	4	1024-25	Intermediate bearing upper and lower Standard
119&120	4	1024-25A	Intermediate bearing upper and lower .010" Undersize
119&120	4	1024-25B	Intermediate bearing upper and lower .020" Undersize
119&120	4	1024-25C	Intermediate bearing upper and lower .030" Undersize
119&120	4	1024-25D	Intermediate bearing upper and lower .040" Undersize

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
121&22	1	1026-27	Center bearing -upper and lower - Standard
121&22	1	1026-27A	Center bearing -upper and lower - .010" Undersize
121&22	1	1026-27B	Center bearing -upper and lower -.020" Undersize
121&22	1	1026-27C	Center bearing- upper and lower -.030" Undersize
121&22	1	1026-27D	Center bearing -upper and lower -.040" Undersize
123&24	1	1028-29	Rear bearing -upper and lower-Standard
123&24	1	1028-29A	Rear bearing -upper and lower-.010" Undersize
123&24	1	1028-29B	Rear bearing -upper and lower-.020" Undersize
123&24	1	1029-29C	Rear bearing -upper and lower-.030" Undersize
123&24	1	1028-29D	Rear bearing -upper and lower-.040" Undersize

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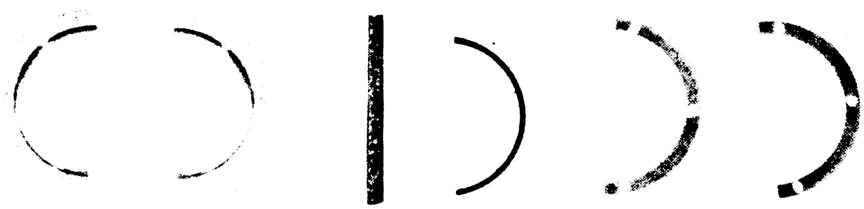
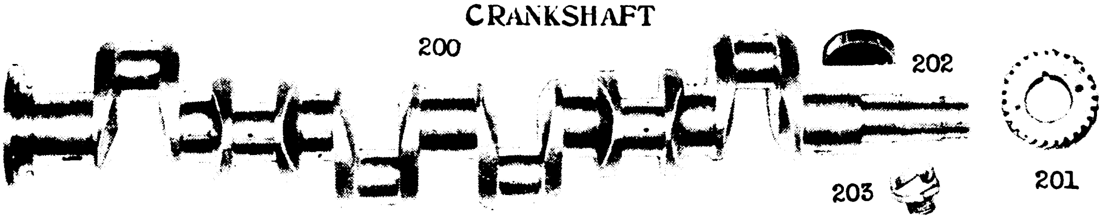


129 130 131 132 133 134

125	7	1030	Main bearing dowel
126	2	H-12289	Front bearing oil stop - short
127	4	H-11950	Main bearing oil stop - long
128	1	DE-55139	Rear bearing cap tube
129	1	DE-56131	Rear bearing oil seal - upper
130	1	DE-56131	Rear bearing oil seal - lower
131	2	DE-56165	Rear bearing oil seal felt
132	2	1561	Rear bearing oil seal gasket - light
133	2	1438	Rear bearing oil seal gasket - heavy
134	6	1560	Rear bearing oil seal capscrew

CRANKSHAFT

200 202

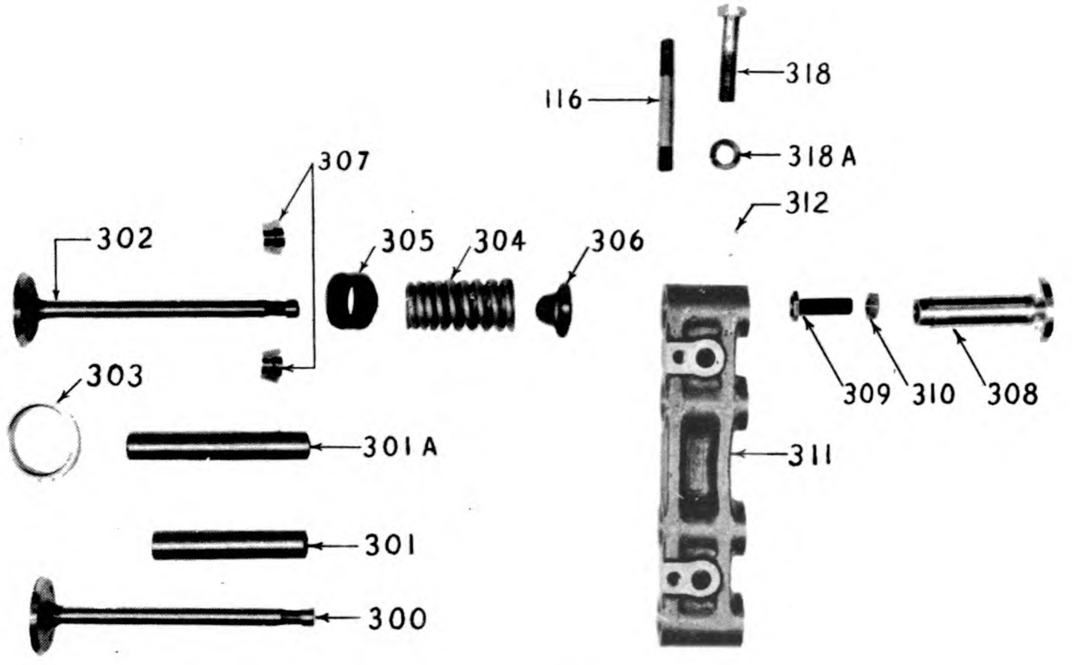


203 201

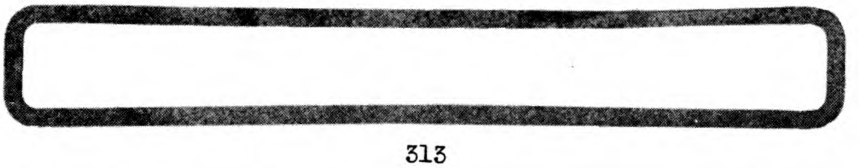
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
200	1	DE-51184	Crankshaft
201	1	H-12092	Crankshaft gear See Note below
202	1	113879	Crankshaft gear key #D
203	1	H-12245	Crankshaft jaw

NOTE: Timing gears are matched sets of camshaft, crankshaft, and idler gears. The end of face is marked to indicate standard (S), oversize (⊕), or undersize (U). The figure in circle or "U" indicates change from standard pitch diameter in thousandths of an inch. In ordering replacement, specify symbol and figure on old gear.

VALVE, LIFTER AND COVER



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
300	6	1310	Intake valve
301	6	1345	Intake valve guide
302	6	3312	Exhaust valve
303	6	3230	Exhaust valve seat
301A	6	1315	Exhaust valve guide
304	12	H-12329	Valve spring
305	12	H-11807	Valve spring seat - upper
306	12	H-11805	Valve spring seat - lower
307	24	H-12280	Valve spring retainer - halves
308	12	H-11731	Valve lifter
309	12	2313	Valve lifter adjusting screw
310	12	1304	Valve lifter adjusting screw nut
311	3	H-11730	Valve lifter bracket



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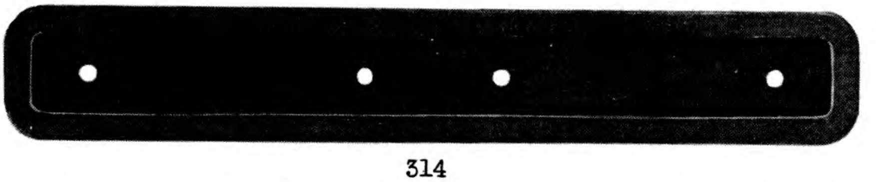

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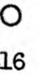

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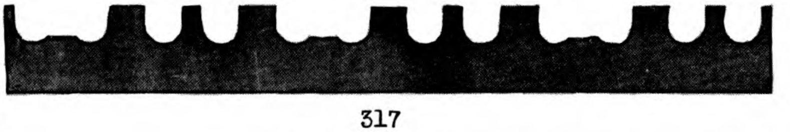


317

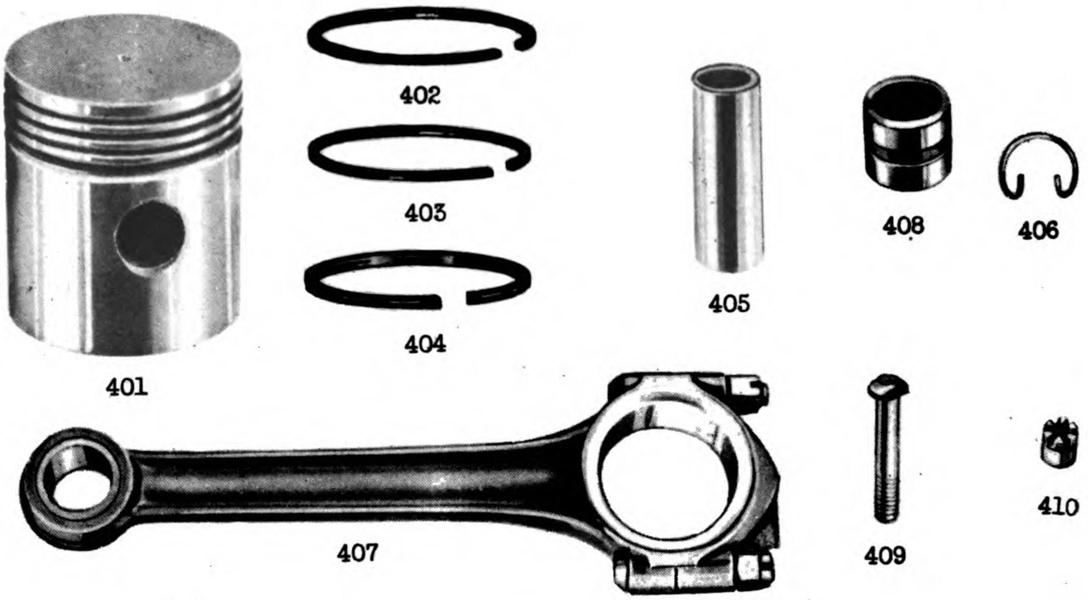
(See Reference Numbers on next page)

VALVE LIFTER AND COVER (Continued)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
318	6	100137	Valve lifter bracket capscrew 3/8"-16 x 1-3/4"
312	6	1305	Valve lifter bracket capscrew dowel
318-A	6	103321	Valve lifter bracket capscrew lock-washer 3/8"
313	1	1070	Valve cover plate
314	1	1033	Valve cover plate gasket
315	4	2065	Valve cover plate stud nut
316	4	1359	Valve cover plate stud nut gasket
317	1	1346	Valve chamber baffle plate

PISTON AND CONNECTING ROD

NOTE: Pistons are only supplied fitted with piston pins and can be furnished in the following stock sizes: Standard .010", .020", .030", .040" oversize and semi-finished. Semi-finished pistons leave our factory completely machined with the exception of the outside diameter, which has 1/16" or more stock for grinding to the desired size.



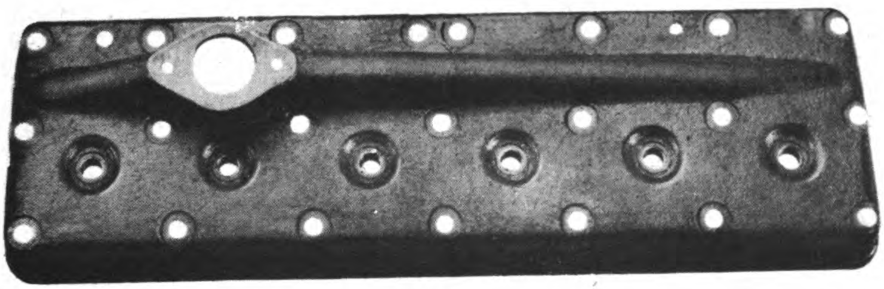
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	6	H-12478	Piston assembly (Includes all items through Ref.No. 406)
401	6	H-12355-P	Piston fitted with pin
402	6	H-11561	Piston ring - top
403	6	4508	Piston ring - second
403	6	4508	Piston ring - third
404	6	3208	Piston ring - lower (Piston ring stock sizes, standard, .010", .020", .030" and .040" oversize)
405	6	1225	Piston pin (Piston pin stock sizes, standard .005", .010", .015", and .020" oversize)
406	12	RSE-155	Piston pin retaining spring

PISTON AND CONNECTING ROD (Continued)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
407	6	1266	**Connecting rod assembly (Includes bushings, bearings, bolts and nuts)**
408	6	1253	**Connecting rod bushing**
409	12	1261	**Connecting rod bolt**
410	12	1255	**Connecting rod nut**

NOTE: Connecting rods are fitted with bearings spun directly in the rod and cannot be replaced separately.

CYLINDER HEAD



500

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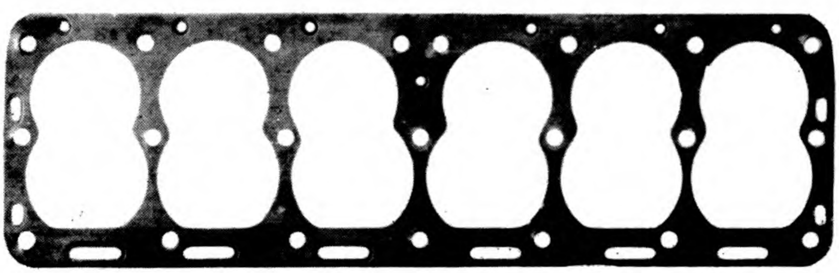


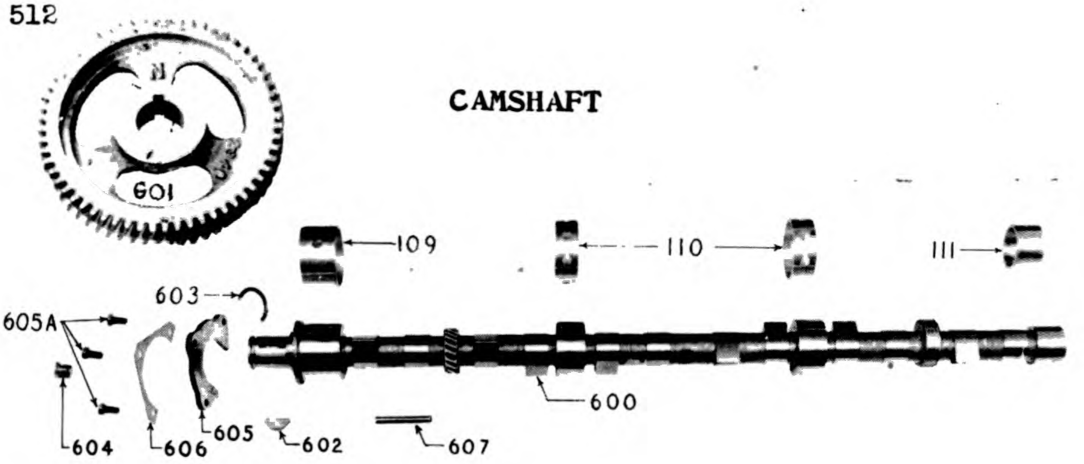
501

504

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
500	1	H-11078	**Cylinder head**
	1	112715	**Cylinder head pipe plug 1/2"**
501	1	1061	**Cylinder head gasket**
502	22	103028	**Cylinder head stud nut -1/2" - 20**
503	22	CUE-705	**Cylinder head stud washer**
504	1	4030E	**Cylinder head tappet clearance plate**

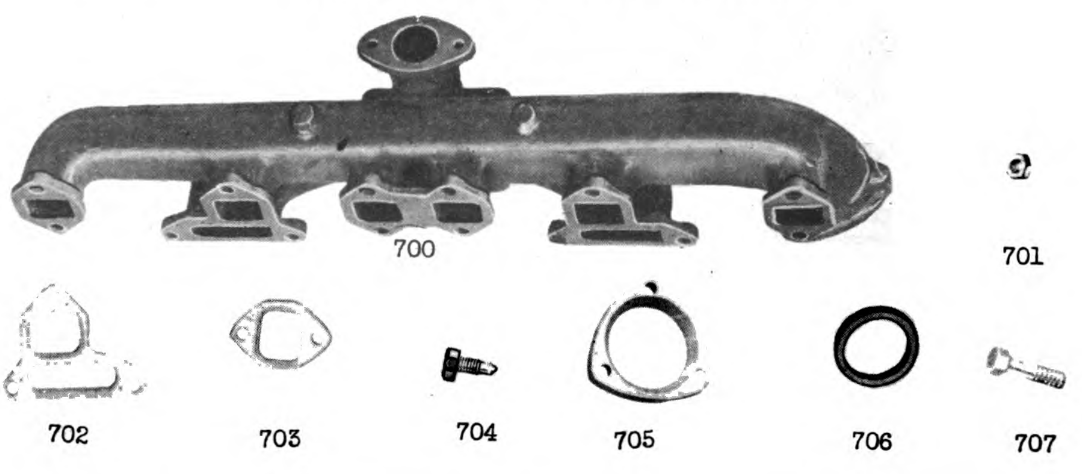
Always give Serial Number of Machine, Parts Number and Description.

CAMSHAFT



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
600	1	1392	Camshaft - front gear - rear eccentric
601	1	H-11279	Camshaft gear (See Note bottom of P. 508)
602	1	113782	Camshaft gear key No. 15
603	1	1307	Camshaft gear retainer
604	1	1318	Camshaft plug
605	1	1309	Camshaft thrust collar
605-A	3	113698	Camshaft thrust collar capscrews - 1/4-28 x 1/2" SAE
606	1	1341	Camshaft thrust collar lockwire
607	1	1308	Camshaft oil pump drive pin

INTAKE AND EXHAUST MANIFOLD



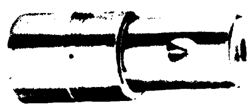
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
700	1	H-11897	Intake and exhaust manifold
701	14	114547	Intake and exhaust manifold stud nut 3/8"-24 SAE
	14	DE-40036	Intake and exhaust manifold stud washers
	2	103865	Intake and exhaust pipe plug 1/8" sq.hd.
702	2	1316	Intake and exhaust port gasket
703	4	1317	Exhaust port gasket
704	1	3360	Exhaust manifold set screw

INTAKE AND EXHAUST MANIFOLD (Continued)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
705	1	H-11898	Exhaust manifold flange
706	1	H-11899	Exhaust manifold flange gasket
707	3	100161	Exhaust manifold flange bolt 1/2" - 13 x 1-3/4" USS
701	3	102637	Exhaust manifold flange bolt nut 1/2" - 13 USS

IDLER GEAR


800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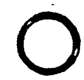
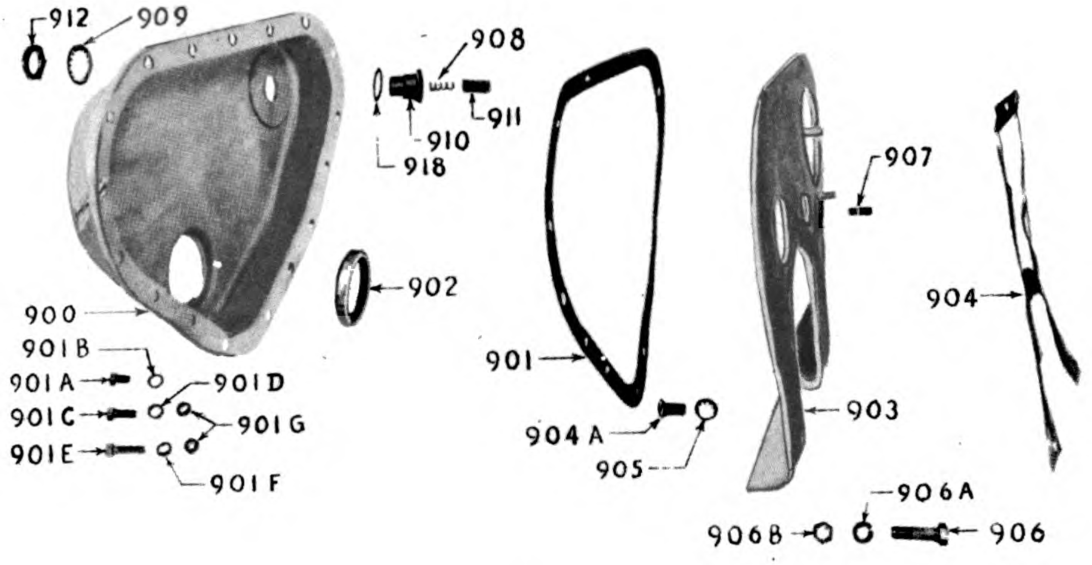

806

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
800	1	H-11280	Idler gear (See Note bottom of P. 508)
801	1	1452	Idler gear shaft
	1	103720	Idler gear shaft pin 3/16 x 1/2"
802	1	3432	Idler gear thrust washer
803	1	1458	Idler gear thrust screw
804	1	DE-4134	Idler gear shaft lockscrew
805	1	131410	Idler gear shaft lockscrew blind nut 5/8" - 11 USS
806	1	105453	Idler gear shaft lockscrew gasket 5/8"

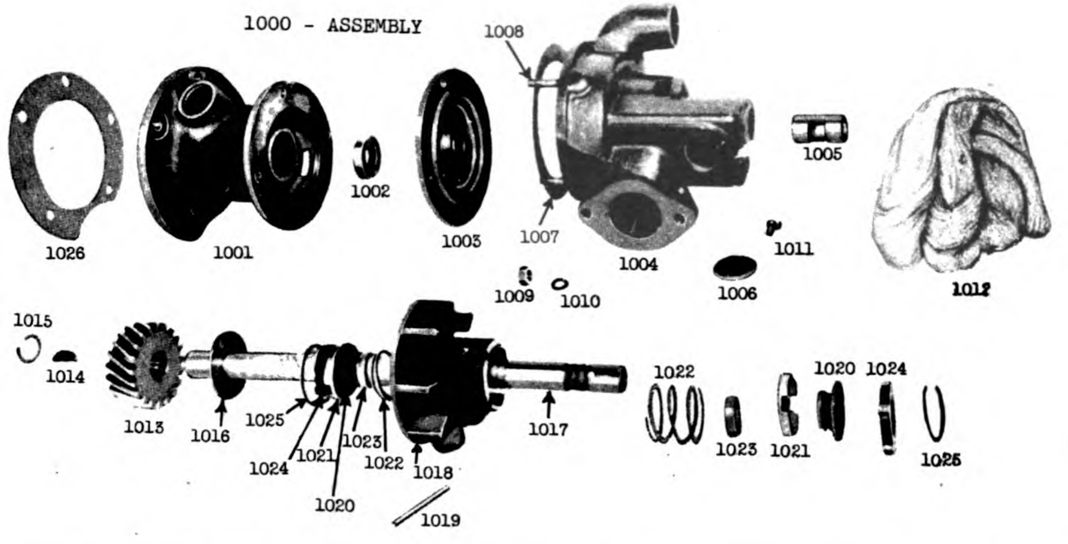
FRONT END COVER AND SUPPORT



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
900	1	H-11275	Front end cover
901	1	H-11276	Front end cover gasket
901-A	5	106974	Front end cover capscrews 3/8"-16 x 1/2" USS
901-C	9	106330	Front end cover capscrews 3/8"-16 x 7/8" USS
901-E	3	100135	Front end cover capscrews 3/8"-16 x 1-1/4" USS
901-G	12	102635	Front end cover capscrews nut 3/8" -16 USS
902	1	PA-117	Front end cover oil seal
901-B,D,F	17	103321	Lockwasher U.S.S. 3/8"
903	1	H-11274	Front support plate
904	1	H-11277	Front support plate gasket
904-A	4	137332	Front support plate screw 1/2"-13 x 1" USS
905	4	1050	Front support plate lockwasher -special
906	2	1054	Front support plate dowel bolt

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
906-B	2	103028	Front support plate dowel bolt nut 1/2" - 20 SAE
907	2	3040	Front support plate stud - for water pump
	1	H-11718	Water pump shaft thrust bearing assembly (Includes all items thru Ref. No. 913)
908	1	H-11363	Water pump shaft thrust spring
909	1	138577	Water pump shaft thrust washer
910	1	H-11719	Water pump shaft thrust housing
911	1	H-11720	Water pump shaft thrust button
912	1	H-11721	Water pump shaft thrust nut
913	1	H-11722	Water pump shaft thrust gasket

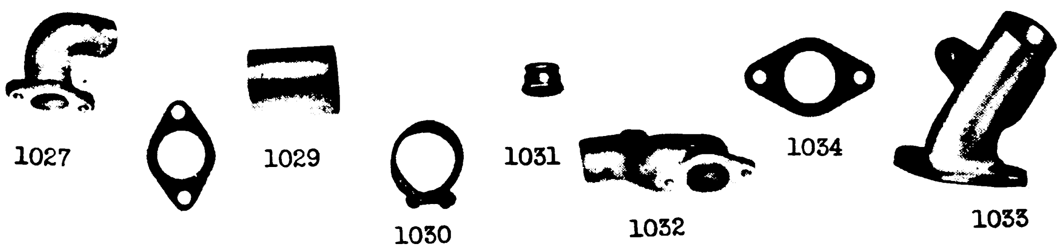
WATER CIRCULATING PARTS



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1000	1	H-11816	Water pump assembly with through shaft (Includes all items thru Ref. No. 1025)
1001	1	H-11750	Water pump drive bearing sleeve
1002	1	H-11773	Water pump drive oil seal
1003	1	H-11751	Water pump seal plate
1004	1	H-11589	Water pump body
1005	1	H-11595	Water pump body bushing
1006	1	103895	Water pump body expansion plug 1-1/4"
1007	1	H-11597	Water pump body to drive gasket
1008	4	ASE-126	Water pump body to drive stud
1009	4	103025	Water pump body to drive stud nut 5/16" - 24" SAE
1010	4	115308	Water pump body to drive stud copper washer 5/16"
1011	1	114998	Water pump body oil cup 5/16"
1012	1	H-11605	Water pump body wool packing
1013	1	H-11593	Water pump drive gear
1014	1	103906	Water pump drive gear woodruff key #8
1015	1	H-11604	Water pump drive gear snap wire
1016	1	H-11596	Water pump drive gear thrust washer
1017	1	H-11935	Water pump drive shaft

WATER CIRCULATING PARTS (Continued)

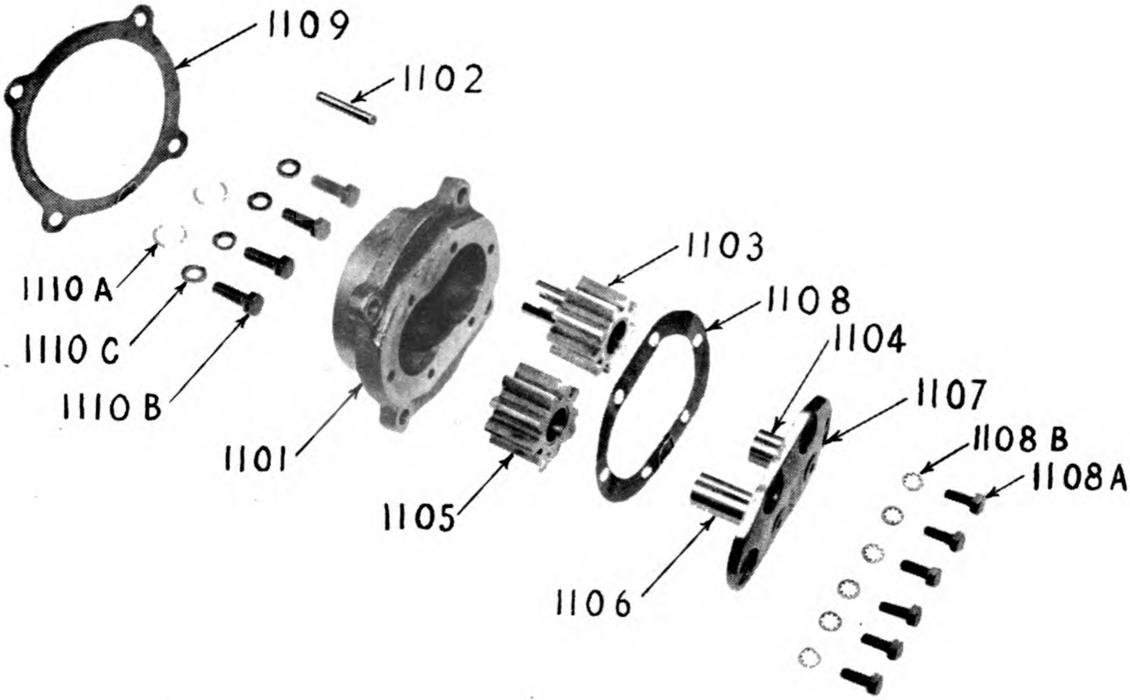
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1018	1	H-11591	Water pump impeller
1019	1	103730	Water pump impeller pin 3/16 x 1-3/4"
	1	H-12560	Water Pump seal assembly (Includes the following 6 items)
1020	2	H-11600	Water pump flexible seal
1021	2	H-11601	Water pump seal clamp ring
1022	2	H-11599	Water pump seal spring
1023	2	H-11598	Water pump seal spring guide
1024	2	H-11603	Water pump seal carbon washer
1025	2	H-11602	Water pump seal retainer snap wire
1026	1	H-11288	Water pump flange gasket



1027	1	H-11366	Water pump to cylinder connection
1028	1	1645	Water pump connection gasket
	2	106331	Water pump connection capscrews 3/8"16 x 1-1/8" USS
1029	1	CUE-824	Water pump connection hose
1030	2	AP-6081	Water pump connection hose clamp
1031	1	H-11281	Cylinder water distributor
	1	103583	Cylinder water distributor dowel #2 x 3/4"
1032	1	H-11566	Water inlet pipe
	1	106330	Water inlet pipe capscrew 3/8"-16 x 7/8" USS
	1	100139	Water inlet pipe capscrew 3/8"-16 x 2-1/2" USS
	1	GE-144	Water inlet pipe gasket
1033	1	4645	Cylinder head water outlet pipe
	2	100134	Cylinder head water outlet pipe capscrew 3/8"-16 x 1" USS
1034	1	1639	Cylinder head water outlet pipe gasket

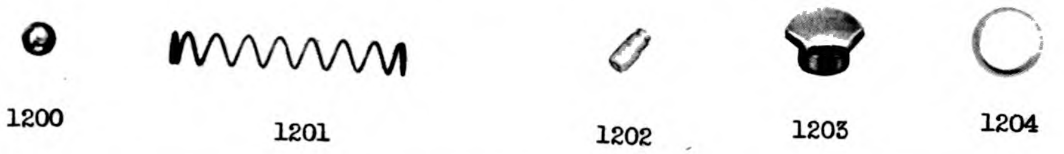
Always give Serial Number of Machine, Parts Number and Description.

OIL PUMP



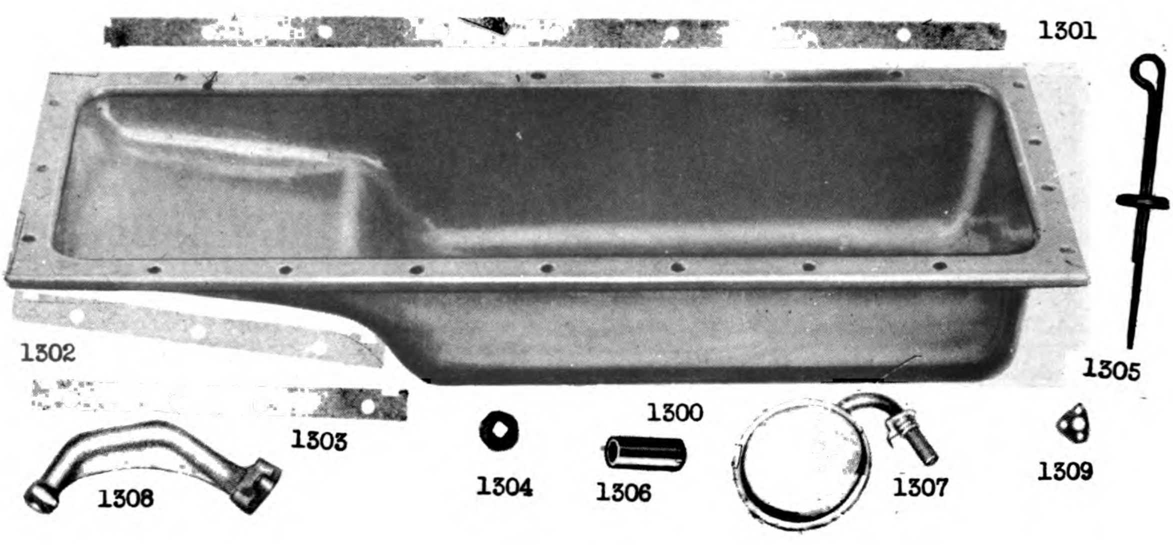
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1100	1	5875	Oil pump assembly (Includes all items to Ref. No. 1109)
1101	1	5876	Oil pump body
1102	1	1535	Oil pump body pin
	1	103892	Oil pump body expansion plug 3/4"
1103	1	5879	Oil pump gear - driver
	1	1563	Oil pump drive gear bushing
1104	1	1510	Oil pump drive shaft
	1	H-11141	Oil pump gear plug
1105	1	5880	Oil pump idler gear
	1	1562	Oil pump idler gear bushing
1106	1	1509	Oil pump idler shaft
1107	1	5899	Oil pump cover (Includes shafts)
1108	1	1508	Oil pump cover gasket
1108-A	6	106319	Oil pump cover capscrew -1/4"-20 x 5/8" USS
1108-B	6	114604	Oil pump cover star washer #14
	2	V-2084	Oil pump cover screw gasket
1109	1	1546	Oil pump to case gasket
1110	2	1547	Oil pump to case dowel
1110-A	2	105453	Oil pump to case dowel gasket 5/8"
1110-B	4	100122	Oil pump to case capscrew 5/16"-18 x 1" USS
1110-C	4	103320	Oil pump to case lockwasher 5/16"

OIL PRESSURE RELIEF VALVE



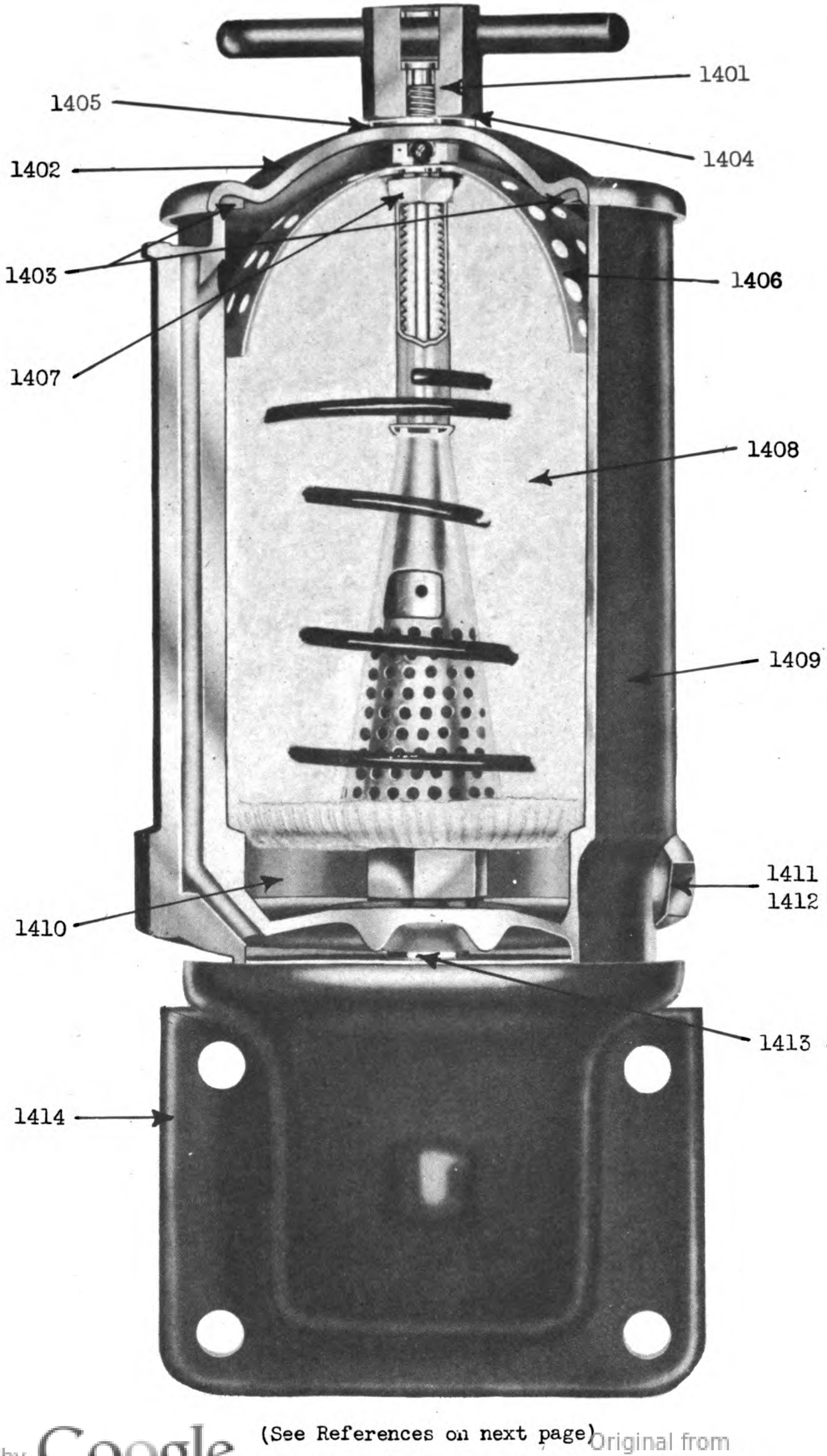
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION .
1200	1	104924	Oil pressure relief valve ball 5/8"
	1	DE-40318	Oil pressure relief valve seat
1201	1	3545	Oil pressure relief valve spring
1202	1	DE-40317	Oil pressure relief valve sleeve
1203	1	5529	Oil pressure relief valve cap
1204	1	1530	Oil pressure relief valve cap gasket

OIL PAN AND SCREEN



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1300	1	1531	Oil pan
1301	2	1539	Oil pan gasket - Side
1302	1	1540	Oil pan gasket - Front
1303	1	1541	Oil pan gasket - Rear
	22	106330	Oil pan capscrew 3/8"-16 x 7/8" USS
1304	1	H-12178	Oil pan drain plug (Magnetized) 1"
1305	1	H-12030	Oil level gauge
1306	1	H-12035	Oil level gauge adapter
1307	1	DE-3284	Oil pan screen - floating type
1308	1	H-12000	Oil pan screen bracket
1309	1	1526	Oil pan screen bracket gasket
	2	100111	Oil pan screen bracket capscrew
	1	100109	Oil pan screen bracket capscrew

OIL FILTER



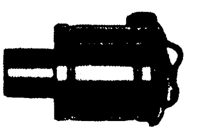
(See References on next page)

OIL FILTER (Continued)

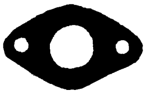
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1400	1	H-11677	Oil filter assembly - Deluxe CSB-41-302M (Includes all items thru Ref. No. 1414
1401	1	CUS-100	Cover assembly consists of next six items:
1402	1	CUS-21	Cover
1403	1	DE-56270	Cover gasket
1404	1	JCUS-32-34	Releif valve assembly
1405	1	JCUS-31	Metal seal gasket
1406	1	CUS-24	Perforated cap
1407	1	JCUS-41	Perforated locknut
1408	1	DE-56119	Filter Cartridge
1409	1	CS-302-M	Filter body
1410	1	CS-121-49	Stud and tube assembly
1411	1	CS-50	Drain plug
1412	1	CS-52	Drain plug gasket
1413	1	DE-56269	Base gasket
	1	CS-51	Stud bolt gasket
1414	1	CSB-41	Base
1415	1	4595	Oil filter gasket
	4	100134	Oil filter capscrews 3/8 - 16 x 1" USS

OIL FILLER AND BREATHER

1500



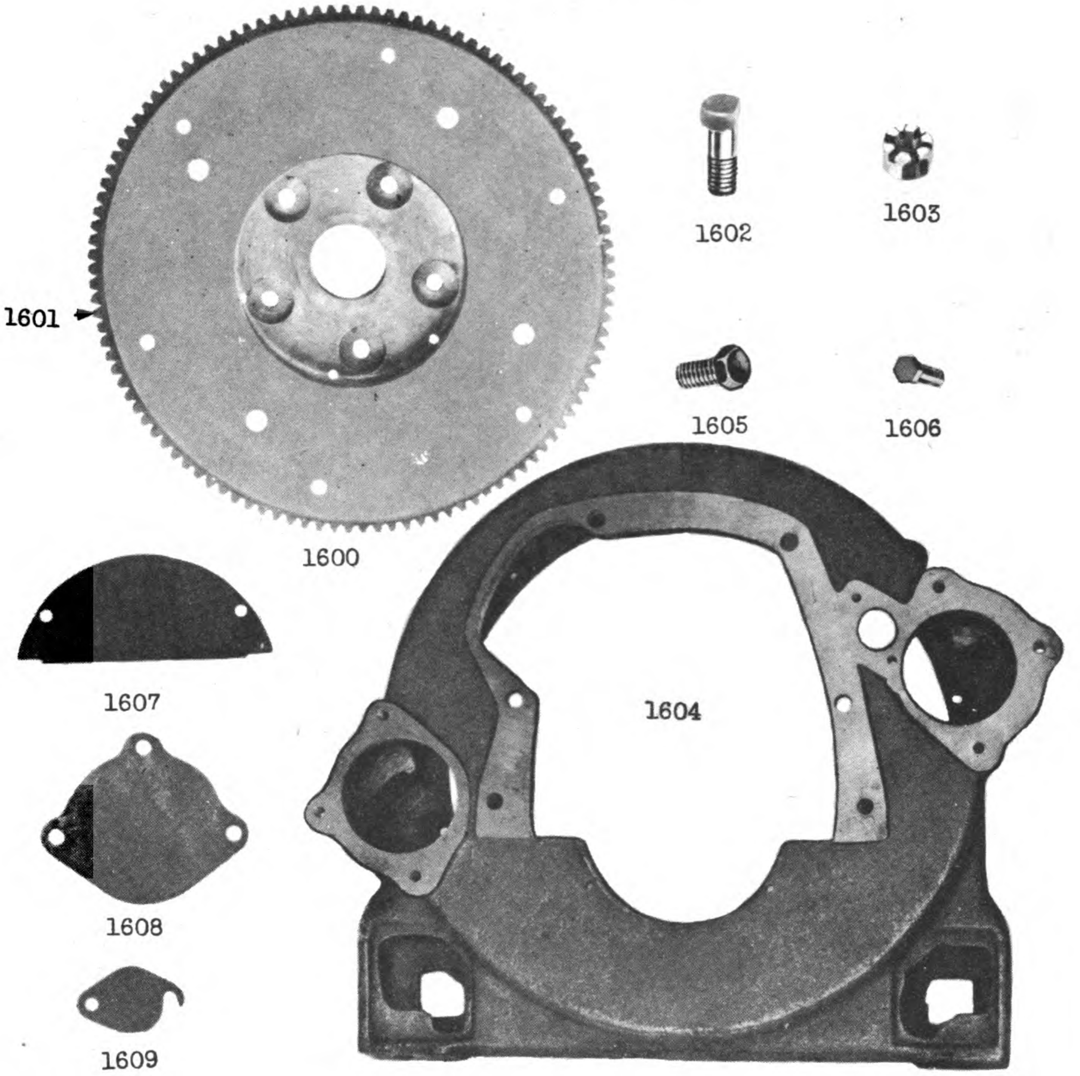
1502



1501

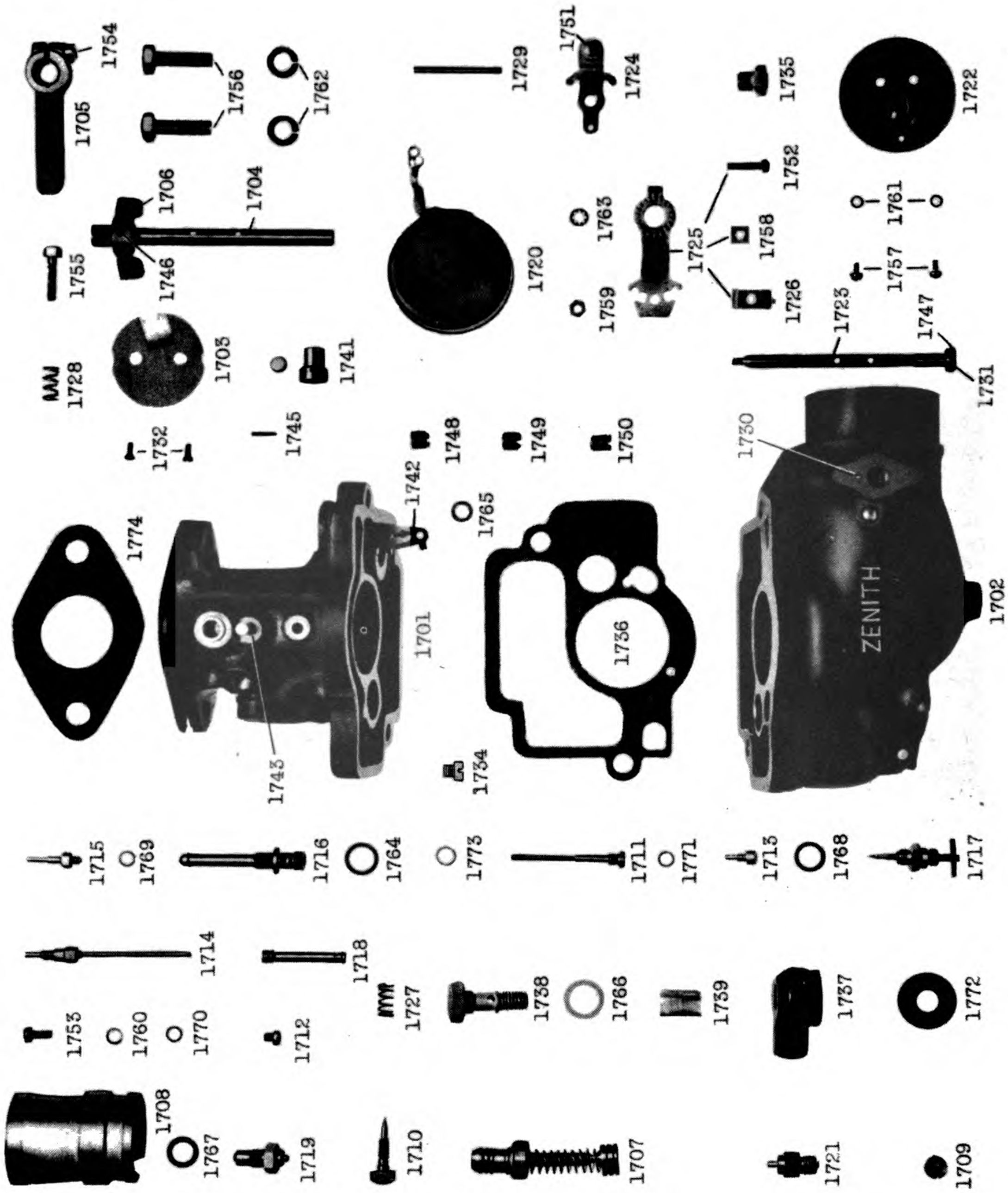
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1500	1	H-12050	Oil filler pipe
1501	1	DE-1169	Oil filler pipe gasket
	2	100121	Oil filler pipe capscrew 5/16-18 x 3/4" USS
1502	1	DE-51170	Oil filler pipe breather cap assembly

Always give Serial Number of Machine, Parts Number and Description.



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1600	1	DE-51695	Flywheel for twin disc clutch
1601	1	1152	Flywheel ring gear SAE #3
1602	5	H-12111	Flywheel bolt
1603	5	CUE-763	Flywheel bolt nut - 1/2" - 20 SAE
	5	10650[illegible]	1/2" Standard Lock Washer
1604	1	DE-56043	Flywheel housing for twin disc clutch
1605	4	2074	Flywheel housing capscrew
1606	2	1054	Flywheel housing dowel bolt
	2	103028	Flywheel housing dowel bolt nut - 1/2" - 20" SAE
1607	1	1078	Flywheel housing dust plate
	2	106973	Flywheel housing dust plate capscrew 5/16" 18 x 1/2" USS
1608	1	1705	Starter opening cover
	3	106630	Starter opening cover capscrew - 3/8" - 16 x 7/8" U.S.S.
1609	1	1079	Timing indicator cover
	2	100121	Timing indicator cover capscrew 5/16" - 18 x 3/4" USS

CARBURETOR



(See Reference Numbers on next page)

CARBURETOR

Zenith 455-2 Outline #0-8411

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1700	1	H-12550	Carburetor Assembly (Includes all items to ref. #1774)
1701	1	B2-17B	Throttle Body
1702	1	B3-17B	Fuel Bowl Assembly
1703	1	C21-34	Throttle Plate
1704	1	C23-235	Throttle Shaft
1705	1	C24-10	Throttle Clamp Lever
1706	1	C28-67	Throttle Stop Lever
1707	1	C36-12	Vacuum Pump Assembly
1708	1	C38-10A	Venturi #25
1709	1	C41-9	Check Valve Assembly
1710	1	C46-6	Idle Adjusting Screw
1711	1	C51-3	Power and Accelerating Jet #13
1712	1	C52-3	Compensating Jet #23
1713	1	C52-6	Main Jet #25
1714	1	C54-1	Idling Jet #14
1715	1	C57-1x3	Cap Jet #28
1716	1	C66-5	Discharge Tube Assembly
1717	1	C71-30	Main Jet Adjustment
1718	1	C76-21	Progressive Well
1719	1	C81-3	Fuel Valve and Set Assembly #55
1720	1	C85-6	Float Assembly
1721	1	C97-10	Power Jet Valve Assembly
1722	1	C101-22	Air Shutter Plate
1723	1	C105-86	Air Shutter Shaft
1724	1	C106-2	Air Shutter Lever Assembly
1725	1	C109-2	Air Shutter Bracket Assembly
1726	1	C110-1	Tube Clamp
1727	1	C111-17	Idle Adjusting Screw Spring
1728	1	C111-62	Throttle Stop Screw Spring
1729	1	C120-3	Float Axle
1730	1	C120-9	Bracket Locating Pin
1731	1	C130-4	Thrust Washer for Air Shutter
1732	2	C136-3	Throttle Plate Screw
1734	1	C138-61	Channel Screw for Fuel Inlet
1735	1	C140-2	Bracket Assembly Screw
1736	1	C142-31	Bowl to Body Gasket
1737	1	C148-9A	Union Body
1738	1	C149-17	Filter Plug
1739	1	C150-1	Filter Screen
1741	1	CR-9-43	Throttle Lever Bushing
1742	1	CR88-2	Float Bracket
1743	1	CR121-10	Throttle Stop Pin
1744	1	CR-134-1	Swivel (Part of Item 1724)
1745	1	CT-63-2	Lever Bushing Taper Pin
1746	1	CT63-2	Stop Lever Taper Pin
1747	1	CT63-2	Thrust Washer Taper Pin
1748	1	CT-91-1	Bowl Drain Plug
1749	1	CT91-1	Vacuum Spark Boss Plug
1750	1	CT91-1	Intake Drain Plug
1751	1	T1S-8-6	Air Shutter Lever Swivel Screw
1752	1	T1S8-10	Tube Clamp Screw
1753	1	T1S10-8	Venturi Screw
1754	1	T8S10-9	Throttle Lever Clamp Screw
1755	1	T8S10-13	Throttle Stop Screw

CARBURETOR - Continued

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
1756	2	T8S31-14	Bowl to Body Screw
1757	2	T11S6-4	Air Shutter Retaining Screw
1758	1	T21S8	Clamp Screw Nut
1759	1	T22S8	Air Shutter Shaft Nut
1760	1	T41-10	Venturi Screw Lockwasher
1761	2	T43-6	Retaining Screw Lockwasher
1762	2	T43-103	Bowl to Body Screw Lockwasher
1763	1	T45-8	Shaft Nut Lockwasher
1764	1	T56-2	Discharge Tube Washer
1765	1	T56-5	Channel Screw Washer
1766	1	T56-10	Filter Plug Washer
1767	1	T-56-23	Fuel Valve Seat Washer
1768	1	T56-23	Adjustment Washer
1769	1	T56-24	Cap Jet Washer
1770	1	T56-24	Compensating Jet Washer
1771	1	T56-24	Main Jet Washer
1772	1	T56-36	Union Body Washer
1773	1	T56-48	Power Jet Washer
	2	T73-15	Float Bracket Pin
1774	1	1645	Carburetor Flange gasket
	2	DE-4999	Carburetor Flange Stud
	2	121932	Carburetor Flange Stud Nut - 3/8" - 24 SAE
	1	2841	Carburetor Bypass Line Assembly

FUEL PUMP & MOUNTING PARTS

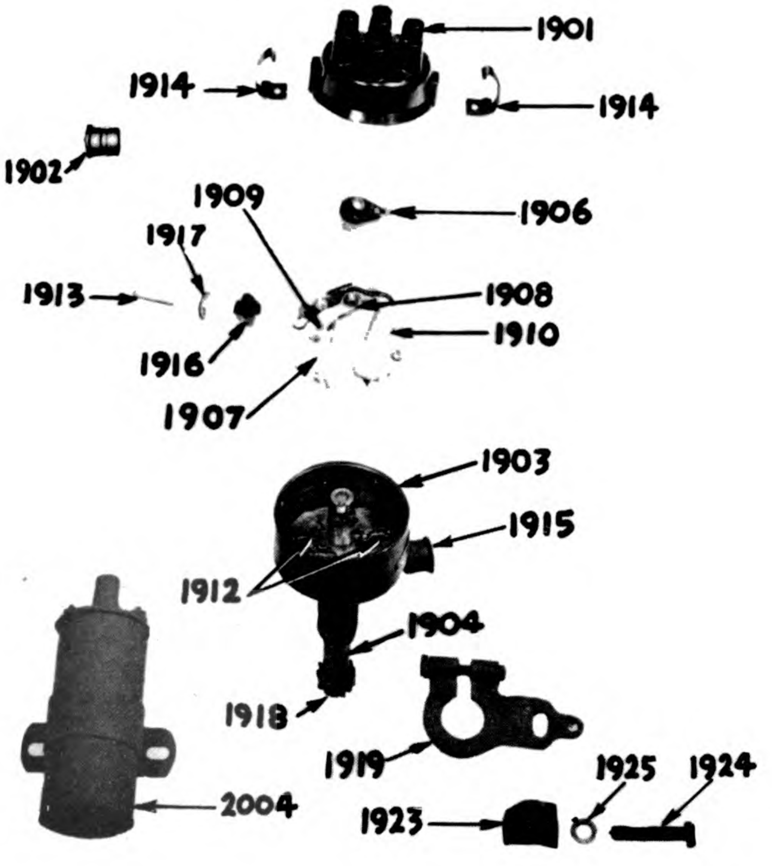
1801

1802

1803

1804

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	1	2903	Fuel Pump Assembly AC#855758
1801	1	1812	Fuel Pump Adaptor
1802	1	1811	Fuel Pump Adaptor Gasket
	4	106325	Fuel Pump Adaptor Capscrews 5/16 - 18 x 7/8" USS
	6	103320	Fuel Pump to Adaptor Lockwasher 5/16"
1803	1	ISE-149	Fuel Pump to Adaptor Gasket
	2	100122	Fuel Pump to Adaptor Capscrew 5/16-18 x 1" USS
1803	1	ISE-149	Fuel Pump Hole Cover Gasket
	2	100121	Fuel Pump Hole Cover Capscrew 5/16-18 x 3/4" USS
	1	H-12410	Fuel Pump to Carburetor Line



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	1	4757	Distributor Assembly Delco-Remy #643-X (Includes all items through Part No. 26153.)
1901	1	824735	Distributor Cap
1902	1	821604	Distributor Cap Carbon Button
1903	1	822622	Distributor Housing
1904	1	824738	Distributor Main Shaft
1905	1	822627	Distributor Cam
1906	1	820445	Distributor Rotor
1907	1	821150	Breaker Plate
1908	1	813238	Breaker Lever
1909	1	1848038	Contact Point and Support
1910	1	1869704	Condenser
1911	2	818222	Distributor Weight
1912	2	1835699	Distributor Weight Spring
	1	106496	Breaker Plate Support Lockwasher
	1	33436	Breaker Lever Stud Insulating Washer 5/16"
	1	1837832	Breaker Lever Stud Insulating Washer 9/32"
	1	810794	Breaker Lever Spring Attaching Screw Washer
	1	106496	Condenser Attaching Screw Lockwasher
	2	106496	Cap Spring Screw Lockwasher
	1	810074	Shim Washer (.005 thick)

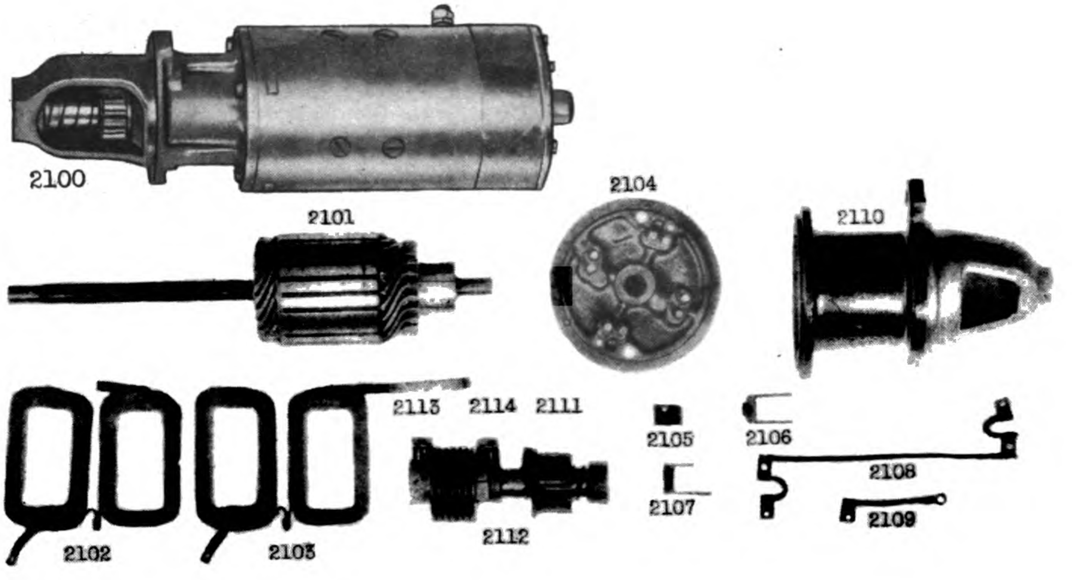
2001

2002

2003

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	1	810078	Shim Washer (.010 thick)
	3	811912	Space Washer (under gear)
	1	811912	Space Washer (under weight plate)
	1	121841	Terminal Screw Lockwasher
	2	811124	Weight Washer
	1	115607	Breaker Plate Support Screw
	1	813511	Breaker Lever Spring Screw
	1	816784	Contact Adjusting Screw
	1	131951	Condenser Attaching Screw
	2	115607	Cap Spring Screw
1913	1	107715	Terminal Screw
	1	813245	Breaker Lever Retainer Spring
1914	2	1871838	Cap Spring
	2	1847289	Cap Spring Support
	1	816803	Felt Wick
1915	1	805579	Grease Cup
1916	1	821160	Terminal Screw Bushing
1917	1	26153	Terminal Screw Clamp
1918	1	H-11872	Distributor Gear
	1	2725	Distributor Gear Pin
1919	1	3731	Distributor Arm (Includes items thru 813046)
		813044	Hold Down Screw
		813045	Hold Down Spring
		813046	Hold Down Washer
1923	1	H-11340	Distributor Arm Support
1924	1	100137	Distributor Arm Support Capscrew 3/8-16 x 1-3/4"
1925	1	103321	Distributor Arm Support Capscrew Lockwasher 3/8"
	1	AP-5816	Distributor Boot
1984	1	3998	Ignition Switch, Briggs & Stratton #50704
			Cable Tube
2001	1	1716	Cable Tube Assembly (Includes all items through #100121.)
2002	1	1708	Cable Tube Only
	2	1709	Cable Tube Stud
	2	1710	Cable Tube Clip
	2	100121	Cable Tube Clip Screw
2003	1	1735	Distributor Cable Set
	1	3729	Distributor Cable Rubber Tie Ring
2004	1	1755	Ignition Coil - 6 Volt Delco-Remy #528-C
	1	H-11419	Ignition Coil Bracket
	2	106324	Ignition Coil Bracket Capscrew 5/16-18 x 5/8"
	2	103320	Ignition Coil Bracket Capscrew Lockwasher 5/16"
	2	117061	Ignition Coil Bracket Capscrew Nut 5/16" - 18
2005	6	H-11629	Spark Plug, AC-87

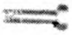
STARTER AND GENERATOR



REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
2100	1	1733	Starting Motor Assembly - Delco-Remy-718-R (Includes all items to Ref. No. 2115)
2101	1	818002	Armature
	4	810601	Pole shoe
	4	828675	Pole shoe screw
	1	826938	Field Terminal stud
	2	1861076	Field Terminal stud Insulation washer
	1	809051	Field Terminal stud Insulation bushing
	2	805790	Field Terminal stud plain washer
	2	110730	Field Terminal stud lockwasher
	1	134569	Field Terminal stud nut (1/4 thk)
	1	805258	Field Terminal stud nut (5/32 thk)
2102	1	810627	Field Coil Assembly (Upper)
2103	1	810626	Field Coil Assembly (Lower)
2104	1	815839	Commutator end Frame & Pin Sub Assembly (Includes following 8 items only)
	2	817314	Brush holder stop pin
	2	817313	Brush holder hinge pin
	2	812015	Brush holder stop pin & Insulation
	2	812016	Brush holder hinge pin & Insulation
	1	809062	Dowel pin - Commutator end
	1	1865182	End plug - Commutator end
	1	1880642	Oiler - Commutator end
	1	802691	Oil wick - Commutator end
2105	4	811553	Brush
2106	4	810226	Brush holder
2107	4	1855685	Brush spring
	4	115903	Brush attaching screw
	4	106495	Brush attaching screw lockwasher

STARTER AND GENERATOR (Continued)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
2108	2	813554	Brush ground lead
	2	122159	Brush ground lead screw
	2	106496	Brush ground lead screw lockwasher
2109	1	819362	Brush connector lead
	1	135616	Brush lead screw
	1	106497	Brush lead screw lockwasher
	1	833602	Space washer - Commutator End
	1	817114	Cover band
2110	1	1839100	Motor Drive Housing
	1	810620	Motor drive housing bushing
	1	809593	Dowel pin - Drive end
	1	124546	Woodruff key
	1	833602	Space washer - Commutator End .563 x 63/64.1/16)
	1	809815	Space washer - Commutator End .626 x 1.062 x 1/16)
	1	1849774	Space washer - Commutator End .626 x 1.062 x 3/32)
	2	809053	Thru bolt
	2	103319	Thru bolt lockwasher
2110	1	811194	Motor Drive (Includes following 7 items)
2111	1	811080	Gear and shaft assembly
	1	808949	Drive head
2112	1	809518	Drive spring
2113	1	810287	Head spring screw
2114	1	810288	Shaft spring screw
	2	806427	Lockwasher
	2	811559	Support
2115	1	4740	Starter adaptor (for Lipe clutch)
2116	3	100137	Starter capscrews 3/8-16 x 1-3/4"
2117	1	DE-44122	Push button switch - Delco-Remy #1385
2118	1	AP-6297	Magnetic switch - Delco-Remy 1549



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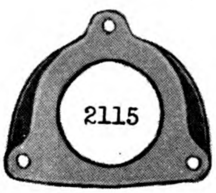

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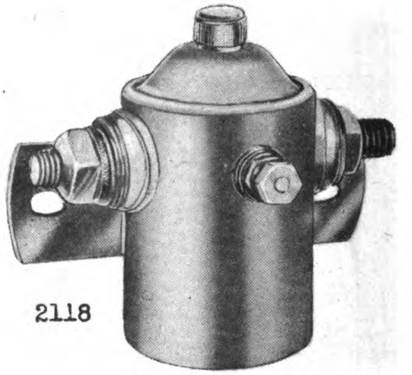
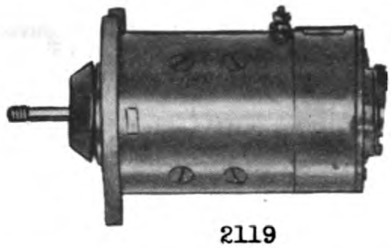


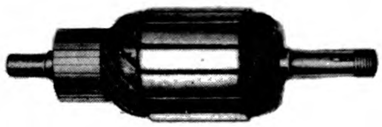
Always give Serial Number of Machine, Parts Number and Description.

STARTER AND GENERATOR (Continued)



2119

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
2119	1	H-12175	Generator assembly - Delco-Remy #1101671-6 volt (Includes all items to Ref. No. 2142)



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2128

2120	1	817807	Armature
2121	2	813496	Pole shoe
	2	828675	Pole shoe screw
2122	1	1858754	Terminal stud and lead assembly
2123	1	1858749	Terminal stud only
	2	1858753	Terminal stud insulation washer
	2	1858752	Terminal stud plain washer
	4	802757	Terminal stud lockwasher
	4	121743	Terminal stud nut
2124	1	814978	Field Coil (R.H.)
2125	1	1863510	Field Coil (L.H.)
	1	1857107	Terminal clip (To Brush)
2126	1	817216	Commutator end frame & pin sub assembly (Includes following 5 items only)
	1	817313	Brush holder hinge pin
	1	817314	Brush holder stop pin
	1	812016	Brush holder hinge pin and insulation
2127	1	812823	Bushing - Commutator end
	1	812015	Brush holder stop pin and insulation
	1	809062	Dowel pin - Commutator end
	1	1880635	Oiler - Commustator end
	1	804076	Oil wick - Commutator end
	1	816315	Oil hole plug - Commutator end
2128	1	809698	Third brush plate

STARTER AND GENERATOR (Continued)


2129

2130

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2134

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
2129	1	817532	Third brush plate clamp
	1	141543	Third brush plate clamp screw
	1	106497	Third brush plate clamp screw lockwasher
	1	809824	Third brush plate spring washer
	1	809614	Third brush plate spring washer pin
2130	3	820517	Brush
2131	3	809642	Brush holder
2132	2	809644	Brush spring (3rd and ground)
2133	1	809658	Brush spring (Insulated Main)
	3	1862803	Brush attaching screw
	3	106495	Brush attaching screw lockwasher
	3	809551	Brush attaching screw plain washer
	1	809688	Brush ground lead
	2	141540	Brush lead screw
	2	802730	Brush lead screw lockwasher
2134	1	820524	End Cover plate - Commutator end
	1	817220	End Cover plate gasket - Commutator end
	3	1868330	End Cover plate screw - Commutator end
	3	106496	End Cover plate screw L.W. Commutator end


2135


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2137

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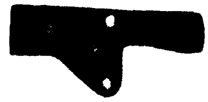
2139

2135	1	1872638	Cover band
	1	107728	Cover band screw
	1	103088	Cover band screw nut
2136	1	1838678	Drive End Frame
	1	1880635	Oiler (Drive End)
	1	817224	Space collar (Outside - Drive End)
	1	809945	Space washer (Inside - Drive End)
2137	1	903203	Ball bearing (Drive end)
2138	1	1855702	Ball bearing retainer plate (Drive end)
	1	1855701	Ball bearing retainer plate gasket (Drive End)
	3	1866970	Ball bearing retainer plate screw (Drive End)
	3	802731	Ball bearing retainer plate screw Lock washer
	1	809961	Felt washer (Drive End)
2139	1	819104	Felt washer retainer plate (Drive End)

STARTER AND GENERATOR (Continued)

2140



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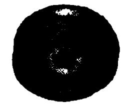

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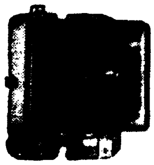


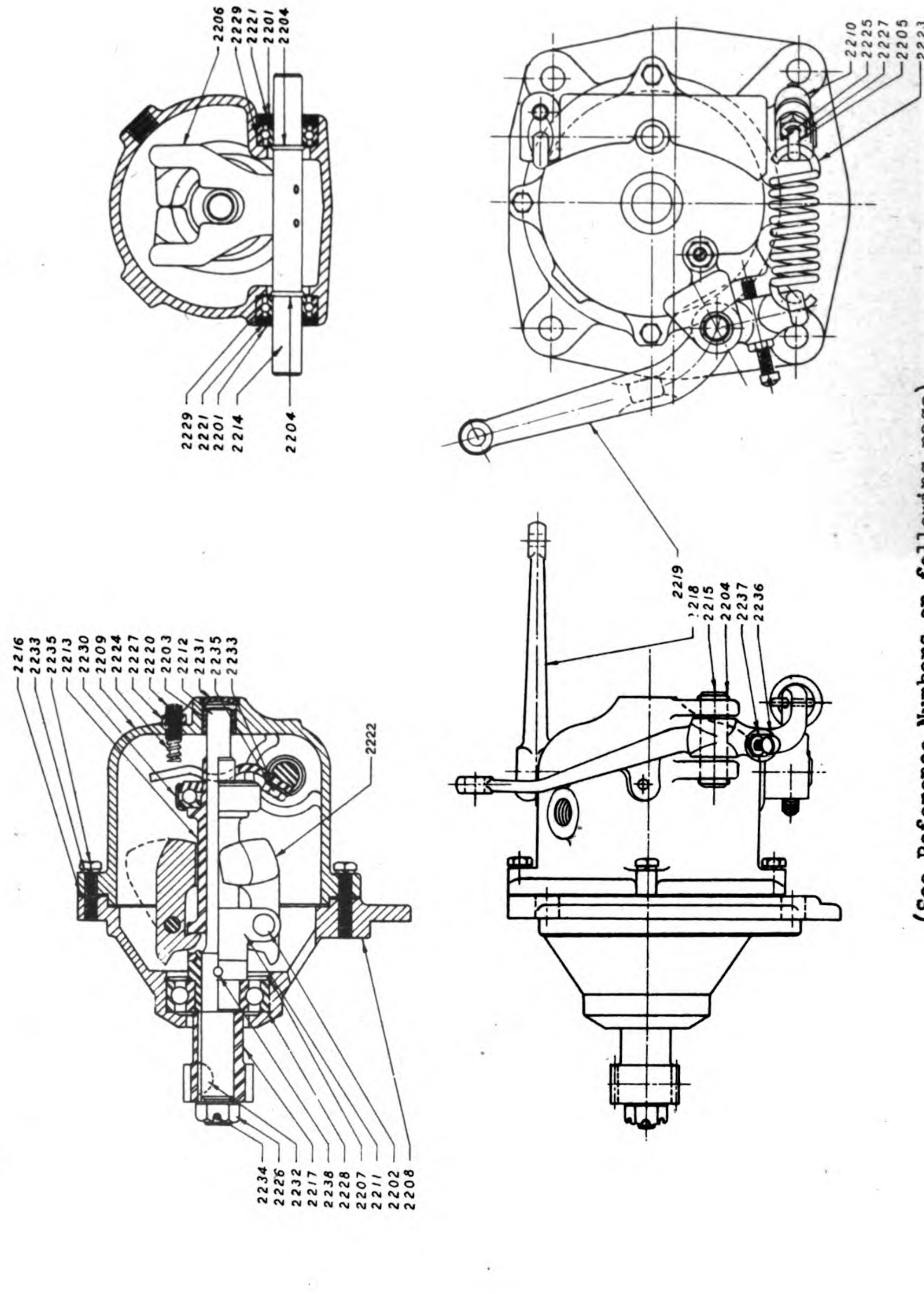
2141

2143

2145

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	1	809593	Dowel pin (Drive End)
	1	124545	Woodruff key (Drive End)
	1	806915	Shaft nut (Drive End)
	1	804000	Shaft nut lockwasher (Drive End)
2140	2	815018	Thru bolt
	2	108579	Thru bolt lockwasher
2141	1	5864	Control Unit
	2	132900	Control Unit mounting screw
	2	138479	Control Unit mounting screw Lock washer
	2	1856056	Control Unit mounting screw plain washer
	1	1850025	Lead Assembly (A"terminal to control Unit)
	1	1873937	Lead Assembly (F"terminal to control Unit)
2142	1	H-12148	Generator bracket
	2	106330	Generator bracket capscrews 3/8"-16 x 7/8" USS
	2	100122	Generator bracket capscrews 5/16"-18 x 1" USS
2143	1	H-11345	Generator adjusting brace
	1	106324	Generator adjusting brace capscrew 5/16"-18 x 5/8" USS
2144	1	H-12117	Generator pulley
2145	1	1743	Ammeter

PIERCE GOVERNOR ASSEMBLY NO. A-1729 — B



(See Reference Numbers on following page)

GOVERNOR (Continued)

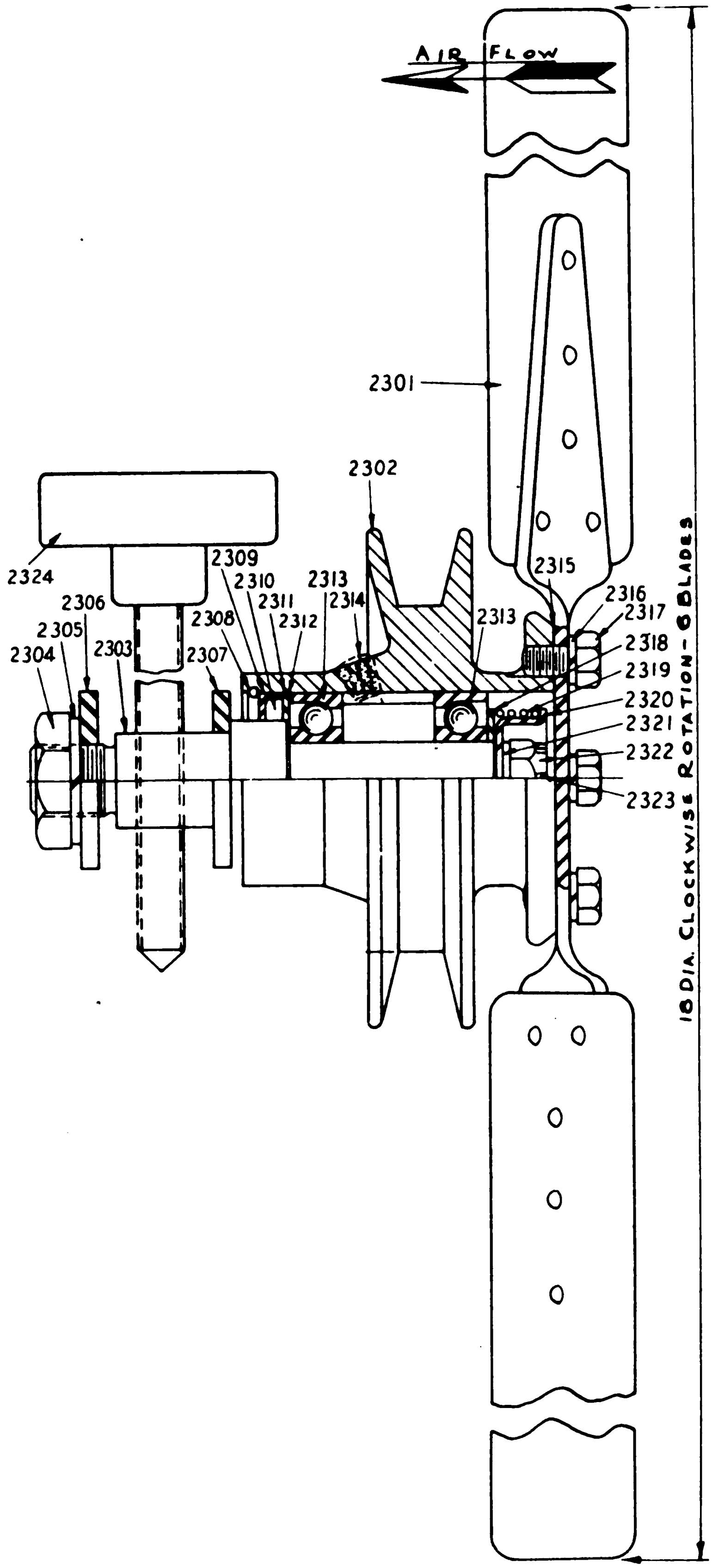
REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
2200	1	K-40167	Governor assembly Pierce A-1729-B (Includes all items to Ref. No. 2239)
2201	2	G-3040	Bearing retainer
2202	2	G-5950	Weight pins
2203	1	G-3168	Drive shaft bushings
2204	4	G-3494	Snap ring
2205	1	G-3947	Spring eye link
2206	1	G-6026	Yoke
2207	1	G-4159	Bearing retainer spring
2208	1	G-4200	Governor body cap
2209	1	G-4201	Governor body
2210	1	G-4203	Adjusting screw bracket
2211	1	A-1938	Weight spider assembly
2212	1	G-4205	Spider shaft
2213	1	G-4206	Thrust sleeve
2214	1	G-6905	Rocker shaft
2215	1	G-4208	Lever shaft
2216	1	G-4209	Gasket
2217	1	G-4211	Gear
2218	1	G-4305	Throttle lever
2219	1	G-4306	Governor adjusting lever
2220	1	G-5113	Bumper screw
2221	2	G-5210	Oil retaining washer
2222	2	G-4449	Weights
2223	1	SN-278	Spring
2224	1	SN-266	Bumper spring
	1	X-28	1/8 x 7/8 pin
2225	2	X-82	Tapper pin #1 x 7/8
2226	1	X-763	Castle nut 3/8 - 24 SAE
2227	3	X-217	Check nut 1/4 - 28 SAE
2228	1	X-310	Bearing
2229	2	X-328	Bearing
2230	1	X-330	Thrust bearing
2231	1	X-454	Welch plug
2232	1	X-461	Woodruff key #2
	1	X-463	Lock washer 1/4"
	1	X-532	Welch plug 5/16
2233	4	X-540	Lock washer #10
	1	X-557	Hex. cap screw 1/4-28 x 7/8 SAE
2234	1	X-425	Cotter pin 3/32 x 3/4
2235	4	X-824	Hexagon cap screw 10-24 x 3/4 USS
2236	1	X-846	Fillister head capscrew 12-24 x 1-1/2
2237	1	X888	Hexagon nut 12-24
2238	1	X-935	Spider to shaft groove pin
	1	103564	Governor drive gear taper pin #0 x 1"

2239

2240

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
	1	H-12162	Governor link assembly
2239	1	1811	Governor gasket
	4	100121	Governor capscrews - 5/16"-18 x 3/4" USS
	1	H12666	Governor oil line
	2	120704	Governor oil line nut 41-F-3/16
	1	120703	Governor oil line union 48-F-3/16
2240	1	4776	Governor oil line restrictor elbow
2241	1	3864	Governor valve box

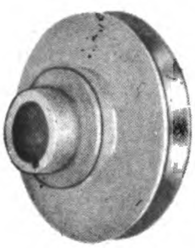
FAN, BELT AND PULLEY



(See Reference Numbers on following page)

FAN BELT AND PULLEY (Continued)

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
2300	1	H-12101	Fan Assembly 18" -6 Blade (Includes all items thru Ref. No. 2323)
2301	1	2605	Fan blade assembly 18" 6 blade
2302	1	B-108157	Fan hub
2303	1	1622	Fan spindle
2304	1	122403	Fan spindle clamp nut 3/4 - 16 SAE
2305	1	103326	Fan spindle clamp nut lockwasher 3/4"
2306	1	1620	Fan spindle clamp washer - rear
2307	1	1628	Fan spindle clamp washer - front
2308	1	C-4832	Fan spindle oil retainer cork lockwire
2309	1	C-3159	Fan spindle oil retainer cork retainer
2310	1	C-3158	Fan spindle oil retainer cork
2311	1	C-3157	Fan spindle cork retaining washer
2312	1	C-3837	Fan spindle bearing gasket - rear
2313	2	C-2815	Fan spindle bearing
2314	1	103883	Fan hub oil plug 1/8" slotted
2315	1	4614	Fan blade gasket
2316	4	103320	Fan blade capscrew lockwasher 5/16"
2317	4	106973	Fan blade capscrew 5/16-18 x 1/2" USS
2318	1	C-2963	Fan spindle cone clamp wahher
2319	1	C-2962	Fan spindle cone spring
2320	1	C-2961	Fan spindle cone spring retainer
2321	1	103323	Fan spindle cone clamp nut lockwasher 1/2"
2322	1	C-2674	Fan spindle cone clamp nut
2323	1	C-2283	Fan spindle clamp nut cotter
2324	1	1618	Fan spindle adjusting screw



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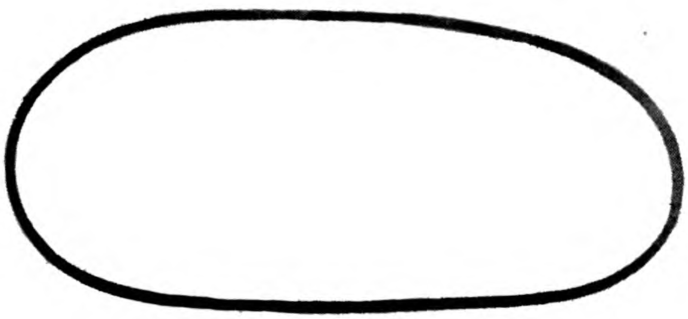


2326

2327

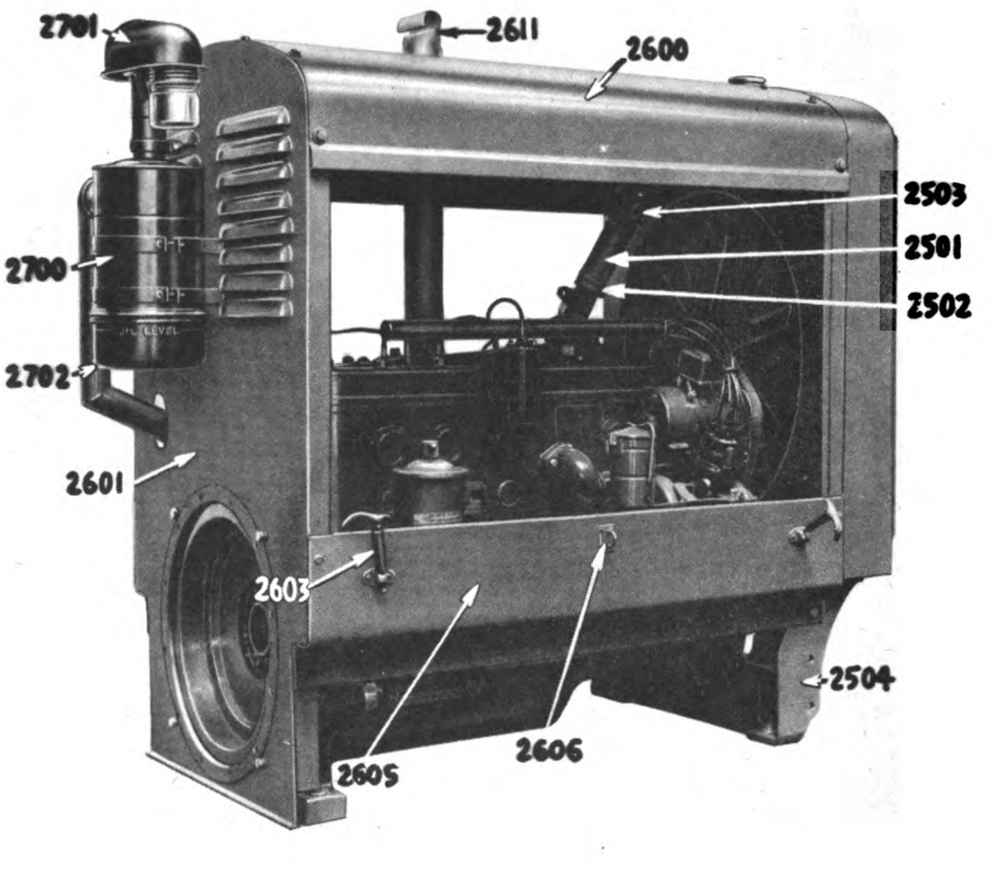
2325	1	H-12086	Fan drive pulley
	1	DE-51708	Fan drive pulley key
2326	1	H-12096	Fan belt
2327	1	1651	Fan bracket
	3	103026	Fan bracket stud nut 3/8-24 SAE

Always give Serial Number of Machine, Parts Number and Description.

STARTING CRANK

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
2400	1	H-12237	Starting crank 6-1/2" shank

RADIATOR AND FRONT SUPPORT GROUP



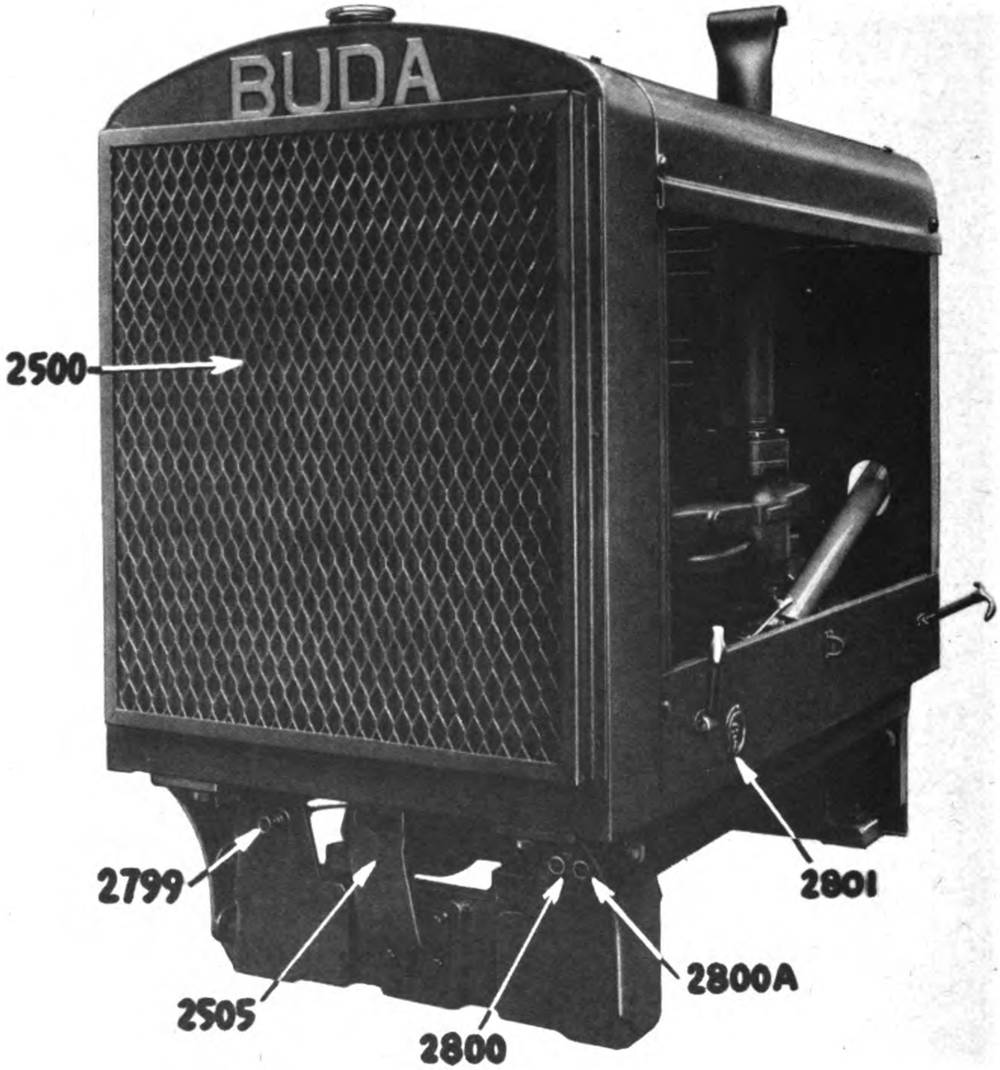
RADIATOR AND FRONT SUPPORT - Continued

REF.NO.	NO. REQ.	PART NO.	DESCRIPTION
2500	1	AP-5657-G	Radiator
	2	MC-3486	Radiator Hold Down Bolts
	2	102639	Radiator Hold Down Bolt, Nuts 5/8-11 USS
2501	2	DP-1467	Radiator Inlet Hose
	1	AP-4966	Radiator Outlet Hose
2502	6	AP-6081	Radiator Hose Clamps
	1	43E-3/8	Radiator Drain Cock
	2	AP-3163	Radiator Shim Pad
2503	1	DE-4755	Thermostat
2504	1	AP-5140	Power Plant Front Support
	2	AP-3068	Power Plant Front Support Shim
	2	108600	Power Plant Front Support Capscrew 1/2-13 x 1-7/8 USS
	2	102637	Power Plant Front Support Capscrew Nuts
2505	1	AP-3187	Starting Crank Support Bracket
	4	100134	Starting Crank Support Bracket Capscrew 3/8-16 x 1" USS
	4	117062	Starting Crank Support Bracket Capscrew Nuts 13/8-16 USS

SHEET METAL AND MUFFLER

REF.NO.	NO. REQ.	PART NO.	DESCRIPTION
2600	1	AP-5526	Hood Top
	16	100121	Hood Top Capscrew 5/16-18 x 3/4" USS
	16	102634	Hood Top Capscrew Nuts 5/16-18 USS
2601	1	AP-6037	Rear Panel
	2	100121	Rear Panel Capscrew 5/16-18 x 3/4" USS
	2	102634	Rear Panel Capscrew Nuts 5/16" - 18 USS
2602	2	AP-6065	Side Doors
2603	4	AP-5136	Side Door Latch Handle
2604	4	AP-5137	Side Door Latch Handle Catch
	16	110499	Side Door Latch Handle Bolts #10-24 x 3/8" USS
2605	1	AP-6062	Side Door Sills R.H.
2605	1	AP-6063	Side Door Sills L.H.
	8	100121	Side Door Sill Capscrew 5/16" - 18 x 3/4" USS
	8	102634	Side Door Sill Capscrew Nuts 5/16"-18 USS
2606	2	AP-6064	Hasps and Staples (for Padlock)
2611	1	AP-3162	Muffler (Crimped Type)

SHEET METAL AND MUFFLER



SHEET METAL AND MUFFLER - Continued

REF.NO.	NO.REQ.	PART NO.	DESCRIPTION
			Air Cleaner
2700	1	AP-6557	Air Cleaner Donaldson #A6605
2701	1	AP-6565	Air Cleaner Precleaner Donaldson X1537-A
	2	AP-6364	Air Cleaner Bracket
	4	AP-6014	Air Cleaner Bracket Spacer
	4	100122	Air Cleaner Bracket Capscrew 5/16"-18 x 1" USS
	4	117061	Air Cleaner Bracket Capscrew Nuts 5/16"-18 USS
2702	1	AP-6362	Air Cleaner Tube
	1	AP-5965	Air Cleaner Tube Hose (to Carburetor)
2703	1	AP-6361	Air Cleaner Tube Hose (to Air Cleaner)
	4	AP-6081	Air Cleaner Tube Hose Clamps
			Miscellaneous
2799	1	AP-4712	Spark Control
2800	1	AP-6157	Throttle Assembly
2800A	1	AP-4713	Choke Control
	1	AP-4792	Choke Control Clip
	1	100764	Choke Control Clip Screw #10-32x1/2" SAE
	1	103101	Choke Control Clip Screw #10-32 SAE
2801	1	AP-3883	Oil Pressure Gauge
	1	AP-4781	Throttle Control Rod Swivel
	1	AP-4782	Throttle Control Rod Swivel Collar
	1	112865	Throttle Control Rod Swivel Screw #8-32 x 3/16" USS

NUMERICAL INDEX

MODEL 833 ACCESSORIES

"No.Req." is total for entire parts list.
Prices subject to change without notice.

Part Number	Page No.	No. Req.	Unit Price
1.03	312	4	.01
	323		
1.06	323	1	.01
1.06-1	312	3	.02
	323		
S1.16	312	1	.02
S1.167B	313	1	.01
1.16	312	1	.01
1.26E	313	1	N/C
1.58	313	2	.01
1.74	313	1	.02
S1.167	323	1	.02
S1.183	313	3	.01
	323		
BM1.245	320	3	.03
	323		
X1-269	323	1	.20
A1-3211-Z-546	324	1	17.48
A1-3211-A547	324	1	17.48
2-1	313	1	1.00
A2-3222-V-282	324	4	13.80
S3.138	323	6	.08
S4.61	313	1	.02
5.43	313	1	.06
5.75	313	2	.02
7.33V	326	1	21.23
M7.341	313	1	.24
CB9.05-2	312	1	3.16
CB9.10	312	1	.16
CB9.11	312	1	.06
CB9.20	313	1	.72
C9.22	313	1	.03
CB9.29	313	1	.24
C9.37	313	1	.02
CB9.50	313	1	.40
CB9.51	313	1	.20
CB9.54	313	2	.08
CB9.55	313	1	.02
CB9.57	313	2	.02
CB9.60	313	1	.24
CB9.61	313	1	.02
CB9.62	313	1	.20
CB9.63	313	1	.02
CB9.185	313	1	.04
CB9.335	313	1	.02
10X39	324	2	.02
AA10.45	313	1	.36
CB10.525-1	313	1	.76
CB10.528	313	1	.72
CB10.530-1	313	1	1.32
CB10.540C	313	1	3.00
CB10.540D	313	1	3.36
CB10.540-1	313	1	1.68
CB11.18	313	1	.02
CA11.21	313	1	.20
EA11.41	320	1	.80
CA11.42	313	1	.06
EA11.43	320	1	.60
F11.52	313	1	.02
F11.53	313	1	.12
D11.74	323	4	.02
CA11.76	313	2	.04
EA11.76	320	2	.05
W12.16	323	2	.02
W12.185	323	2	.04
E14.16	323	2	.01
S15.167	323	2	.01
X30.270	323	1	.06
P45.138	323	1	.01
P45.139	323	1	.01
P60.06	323	2	.12
P60.10	323	1	.16
P60.11	323	1	.12
P60.12	323	1	.16
P60.24	323	1	.24
P60.26	323	1	.05
P60.37	323	2	.02
P60.161	323	1	.05
P60.236	323	1	.12
P60.268	323	1	.12
P60.306	323	1	.20
P60.307	323	1	.24
P60.308	323	1	.28
P61.26	323	1	.06
P63.51-1	323	1	1.00
P63.264-1	323	1	6.60
P63.268	323	1	.20
65	326	6	.07
69	326	6	.10
M101	309	2	.01
P101.234	323	1	1.20
M102	310	2	.06
103F	309	4	.55
106A	309	4	.12
M108	309	1	1.05
P111.61	323	1	.02
115	309	1	.06
M116	309	24	.01
117C8S	309	1	3.30
119B2	309	8	.20
W154.245	323	1	.03
P156.05	323	1	4.80
P156.70	323	1	1.20
P156.70-A	323	1	2.70

Part Number	Page No.	No. Req.	Unit Price	Part Number	Page No.	No. Req.	Unit Price
M167	309	1	5.35	953	319	2	.79
M184	309	1	18.60	954	319	1	4.24
M226	309	1	1.85	956	319	1	1.52
M227	309	2	.02	A1003	310	1	.13
M236	310	9	.03	1037	309	1	1.80
M256	309	10	.01	A1069	309	6	.11
M258	309	2	.05	1092A	309	1	.60
M266	310	1	.18	1144F	309	1	2.20
M291	310	2	.10	1229-D-108	324	2	.05
R294.21	320	1	.80	1229-R-122	324	4	.04
R294.44	320	1	1.24	A-1229-J-166	324	2	.21
R294.71	320	1	2.48	M1246	309	1	.20
R294.317	320	1	.36	1259-B-28	324	4	2.20
301	326	6	.29	A1339	309	1	.10
M302	310	1	.15	M1344	309	1	.65
M309	310	1	.05	X-1402	324	2	.10
M326	309	8	.04	A1461G	310	1	.40
Q-328W	326	1	58.24	1497	310	6	.22
R340.05	320	1	20.00	A1557B	310	1	1.10
R340.30	320	1	24.80	A1558	310	1	1.25
R340.40	320	1	28.00	A1588	309	1	.06
M342	310	1	.12	A1663	310	1	1.10
M343	309	1	.05	A1664	310	1	.10
M356	309	1	.15	X-1838	324	64	.01
M398	309	1	13.95	1965R	309	1	.85
M399	309	1	9.00	1968A	309	8	.12
M436	309	1	.12	A1972	310	1	.20
M507	310	1	.05	1990	309	1	3.63
X-528	324	2	.05	2137	309	1	3.85
L-560	326	1	1.20	2210-S-1293	324	1	8.48
M639	309	1	.62	2210-T-1294	324	1	8.48
M641	309	4	.01	2240-B-496	324	4	2.32
M642	310	8	.01	2245	309	1	.24
M645	309	2	.03	2258-T-124	324	2	.26
X-652	324	2	.04	2830A	309	1	1.85
X-702	324	2	.02	A3089	309	1	22.00
930	318	1	.74	A3091	309	1	26.40
931	318	1	4.24	G-3203	326	1	23.30
932	319	1	4.18	A5223H	309	2	2.20
934	318	1	.48	5520	326	1	2.64
935	318	1	1.64	5720	326	1	3.72
936	318	1	.97	5791	309	1	6.00
937	318	1	.24	6158	309	1	9.50
938	318	1	.67	6310J	309	1	5.50
939	318	1	.67	6625A	309	1	6.15
940	318	1	3.63	8375	309	1	71.00
941	318	1	5.45	8503D	310	1	48.50
942	318	2	2.13	8504	309	1	34.00
943	318	1	3.93	8506	309	1	22.00
944	318	1	7.26	200001	330	1	1.88
945	319	1	.67	200029	339	1	.08
M945	309	2	.06	201225	331	3	.14
946	318	1	1.21	201318	330	18	.004
947	318	1	.91	201326	331	1	.08
948	318	2	.67	201327	331	1	.02
950	318	1	7.26	201687	330	1	.30
951	319	1	4.24	202672	330	2	.15
952	319	2	2.73	202690	339	1	.34

Part Number	Page No.	No. Req.	Unit Price
202691	339	1	1.31
202692	339	1	.53
202693	339	1	1.61
202695	339	1	.26
202696	339	1	.23
202697	339	1	.23
202698	339	1	.49
202699	339	1	.11
202735	339	1	.11
202736	339	1	.19
202737	339	1	.11
202738	339	1	.23
202741	339	1	.41
202743	339	1	.19
202744	339	1	.11
202746	339	1	5.22
202747	339	1	.11
202869	339	1	.19
202880	330	1	1.31
202982	339	4	.004
203016	339	1	.01
203145	330	18	.02
203151	330	18	.02
203156	330	2	.02
203172	330	2	.05
203173	330	2	.02
203227	339	1	.02
203379	339	1	1.09
203388	339	4	.08
203575	330	1	.02
203680	331	1	.04
204055	339	1	.75
204056	339	1	.15
204568	339	1	6.56
204650	339	1	.98
204651	339	1	.19
205433	330	1	.68
211367	339	1	.11
211537	339	1	.23
211538	339	1	.41
211539	339	1	.23
211541	339	1	.30
211542	339	1	.15
211595	339	1	.30
212135	339	1	.68
212294	330	1	.30
212295	330	1	.38
212357	331	1	.01
212628	331	1	1.10
212629	331	1	1.91
212630	331	1	.24
212631	331	2	.19
212632	331	4	.01
212633	331	1	.04
213086	331	1	4.47
213224	339	1	.02
213225	339	1	1.58
213226	339	1	.11
213227	339	1	.12
213228	339	1	.11

Part Number	Page No.	No. Req.	Unit Price
213229	339	1	.04
213230	339	1	.30
213387	339	1	.08
215204	339	1	5.93
216071	339	1	9.90
220304	339	1	2.62
220305	339	1	3.75
220829	339	1	20.21
221135	339	1	1.66
BU-HA-E1-1	306	1	4.50
BU-HA-E1-2	306	1	30.00
BU-HA-E1-3	306	1	1.00
BU-HA-E1-4	306	1	1.50
BU-HA-E1-5	306	1	.30
BU-HA-E1-6	306	1	12.00
BU-HA-E1-7	306	1	2.50
BU-HA-E1-8	306	2	3.50
BU-HA-E1-9	306	2	with #8
BU-HA-E1-10	306	1	4.50
BU-HA-E1-11	306	1	4.50
HT-PD-B1-2	318	1	.11
HT-PD-B1-3	318	1	.06
HT-PD-B1-14	318	2	4.40
HT-PD-B1-25	319	1	1.10
HT-PD-B1-27	319	1	.22
HT-PD-B1-28	319	1	.77
HT-PD-B1-30	319	1	1.65
HT-PD-B1-31	319	1	2.73
HT-PD-B1-46	319	1	.42
HT-PD-B1-47	319	2	.17
PU-VK-B-1	317	1	.77
PU-VK-B-2	317	1	1.54
PU-VK-B-3	317	1	2.31
PU-VK-B-4	317	1	.62
PU-VK-B-5	317	1	.77
PU-VK-B-6	317	1	.46
PU-VK-B-9	317	1	.14
PU-VK-B-10	317	1	.77
PU-VK-B-11	317	1	3.08
PU-VK-B-12	317	1	6.16
PU-VK-B-20	317	1	.15
PU-VK-B-21	317	1	.31
PU-VK-B-23	317	6	.08
PU-VK-B-25	317	1	.22
PU-VK-B-37	317	1	.31
PU-VK-B-38	317	1	.22
VA-HA-C1-1B	304	1	1.00
VA-HA-C1-2	304	2	.50
VA-HA-C1-3	304	1	.15
VA-HA-C1-4	304	1	3.85
VA-HA-C1-5	304	1	.35
VA-HA-C1-6	304	1	.35
VA-HA-C1-7	304	1	.20
VA-HA-C1-8	304	1	.05
VA-HA-C1-9	304	1	.75
VA-HA-C1-10	304	1	.25
VA-HA-C1-11	304	1	5.50
VA-HA-C1-12	304	1	3.50
VA-HA-C1-13a	304	4	.15
VA-HA-C1-13b	304	4	.15

NUMERICAL INDEX

Buda HP-351 Engine

"No. Req." is total for entire parts list.
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Part Number	Page	No. Req.	Unit Price	Part Number	Page	No. Req.	Unit Price
T1S-8-6	523	1	.05	C-81-3	523	1	.75
T1S-8-10	523	1	.05	X-82	533	2	.05
T1S-10-8	523	1	.05	C-85-6	523	1	.90
B-2-17B	523	1	6.00	CR-88-2	523	1	.10
B-3-17B	523	1	8.00	CT-91-1	523	3	.10
T8S-10-9	523	1	.05	C-97-10	523	1	.80
T8S-10-13	523	1	.05	CUS-100	520	1	3.75
T8S-31-14	524	2	.10	C-101-22	523	1	1.50
CR-9-43	523	1		C-105-86	523	1	.60
T11S-6-4	524	2	.05	C-106-2	523	1	.35
CUS-21	520	1	1.00	C-109-2	523	1	.35
T21S-8	524	1	.05	C-110-1	523	1	.05
C-21-134	523	1	.90	C-111-17	523	1	.10
T22S-8	524	1	.05	C-111-62	523	1	.10
C-23-235	523	1	.65	PA-117	514	1	.85
CUS-24	520	1	1.00	C-120-3	523	1	.10
C-24-10	523	1	1.20	C-120-9	523	1	.10
X-28	533	1	.05	CR-121-10	523	1	.05
C-28-67	523	1	.75	CS-121-49	520	1	1.50
JCUS-31	520	1	.10	ASE-126	515	4	.12
JCUS-32-34	520	1	1.50	C-130-4	523	1	.05
C-36-12	523	1	.95	CR-134-1	523	1	.20
C-38-10A	523	1	1.10	C-136-3	523	2	.05
CSB-41	520	1	5.00	C-138-61	523	1	.05
JCUS-41	520	1	.10	C-140-2	523	1	.05
C-41-9	523	1	.25	C-142-31	523	1	.10
T-41-10	524	1	.05	GE-144	516	1	.08
43E-3/8	537	1	.60	C-148-9A	523	1	1.10
T-43-6	524	2	.05	ISE-149	524	2	.05
T-43-103	524	2	.05	C-149-17	523	1	.40
T-45-8	524	1	.05	C-150-1	523	1	.20
C-46-6	523	1	.35	RSE-155	510	12	.08
CS-50	520	1	.20	X-217	533	3	.06
CS-51	520	1	.05	SN-266	533	1	.15
C-51-3	523	1	.75	SN-278	533	1	.60
CS-52	520	1	.05	CS-302-M	520	1	4.75
C-52-3	523	1	.45	X-310	533	1	1.80
C-52-6	523	1	.75	X-328	533	2	.50
C-54-1	523	1	.60	X-330	533	1	2.70
T-56-2	524	1	.05	X-425	533	1	.03
T-56-5	524	1	.05	X-454	533	1	.06
T-56-10	524	1	.05	X-461	533	1	.12
T-56-23	524	2	.05	X-463	533	1	.06
T-56-24	524	3	.05	X-532	533	1	.06
T-56-36	524	1	.05	X-540	533	4	.04
T-56-48	524	1	.05	X-557	533	1	.20
C-57-1x3	523	1	.40	CUE-705	511	22	.04
CT-63-2	523	3	.05	CUE-763	521	5	.05
C-66-5	523	1	.75	X-763	533	1	.10
C-71-30	523	1	.85	CUE-824	516	1	.18
T-73-15	524	2	.05	X-824	533	4	.06
C-76-21	523	1	.85	X-846	533	1	.08

Part Number	Page	No. Req.	Unit Price
X-888	533	1	.03
X-935	533	1	.10
1004	507	1	2.00
1005	507	4	1.75
1018	507	14	.34
1022-23	507	1	3.75
1022-23A	507	1	4.20
1022-23B	507	1	4.60
1022-23C	507	1	5.00
1022-23D	507	1	5.20
1024-25	507	4	3.30
1024-25A	507	4	3.75
1024-25B	507	4	4.00
1024-25C	507	4	4.20
1024-25D	507	4	4.40
1026-27	508	1	4.60
1026-27A	508	1	5.00
1026-27B	508	1	5.50
1026-27C	508	1	5.80
1026-27D	508	1	6.00
1028-29	508	1	6.60
1028-29A	508	1	7.15
1028-29B	508	1	7.50
1028-29C	508	1	7.70
1028-29D	508	1	7.90
1030	508	7	.04
1033	510	2	.22
1034	507	1	.30
1050	514	4	.04
1054	514	4	.15
	521		
1061	511	1	2.20
1070	510	1	1.60
1078	521	1	.20
1079	521	1	.10
1083	507	22	.15
1152	521	1	3.50
DE-1169	520	1	.10
1225	510	6	.95
1253	511	6	.38
1255	511	12	.08
1261	511	12	.20
1266	511	6	7.75
1304	509	12	.04
1305	510	6	.08
1307	512	1	.04
1308	512	1	.25
1309	512	1	.55
1310	509	6	.90
1315	509	6	.40
1316	512	2	.25
1317	512	4	.10
1318	512	1	.14
1341	512	1	.03
1345	509	6	.40
1346	510	1	.34

Part Number	Page	No. Req.	Unit Price
1357	507	4	.06
1359	510	4	.02
1392	512	1	33.00
1438	508	2	.04
1452	513	1	2.50
1458	513	1	.10
DP-1467	537	2	.65
1508	517	1	.05
1509	517	1	.65
1510	517	1	.65
1526	518	1	.04
1530	518	1	.06
1531	518	1	11.00
1535	517	1	.04
1539	518	2	.10
1540	518	1	.06
1541	518	1	.06
1546	517	1	.04
1547	517	2	.06
1560	508	6	.04
1561	508	2	.04
1562	517	1	.20
1563	517	1	.20
1618	535	1	1.60
1620	535	1	.16
1622	535	1	4.30
1628	535	1	.16
1639	516	1	.04
1645	516	2	.04
	524		
1651	535	1	2.75
1655	507	2	.06
1656	507	1	.06
1705	521	1	.16
1708	526	1	1.50
1709	526	2	.16
1710	526	2	.15
1716	526	1	3.00
1733	527	1	24.00
1735	526	1	3.50
1743	531	1	1.60
1755	526	1	3.50
1811	524	2	.10
	533		
1812	524	1	1.60
A-1938	533	1	1.80
2034	507	1	.10
2065	510	4	.08
2074	521	4	.08
V-2084	517	2	.04
C-2283	535	1	.02
2313	509	12	.28
2605	535	1	6.25
C-2674	535	1	.16
2725	526	1	.05
C-2815	535	2	3.30
2841	524	1	1.00

Part Number	Page	No. Req.	Unit Price	Part Number	Page	No. Req.	Unit Price
2903	524	1	5.00	DE-4870	507	8	.06
C-2961	535	1	.40	AP-4966	537	1	.40
C-2962	535	1	.40	DE-4999	524	2	.20
C-2963	535	1	.20	G-5113	533	1	.10
3040	515	2	.06	AP-5136	537	4	.35
G-3040	533	2	.30	AP-5137	537	4	.35
AP-3068	537	2	.30	AP-5140	537	1	15.00
C-3157	535	1	.24	G-5210	533	2	.10
C-3158	535	1	.16	DE-5476	507	7	.02
C-3159	535	1	.40	5529	518	1	.20
AP-3162	537	1	5.80	5654	507	1	.16
AP-3163	537	2	.35	AP-5657-G	537	1	80.00
G-3168	533	1	.26	AP-5723	537	1	8.50
AP-3187	537	1	2.00	AP-5816	526	1	.60
3208	510	6	.50	5864	530	1	3.50
3230	509	6	1.00	5875	517	1	14.50
DE-3284	518	1	1.30	5876	517	1	4.75
3312	509	6	1.40	5879	517	1	2.50
3360	512	1	.50	5880	517	1	2.50
3432	513	1	.30	5899	517	1	2.75
MC-3486	537	2	.12	G-5950	533	2	.16
G-3494	533	4	.06	AP-5965	539	1	.15
3545	518	1	.06	AP-6014	539	4	.20
3729	526	1	.05	G-6026	533	1	1.80
3731	526	1	.50	AP-6037	537	1	9.25
C-3837	535	1	.15	AP-6062	537	1	4.20
3864	533	1	6.50	AP-6063	537	1	2.10
AP-3883	539	1	2.25	AP-6064	537	2	.20
G-3947	533	1	.50	AP-6065	537	2	6.50
3943	507	14	.10	AP-6081	516	12	.05
3998	526	1	1.00		537		
4030E	511	1	.20		539		
DE-4134	513	1	.20	AP-6157	539	1	.75
G-4159	533	1	.25	AP-6297	528	1	3.25
G-4200	533	1	4.50	AP-6361	539	1	.10
G-4201	533	1	6.90	AP-6362	539	1	5.20
G-4203	533	1	2.40	AP-6364	539	2	1.10
G-4205	533	1	1.80	AP-6557	539	1	11.00
G-4206	533	1	1.80	AP-6565	539	1	2.40
G-4208	533	1	1.20	G-6905	533	1	.60
G-4209	533	1	.05	H-11078	511	1	35.00
G-4211	533	1	1.80	H-11141	517	1	.10
G-4305	533	1	.90	H-11175	507	1	.40
G-4306	533	1	1.10	H-11274	514	1	7.00
G-4449	533	2	.60	H-11275	514	1	6.50
4508	510	6	.20	H-11276	514	1	.35
4595	520	1	.06	H-11277	514	1	.15
4614	535	1	.15	H-11279	512	1	5.75
4645	516	1	1.75	H-11280	513	1	5.25
AP-4712	539	1	.75	H-11281	516	1	1.20
AP-4713	539	1	1.25	H-11288	516	1	.08
4740	528	1	3.00	H-11340	526	1	.65
DE-4755	537	1	11.00	H-11345	530	1	.40
4757	525	1	8.00	H-11363	515	1	.04
4776	533	1	.35	H-11366	516	1	.90
AP-4781	539	1	.15	H-11419	526	1	1.20
AP-4782	539	1	.20	H-11561	510	6	.20
AP-4792	539	1	.20	H-11566	516	1	1.65
C-4832	535	1	.08	H-11589	515	1	6.60

Part Number	Page	No. Req.	Unit Price	Part Number	Page	No. Req.	Unit Price
H-11591	516	1	2.25	H-12550	523	1	18.50
H-11593	515	1	5.75	H-12560	516	1	1.35
H-11595	515	1	.60	H-12666	533	1	1.25
H-11596	515	1	.25	26153	526	1	.05
H-11597	515	1	.12	33436	525	1	.01
H-11598	516	2	.08	DE-40036	512	14	.15
H-11599	516	2	.20	K-40167	533	1	25.40
H-11600	516	2	.35	DE-40317	518	1	.28
H-11601	516	2	.08	DE-40318	518	1	.35
H-11602	516	2	.05	DE-44122	528	1	.90
H-11603	516	2	.35	DE-51170	520	1	4.00
H-11604	515	1	.05	DE-51184	508	1	90.00
H-11605	515	1	.12	DE-51302	507	1	.60
H-11629	526	6	.65	DE-51695	521	1	35.00
H-11677	520	1	16.00	DE-51708	535	1	.06
H-11704	507	1	7.00	DE-55139	508	1	.12
H-11718	515	1	1.40	DE-56043	521	1	24.00
H-11719	515	1	.65	DE-56103	507	2	.55
H-11720	515	1	.50	DE-56119	520	1	1.05
H-11721	515	1	.15	DE-56131	508	2	1.25
H-11722	515	1	.04	DE-56165	508	2	.08
H-11730	509	3	3.40	DE-56269	520	1	.20
H-11731	509	12	1.00	DE-56270	520	1	.15
H-11750	515	1	9.50	100109	518	1	.04
H-11751	515	1	3.87	100111	518	2	.04
H-11773	515	1	1.50	100121	520	38	.04
H-11805	509	12	.10		521		
H-11807	509	12	.06		524		
H-11816	515	1	29.00		526		
H-11872	526	1	1.65		533		
H-11897	512	1	28.50		537		
H-11898	513	1	2.25	100122	517	12	.04
H-11899	513	1	.15		524		
H-11935	515	1	6.50		531		
H-11950	508	4	.15		539		
H-11951	507	1	3.85	100134	516	10	.04
H-12000	518	1	2.85		520		
H-12030	518	1	.50		537		
H-12035	518	1	.30	100135	514	3	.04
H-12050	520	1	1.75	100137	510	10	.06
H-12086	535	1	6.00		526		
H-12092	508	1	4.40		528		
H-12096	535	1	2.85	100139	516	1	.06
H-12101	535	1	15.00	100161	513	3	.06
H-12111	521	5	.16	100764	539	1	.04
H-12117	531	1	2.50	102634	537	26	.02
H-12148	531	1	2.50	102635	514	12	.02
H-12162	533	1	1.35	102637	537	5	.04
H-12175	529	1	25.00		513		
H-12178	518	1	.16	102639	537	2	.06
H-12237	536	1	3.50	103025	515	4	.02
H-12245	508	1	2.50	103026	535	3	.02
H-12280	509	24	.08	103028	511	26	.04
H-12288	507	1	3.85		515		
H-12289	508	2	.05		521		
H-12295	507	1	.70	103088	530	1	.02
H-12329	509	12	.40	103101	539	1	.02
H-12355P	510	6	5.55	103319	528	2	.01
H-12398	507	1	.40	103320	517	16	.01
H-12410	524	1	2.20		524		
H-12478	510	6	6.70		526		

Part Number	Page	No. Req.	Unit Price	Part Number	Page	No. Req.	Unit Price
	535			115773	513	3	.20
103321	510	18	.01	115903	527	4	.01
	514			117061	526	6	.02
	626				539		
103323	535	1	.01	117062	537	4	.02
103326	535	1	.02	H-11872	526	1	1.65
103564	533	1	.04	120703	533	1	.08
103583	516	1	.02	120704	533	2	.08
103720	513	1	.04	121743	529	4	.02
103730	516	1	.10	121932	524	2	.04
103865	512	2	.04	122159	528	2	.01
103875	507	2	.10	124546	528	1	.02
103877	507	1	.04	121841	526	1	.01
103883	535	1	.02	122403	535	1	.06
103892	517	1	.04	124545	531	1	.04
103895	507	6	.04	131410	513	1	.04
	515			131951	526	1	.01
103896	507	1	.06	132900	531	2	.01
103906	515	1	.04	134569	527	1	.05
104924	518	1	.06	135616	528	1	.01
105453	513	2	.04	137332	514	4	.20
	517			138479	531	2	.10
106319	517	6	.04	138577	515	1	.05
106324	526	3	.04	141540	530	2	.01
	531			141543	530	1	.01
106325	524	4	.04	802691	527	1	.05
106330	514	24	.04	802730	530	2	.01
	516			802731	530	3	.01
	518			802757	529	4	.01
	531			804000	531	1	.05
106331	516	2	.04	804076	529	1	.05
106495	527	7	.01	805258	527	1	.05
	530			805579	526	1	.20
106496	525	9	.01	805790	527	2	.01
	528			806427	528	2	.01
	530			806915	531	1	.10
106497	528	2	.01	808949	528	1	.40
	530			809051	527	1	.05
106500	521	5	.02	809053	528	2	.10
106630	521	3	.06	809062	527	2	.05
106973	521	6	.04		529		
	535			809518	528	1	.55
106974	514	5	.04	809551	530	3	.05
107715	526	1	.01	809593	528	2	.05
107728	530	1	.05		531		
B-108157	533	1	4.50	809614	530	1	.05
108579	531	2	.02	809642	530	3	.10
108600	537	2	.08	809644	530	2	.05
110499	537	16	.04	809658	530	1	.05
110730	527	2	.01	809688	530	1	.10
112715	511	1	.06	809698	529	1	.30
112865	539	1	.01	809815	528	1	.05
113698	512	3	.04	809824	530	1	.02
113782	512	1	.04	809945	530	1	.05
113879	508	1	.04	809961	530	1	.05
114547	512	14	.08	810074	525	1	.02
114604	517	6	.01	810078	526	1	.02
114998	515	1	.30	810226	527	4	.10
115308	515	4	.04	810287	528	1	.07
115607	526	3	.01	810288	528	1	.0[illegible]

Part Number	Page	No. Req.	Unit Price	Part Number	Page	No. Req.	Unit Price
810601	527	4	.50	820524	530	1	.05
810620	528	1	.10	821150	525	1	.75
810626	527	1	1.80	821160	526	1	.15
810627	527	1	1.80	821604	525	1	.05
810794	525	1	.01	822622	525	1	1.50
811080	528	1	3.90	822627	525	1	1.00
811124	526	2	.01	824735	525	1	.85
811194	528	1	5.50	824738	525	1	1.50
811553	527	4	.05	826938	527	1	.10
811559	528	2	.07	828675	527	6	.05
811912	526	4	.05		529		
812015	527	3	.10	833602	528	2	.05
	529			903203	530	1	1.15
812016	527	3	.10	1835699	525	2	.10
	529			1837832	525	1	.05
812823	529	1	.20	1838678	530	1	2.00
813238	525	1	.50	1839100	528	1	3.25
813245	526	1	.01	1847289	526	2	.25
813496	529	2	.50	1848038	525	1	.30
813511	526	1	.02	1849774	528	1	.05
813554	528	2	.10	1850025	531	1	.10
814978	529	1	1.00	1855685	527	4	.05
815018	531	2	.10	1855701	530	1	.05
815839	527	1	1.50	1855702	530	1	.10
816315	529	1	.05	1856056	531	2	.01
816784	526	1	.05	1857107	529	1	.01
816803	526	1	.05	1858749	529	1	.01
817114	528	1	.10	1858752	529	2	.01
817216	529	1	1.25	1858753	529	2	.02
817220	530	1	.05	1858754	529	1	.10
817224	530	1	.10	1861076	527	2	.01
817313	527	3	.05	1862803	530	3	.01
	529			1863510	529	1	1.00
817314	527	3	.05	1865182	527	1	.05
	529			1866970	530	3	.01
817532	530	1	.05	1868330	530	3	.01
817807	529	1	7.50	1869704	525	1	.45
818002	527	1	5.00	1871838	526	2	.10
818222	525	2	.20	1872638	530	1	.50
819104	530	1	.05	1873937	531	1	.15
819362	528	1	.15	1880635	529	2	.05
820445	525	1	.25		530		
820517	530	3	.10	1880642	527	1	.05