No. 1999

HANDBOOK OF THE

TWO-TON TRUCK CHASSIS
NASH MODEL
4017-A AND 4017-L

(SEVENTY-FOUR - PLATES)

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WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
WASHINGTON, July 3, 1918.

This manual is published for the information and government of the Regular Army, National Guard, and National Army of the United States.

By order of the Secretary of War:

C. C. WILLIAMS,
Brig. Gen., Ordnance, N. A., Acting Chief of Ordnance.

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NOMENCLATURE.

SPECIFICATIONS, TECHNICAL DATA, DIMENSIONAL INFORMATION, PARTS NUMBERS AND DESIGNATIONS, CARE AND REPAIR OF

TWO-TON CHASSIS NASH MODELS 4017-A AND 4017-L.

These chassis models are alike except as follows:

Model 4017-A has electric generator and storage battery lighting.

Electric searchlight and electric side and tail lamps.

Magneto without impulse starter.

Model 4017-L has acetylene generator and searchlight. Oil side and tail lamps.

Speedometer.

Magneto fitted with an impulse starter.

Other than changes mentioned, the specifications for both models are identical. Where information or data applies only to one model it is so stated in the proper place.

HANDBOOK OF THE TWO-TON TRUCK CHASSIS NASH MODEL 4017-A AND 4017-L

CHAPTER I.

WEIGHTS AND OUTLINE SPECIFICATIONS.

Rated load capacity	pounds	4,000.00
Body weight allowance	do	1,200.00
Weight of chassis only	do	6,700.00
Maximum gross weight (including chassis, body and pay load)	pounds	11,900.00
Percentage of chassis weight on front tires (without load)		66.66
Percentage of chassis on rear tires (without load)		33.33
Percentage of load weight on front tires		30.00
Percentage of load weight on rear tires		70.00
Percentage of gross weight on front tires		45.00
Percentage of gross weight on rear tires		55.00
Overall length of chassis (without body)	inches	202.50
Overall width of chassis (at widest part)	do	78.50
Chassis wheelbase	do	124.00
Length of frame back of driver's seat	do	117.13
Width of frame (outside dimensions)	do	38.13
Height of rear end of frame from ground loaded	do	35.50
Height of rear end of frame from ground unloaded	do	38.50
Diameter of turning circle	feet	50.00
Tread of front wheels	inches	60.50
Tread of rear wheels	do	60.50
Road clearance under front axle (lowest point)	do	14.75
Road clearance under rear axle (lowest point)	do	14.75

ENGINE.—Four-cylinder, 4-cycle; L-head type, cylinders cast en bloc, with integral head. Bore 4.25 inches, stroke 5.5 inches. Horsepower 28.9, N. A. C. C. rating.

COOLING.—Water, centrifugal pump circulation.

LUBRICATION.—Force feed, using drilled crankshaft; spray to cylinders.

RADIATOR.—Tubular type with fins, removable cast iron headers.

IGNITION.—Eisemann high-tension variable spark magneto, type G4-II Edition. Model 4017-L fitted with an impulse starter.

CARBURETOR.—Type M-2, 1.25-inch Stromberg, plain-tube type, with hot-air connection.

FUEL FEED.—From main tank of 27 gallons capacity to auxiliary tank, holding two quarts, from latter to carburetor by gravity.

GOVERNOR.—Fly ball type, drives through flexible shaft from camshaft and is mounted between carburetor and short external inlet manifold.

CLUTCH.—Single-plate, dry-disc, fitted with clutch brake.

TRANSMISSION.—Selective, sliding-jaw clutch type, combined with silent chain reduction. Four speeds forward—one reverse.

DRIVE.—Drive from transmission through two propeller shafts fitted with Spicer universal joints, then to bevel ring gear in axles and through axles to internal gearing in four wheels. Torque absorbed through springs. Full Hotchkiss drive.

FRAME.—Channel section pressed steel. Six cross members. Five standard Ordnance transoms. Ordnance pintle at rear, towing hooks in front.

SPRINGS.—Front and rear semi-elliptic with auxiliary coil springs.

AXLES.—Front and rear identical. Bevel pinion and gear with M. & S. locking type differential at propeller shaft and internal gear at wheels.

BRAKES.—Two sets of brakes. Pedal-operated service brake of internal expanding type in wheel brake drums. Hand-lever operated emergency brake of external contracting type on transmission; hand-brake applies foot brakes also.

WHEELS.—Cast-steel disc wheels, all four identical. Wheels have brake drums cast integral. Wheels fitted with taper roller bearings.

TIRES.—36 inches x 6 inches, solid tires, pressed-on type.

STEERING.—All four wheels used for steering. Vertical steering column. Steering gear of screw and split nut type. Hardwood steering wheel.

CONTROLS.—Left hand steer. Change gear and emergency brake levers in front of driver's seat to right of steering column. Spark and throttle lever operated on sector clamped below steering wheel on front of steering column. Ignition ground wire switch on left side dash. Carburetor choke control on steering column. Clutch and service brake pedals left and right respectively. Accelerator pedal to left of change gear lever.

MAIN GASOLINE TANK.—Galvanized steel tank, 27-gallon capacity.

AUXILIARY GASOLINE TANK.—Steel tank, two quarts capacity.

EQUIPMENT.—Pyrene fire extinguisher; non-skid chains, complete in chain box; eyes for non-skid chains; hand-operated horn; odometer; hand flashlight; *Model 4017-A, fitted with speedometer;* electric searchlight, electric side lamps, electric taillamp, Bijur generator, storage battery. Model 4017-L, acetylene searchlight, acetylene generator, oil side lamps, oil tail lamp and speedometer.

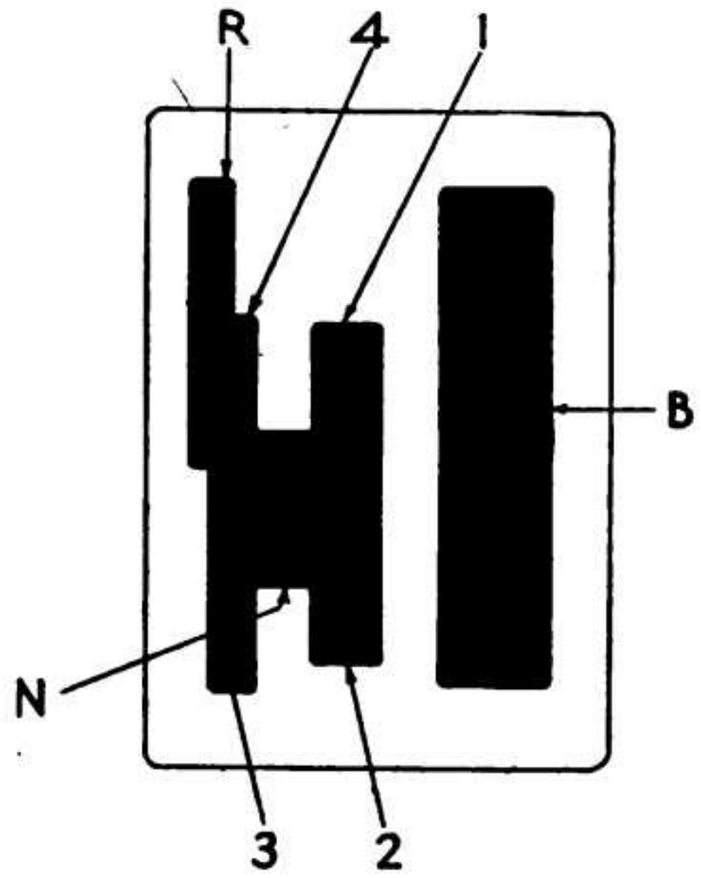
BRIEF DESCRIPTION NASH MODELS 4017-A AND 4017-L.

With the exception of a few details of equipment these models are identical. The Model 4017-L uses an impulse starting device on the

magneto shaft, while the 4017-A model has none; it uses acetylene lighting while the 4017-A model employs an electric generator and storage battery system; it is fitted with a speedometer in addition to an odometer, while the Model 4017-A has only an odometer.

The chassis is one of 124 inches wheelbase and is fitted with a four-cylinder engine, dry-disc clutch, four-speed transmission, and a drive

Plate No. 1



CHANGE-GEAR AND HAND BRAKE QUADRANT SHOWING POSITION LEVER SHOULD TAKE FOR DIFFERENT SPEEDS.

1—First speed.
2—Second speed.
3—Third speed.
4—Fourth or direct speed.

B—Emergency brake lever slots.
N—Neutral position.
R—Reverse.

to all four wheels, through shafts and internal gear-drive axles which are identical front and rear.

The engine is a standard design L-head, of Buda make, using force-feed lubrication, pump cooling, and fitted with a Stromberg carburetor feeding through cored manifold cast integral with cylinder block, an Eisemann magneto, and on the Model 4017-A only, with a Bijur generator.

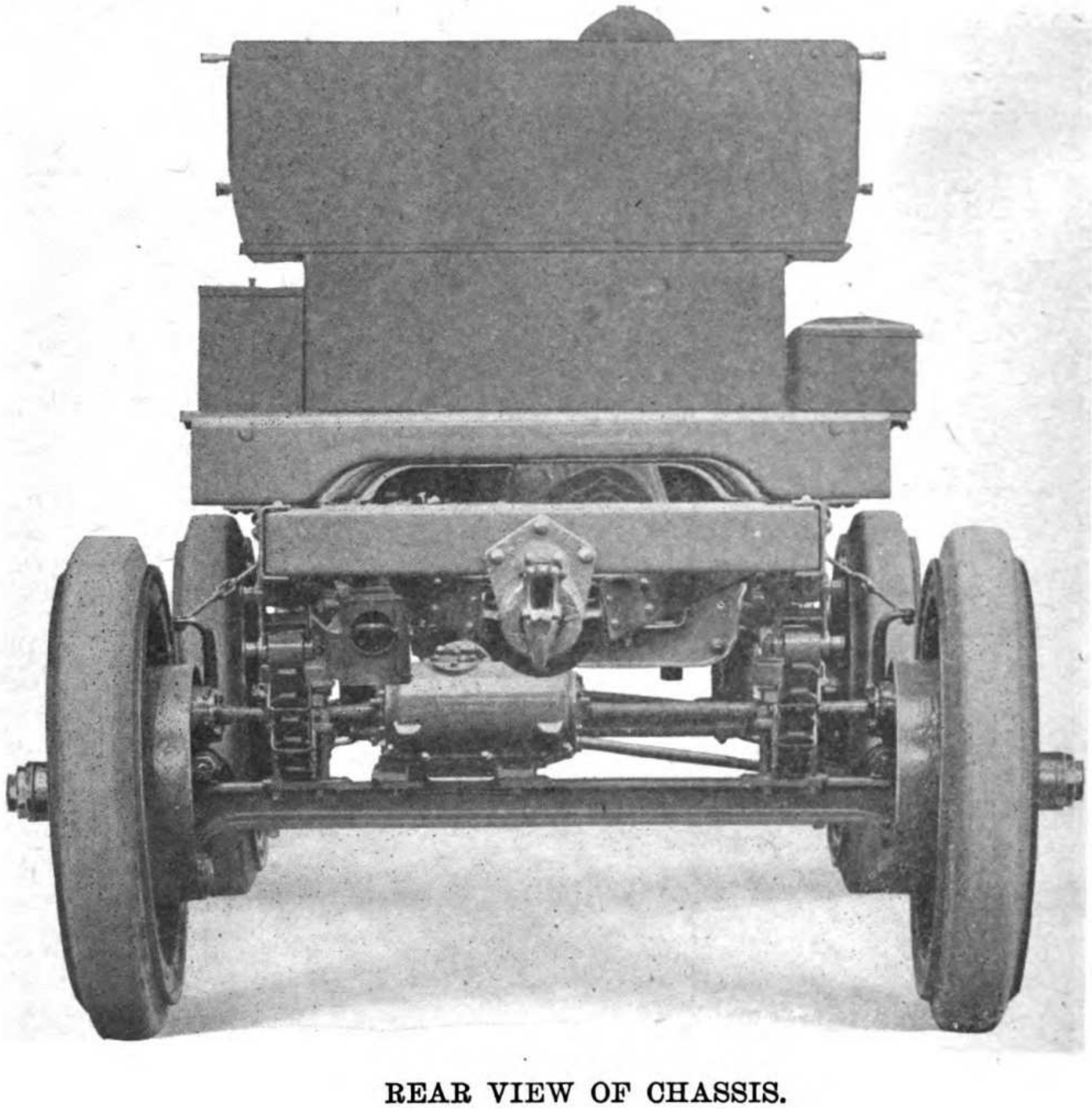
The clutch is of the dry-plate type and the drive from it is through an open two-joint propeller shaft to a four-speed, sliding jaw clutch type transmission. From the latter extend two two-joint propeller shafts, one forward and one rearward, to identical internal gear-drive axles. The live member has exposed axle shafts extending from it, and the ends of these shafts are each fitted with a universal joint and a spur pinion, the latter meshing with an internal gear bolted to a disc steel wheel. All the wheels are interchangeable and are all driving and steering wheels.

BRIEF OPERATING INSTRUCTIONS.

PRELIMINARY TO STARTING ENGINE.

See that gear shift lever is in neutral.
Set emergency brake.
Advance gas lever one-third travel.
Advance spark lever one-fourth.
Turn ignition switch to "MAGNETO" position.
Crank engine by spinning rapidly.
Pull up air choke lever for rich mixture, if necessary.

Plate No. 2



REAR VIEW OF CHASSIS.

AFTER ENGINE STARTS.

Advance spark.
Regulate auxiliary air control lever to secure smooth engine operation.
Close throttle lever until engine runs slowly.

TO START TRUCK.

Release hand brake.
Disengage clutch.
Engage low speed gear.
Increase engine speed slightly.
Slowly engage clutch.

GEAR CHANGES.

As truck gains momentum, disengage clutch, close throttle, shift to intermediate speed, open throttle slightly and engage clutch. When momentum is gained again disengage clutch, close throttle and engage next higher gear. Repeat operation until fourth speed is reached, after which truck speed can be controlled by accelerator (or hand lever).

GEAR CHANGES TO LOWER SPEEDS.

In changing to lower speed, necessitated by heavy loads or steep grades, disengage clutch, accelerate engine slightly, instantly shift to lower gear, engage clutch and open throttle to gain speed.

TO REVERSE TRUCK.

Reduce engine speed, disengage clutch, apply foot brake. When truck has stopped, engage reverse gear, release brake and engage clutch. Never engage reverse gear when truck is moving forward.

TO STOP TRUCK.

Reduce engine speed, disengage clutch, apply brake, place gear shift lever in neutral, engage clutch, set emergency brake.

TO STOP ENGINE.

Turn ignition switch to "OFF" position. Advance gas lever slightly to supply initial charge to assist for next start. In winter, pull up air choke when stopping.

DETAIL OPERATING INSTRUCTIONS.

PREPARATION OF TRUCK FOR SERVICE.

UNLOADING FROM SHIP OR CAR.

Great care should be exercised in unloading the truck, as carelessness may cause serious loss later. A thorough inspection should be made of the equipment sheet, comparing it with the equipment received. The box of tools and parts should be opened and checked over before being receipted for, and any movable parts that might be stolen or lost from the truck should be checked up. All seals on governor, transmission, differential and other places should be intact and if any have been tampered with make a careful inspection of the place where the seal belonged and note whether any damage might have been done to important parts. A

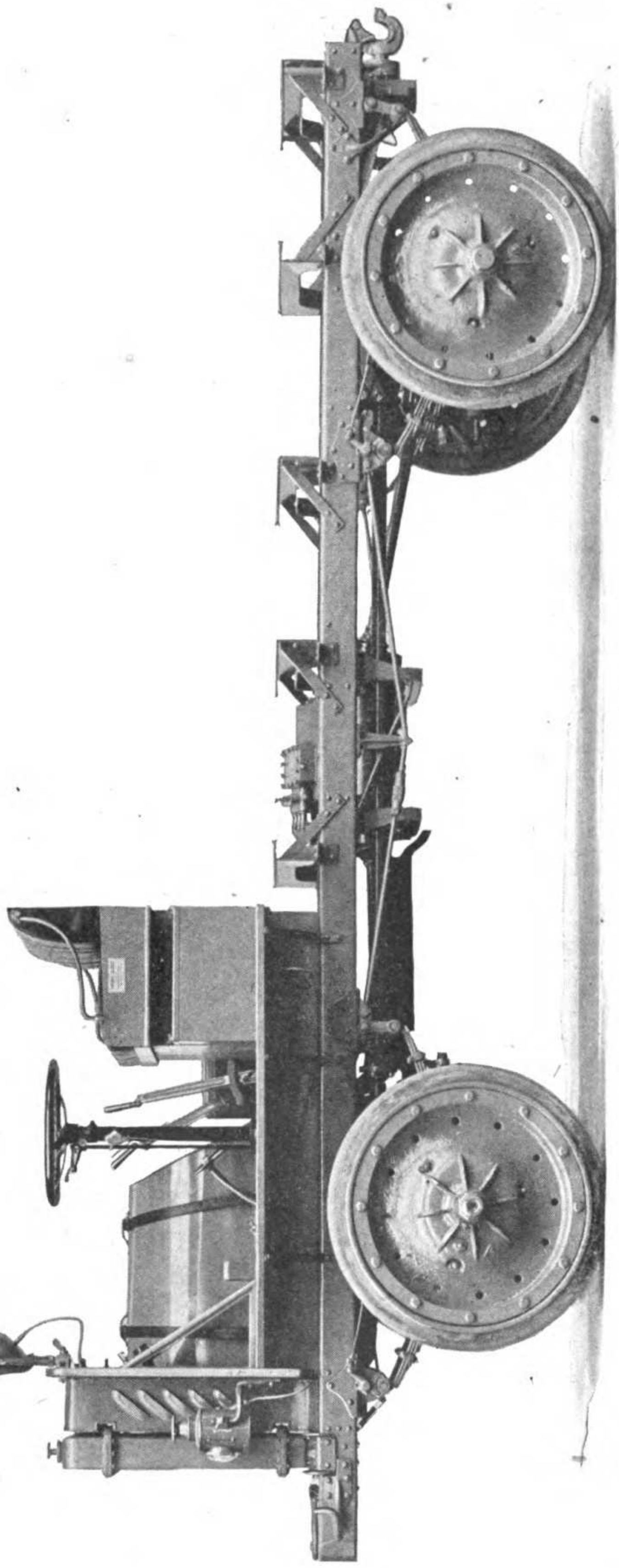
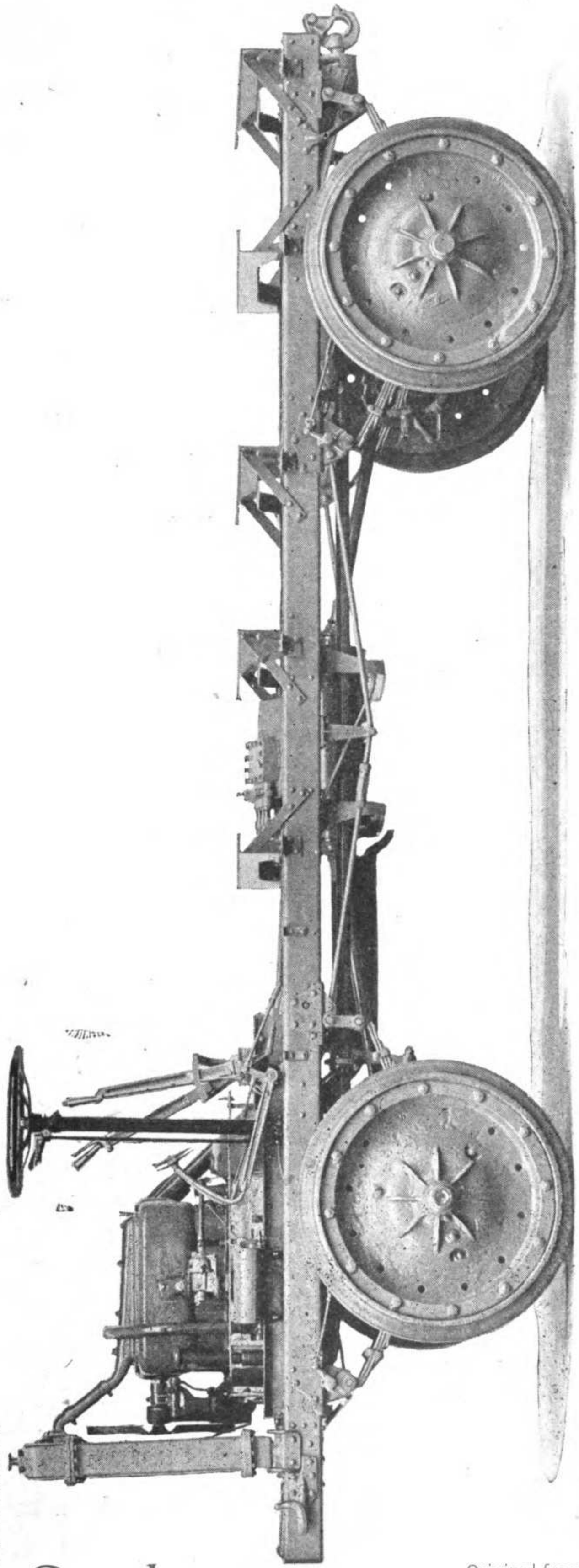


Plate No. 3

LEFT SIDE OF CHASSIS WITH DRIVER'S SEAT AND ENGINE HOOD IN PLACE



LEFT SIDE OF CHASSIS, ENGINE UNCOVERED AND MINUS DRIVER'S SEAT, SHOWING FIVE STANDARD ORDNANCE TRANSOMS MOUNTED ON FRAME.

Plate No. 4

nut or broken bolt slipped into the transmission may completely ruin a truck or cause loss of life, and these things should be watched carefully.

After the inspection of the shipment, so far as completeness goes, see that the drain cocks under radiator and water pump and the plug in cylinder water jacket are closed, and that all hose connections are tight. The radiator should then be filled with clean water to within two inches of the bottom of filler neck on radiator and all connections and joints tested. Care should be exercised in selecting water, get soft water, if it is procurable. The radiator and cooling system holds about seven gallons of water.

The crankcase of the engine should be examined and the specified grade of heavy oil put in so that the gauge on the left side of the engine indicates the proper level. The grease cups on the water pump glands should be turned down. Note if there is a water leak at that point. The spark plugs should be removed, and with a squirt can, about a tablespoonful of motor oil should be squirted on to the top of each piston, and the engine revolved by hand a number of times after replacing plugs, so that the oil will lubricate the cylinder walls. While turning the engine over notice whether there are any compression leaks around the cylinder head pet cocks, and have them closed.

Dampness and moisture may get to the working parts, and on arrival they may be rusted badly, grease may be lost out of important places, and equipment stolen or lost. In the former case the engine should be handled very carefully, because the pistons might have rusted fast or valves seized in the guides. Kerosene applied with an oil can to the tight parts will loosen them. A little kerosene in the clutch will make it function better, and prevent grabbing in case it has rusted on the plate. After the engine has been cranked freely by hand the gasoline tank lever should be turned to main supply with the long end of the lever down inclined at an angle of about forty-five degrees to the left. Fill gasoline tank with clean gasoline, being sure funnel and receptacle gasoline is carried in is thoroughly grounded on tank or explosion may occur, and after a sufficient quantity has been put in, unscrew the end of the gasoline pipe near carburetor and drain out a quart or so to clear line and tank of dirt before it reaches the carburetor.

Open the plug on the side of the transmission case and note oil level. If oil does not flow, fill to proper height with grade specified in lubricating instructions. Note oil level of differential housings and fill, if necessary, with specified grade.

A careful inspection should be made of the amount of grease in the wheels and on spindle bearings.

The pinion shaft roller bearings should be looked at in case they may have rusted or broken. If one of these bearings fail, serious damage might result.

After all spring bolts are oiled and grease cups have been turned down

to the limit and refilled with fresh grease, every universal joint on the truck should be opened and, if necessary, packed with grease. The propeller shaft joints should be given the greatest attention.

PRELIMINARY TO STARTING.

Before attempting to start be certain you have enough fuel, oil and water for the run. See that the crankcase level is correct, and that all lubricating instructions (see under lubrication, page 34) have been carried out. Make a superficial examination to see that nothing about the truck is broken or out of place; look underneath and notice if there is dripping which indicates a leak, except in the case of water coming out through the radiator overflow. You can tell by the feel and odor whether it is water, oil or gasoline. See that any danger is removed from driving, by an excessively loose part of the running gear or controls, such as steering knuckles, tie rod, drag link, wheels, etc.

The engine should then be started and let run idle without any load for from one-half to one hour before starting the truck. After standing on freight cars or on board ship for a long time piston rings may gum fast, valves rust in or the gasoline line clog up, and this preliminary running in will repay for the trouble in the time saved on adjustment later on.

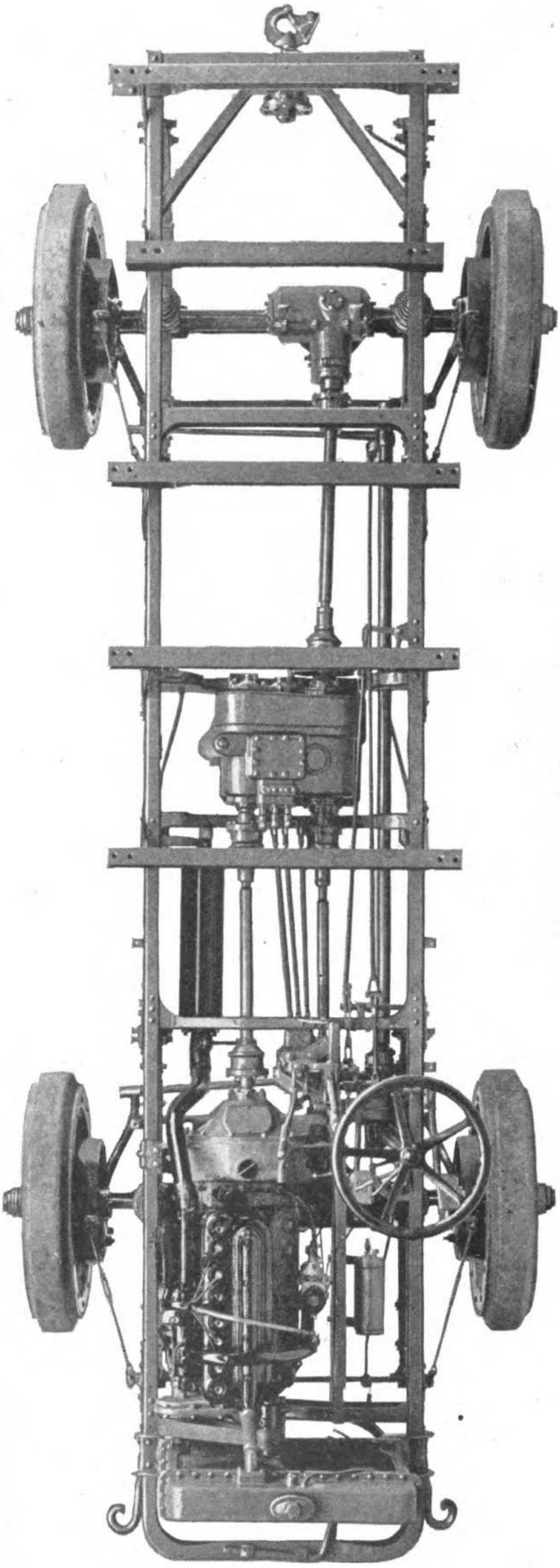
After going into service the truck should be driven very carefully for the first week in order that the various parts may work into place and the rough edges wear off. The first five hundred miles are the most important in the life of the truck, and abuse early will surely result in poor efficiency probably later on, when the best will be required of the truck.

STARTING.

Before cranking the engine always see that the gearshift lever is in neutral position and the hand brake set. If you make a practice of setting the hand brake every time you shift into neutral when stopping you will be on the safe side. When stopping set the spark one-quarter advance and set the hand throttle lever one-quarter open. This sets these for the next start. Get into the habit of doing these things automatically.

Turn ignition switch to "mag" and then crank engine.

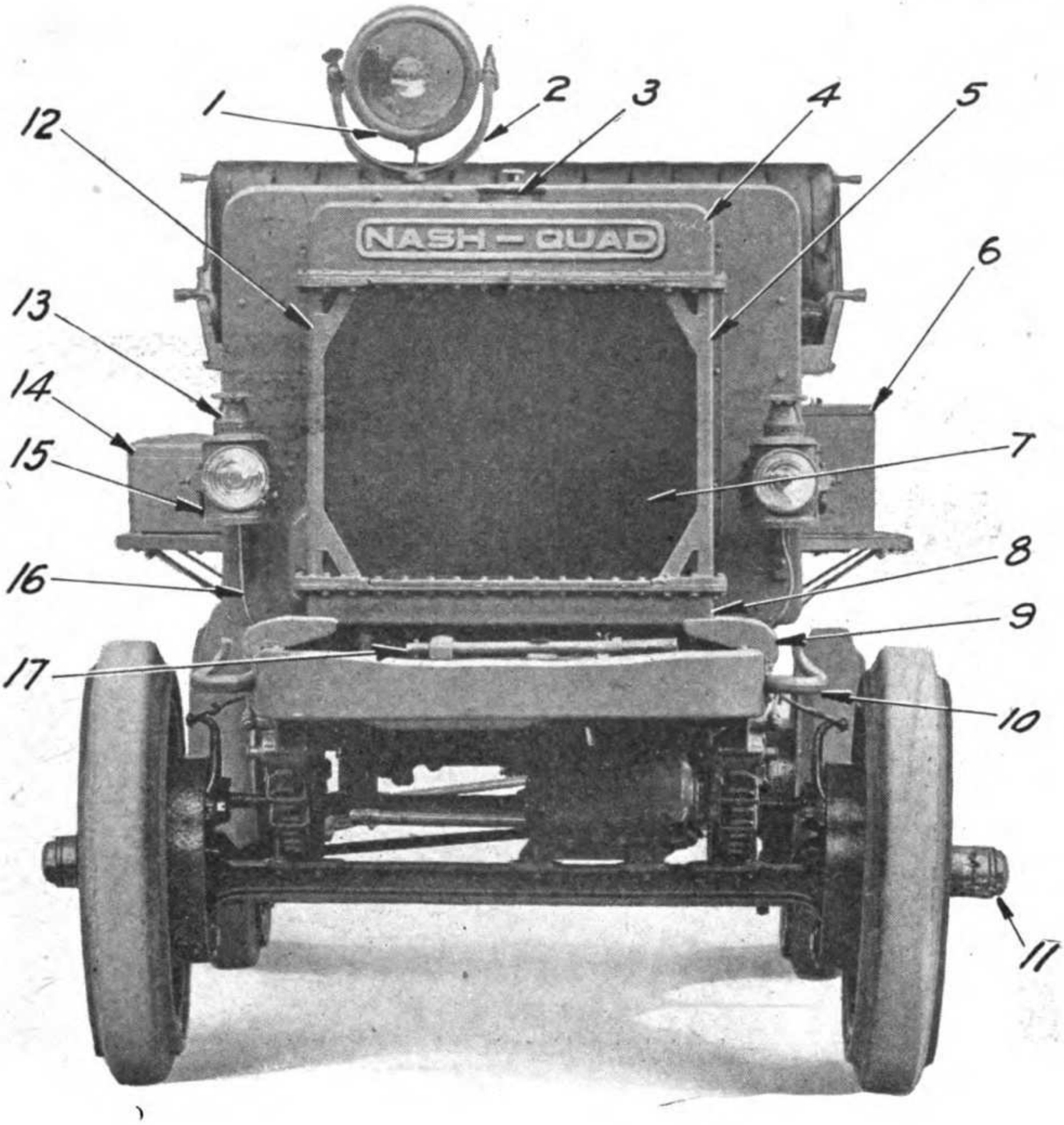
After the engine has started firing advance the spark as far as it will go and get a good idling position for the throttle lever. In the winter time it will be necessary to pull up the carbureter air choke before cranking so that a rich mixture is drawn into the cylinders. Do not keep the air choke pulled up longer than necessary. That means as soon as the engine starts firing push the choke down gradually until the engine runs and pulls smoothly. If it starts to backfire and spit keep the choke on full or part way as needed. It will require only a minute in the cold weather to get smooth running with the choke closed, that is, up.



PLAN VIEW OF CHASSIS.

Plate No. 5

Plate No. 6

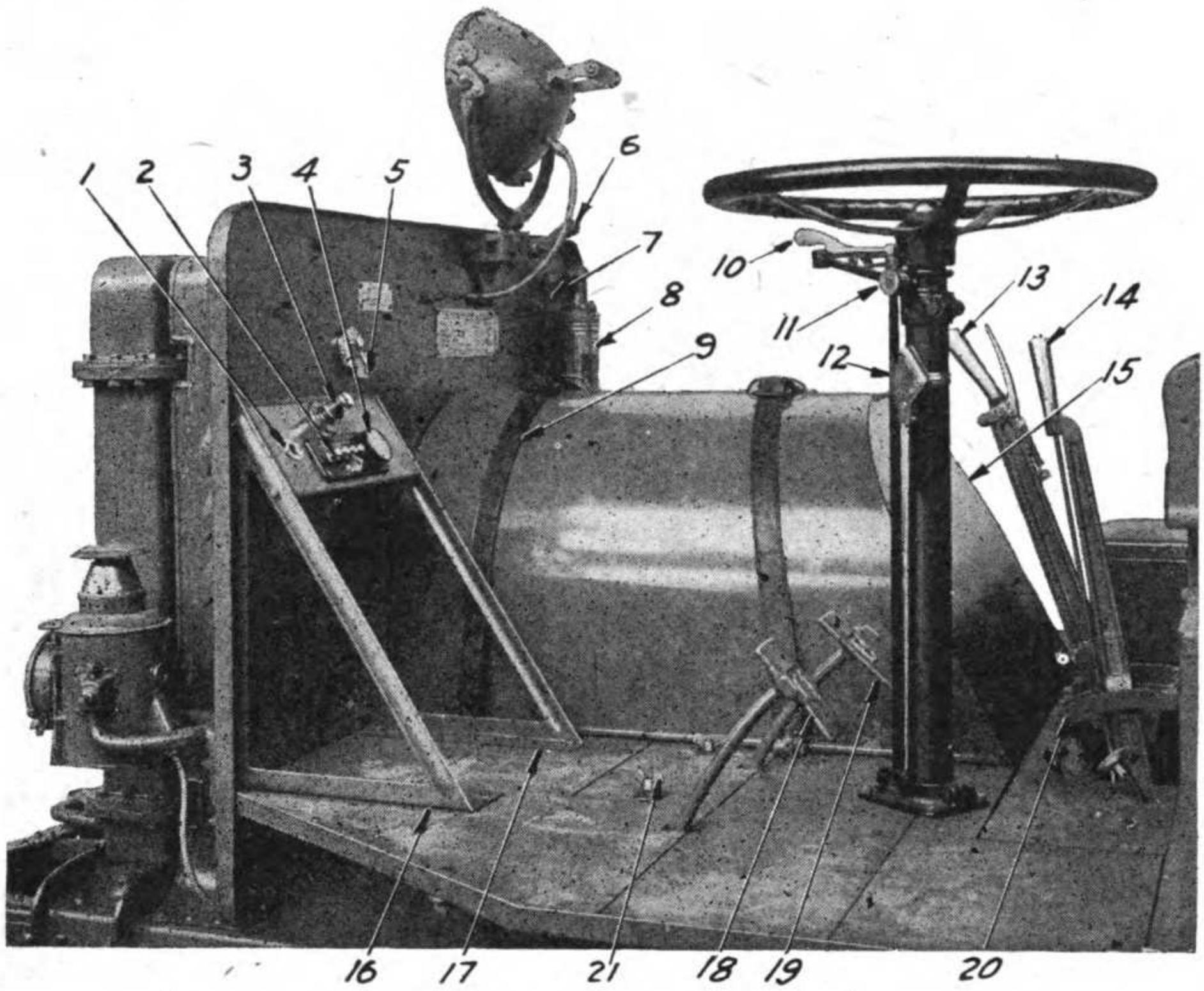


FRONT VIEW OF CHASSIS. MODEL 4017-A ONLY.

Ref. No.	Part No.	Name of Part.
1	37057-A	Searchlight.
2	35259-A	Searchlight bracket, complete.
3	32183-A	Radiator filler cap.
4	32186-A	Radiator top tank.
5	32178	Radiator side member.
6	35836-A	Battery cover.
7	32171	Radiator core, complete.
8	32185	Radiator bottom tank.
9	31087	Radiator bracket.
10	32530	Tow hook (left).
11	32713	Wheel odometer and hub cap.
12	32178	Radiator side member.
13	35327-A	Head lamp complete (Adlake).
14	32620-A	Tool box.
15	35339	Head lamp bracket.
16	35723	Side lamp wire.
17	32674	Starting crank.

Note.—Special instructions for Model 4017-L. This engine should be easier to start than in the 4017-A, because of the use of an impulse starting device fitted to the magneto. This impulse starter gives a very quick turn

Plate No. 7



DRIVER'S COMPARTMENT. MODEL 4017-A ONLY.

Ref. No.	Part No.	Name of Part.
1	35871	Trouble lamp socket.
2	35287-A	Lighting switch, complete.
3	35284-A	Instrument board lamp, complete.
4	36839	Ammeter (Weston).
5	35902	Magneto switch (Kick type).
6	36636	Searchlight bracket lever.
7	35281	Fire extinguisher bracket.
8	35249	Fire extinguisher.
9	35305-A	Hood strap (left).
10	33778	Spark lever.
11	CU-113	Steering column grease cup.
12	33662	Carburetor control.
13	32206-A	Hand brake lever.
14	35404-A	Change gear lever assembly.
15	32880-A	Hood, complete.
16	33042	Dash brace (upper left).
17	33043	Dash brace (upper center).
18	32651	Clutch pedal pad.
19	32650	Brake pedal pad.
20	32317	Gear shifted lever quadrant (outer).
21	NU-1006	Floor board clamp nut.

to the magneto armature, causing a good, hot spark to occur with only a single turn of the crank. It is not necessary to spin the engine to get the needed good spark, but it may be to get a good mixture.

If in cranking the engine it does not respond in a reasonable time, investigate instead of wasting energy cranking further. Go at the work systematically, keeping in mind all the time that there are three important systems, the failure of which will cause engine failure. These systems are: The fuel system, the ignition system and the valve system. If there is fuel and spark and the valves are working properly the engine should start, other things being equal. See page 104 for further information about failure to start.

If on cranking, the engine turns over only part way, stopping suddenly at one point and not going beyond, make an investigation to find an obstruction. In the winter a frozen water pump might cause this. Breakage of a timing gear or interference with free movement of any moving part of the engine will cause stoppage of this kind. Use your judgment, based on the previous run of the truck, recalling whether it was run with proper amount of oil, or if any unusual noises were heard.

In the winter time cranking may be more difficult than in warm weather, because of the thickening of the oil around the interior moving parts. Once the engine is started in cold weather let the engine idle for a while, until the oil has become sufficiently thin to circulate properly. Cold oil is like cold molasses, it will not flow readily.

RUNNING.

PRELIMINARY ADVICE.

Remember that in the first few hundred yards of running you should keep your eyes, ears and sensory system at work. Test the brakes to make sure they are working, instead of finding out in an emergency. Be satisfied that everything is running right.

THE CONTROL SYSTEM.

The control system consists of those parts necessary to start the engine, shift the gears, accelerate and keep the truck moving forward, and those needed to stop the truck. Thus the complete system consists of clutch and brake pedals, hand or emergency brake lever, spark and throttle levers, accelerator pedal, ignition switch, and carburetor air control.

THE CONTROLS AND THEIR USE.

STEERING WHEEL.

The steering wheel controls the direction of the truck. Turning the wheel to the right turns the truck to right and vice versa. Do not at-

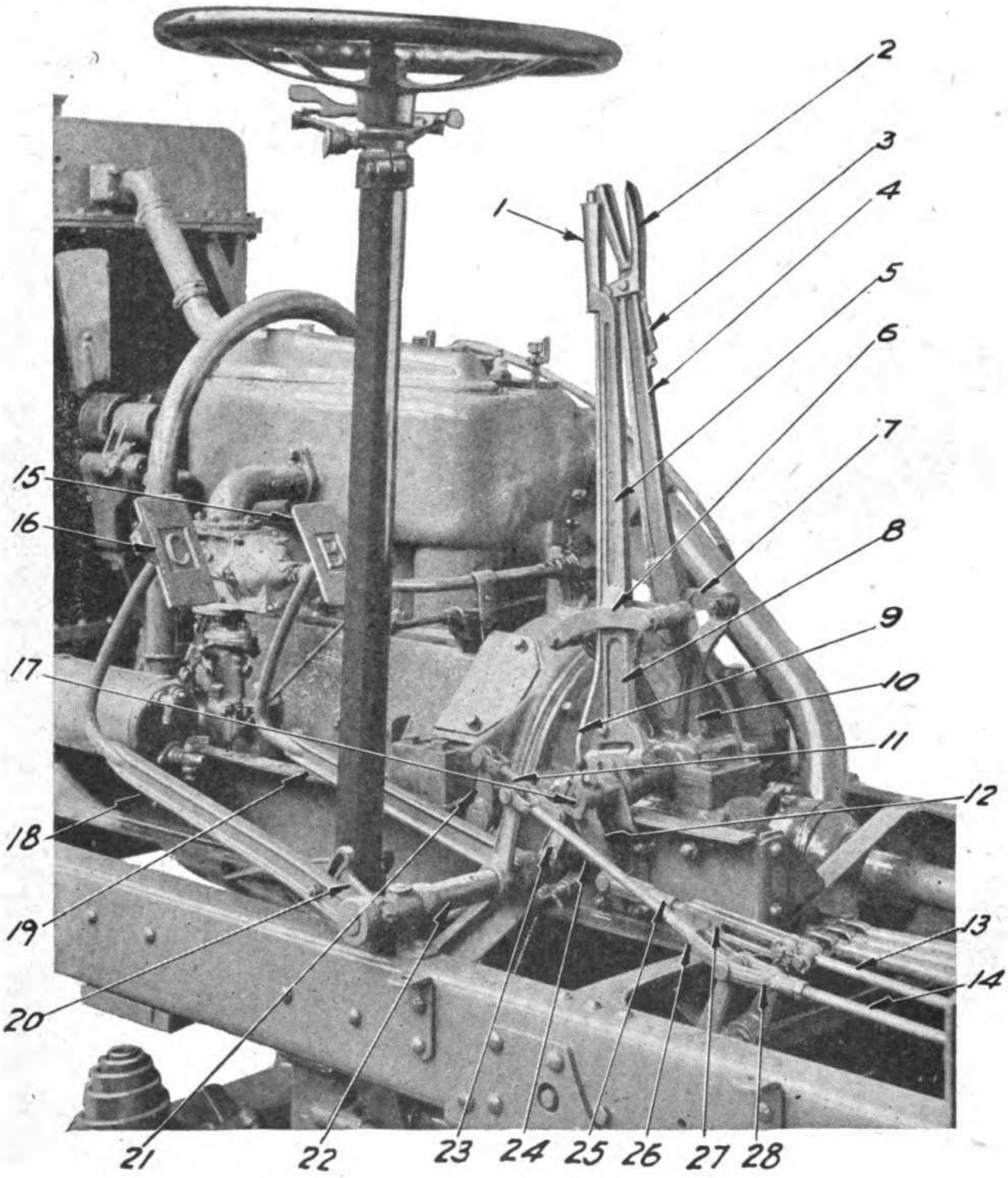
tempt, however, to turn the wheel forcibly when the truck is at rest. This throws needless strain on the steering connections. If you wish to observe the movement of the wheels, jack up the truck.

PEDALS.

CLUTCH PEDAL.

In front of the driver are two pedals. The one on the left is the clutch pedal. The one on the right is the wheel brake pedal. It is ordinarily used and without much pressure will lock all wheels. The clutch pedal, untouched, is in normal position, and in that position the clutch is engaged. When depressed the clutch is disengaged, i. e., independent of flywheel movement.

Plate No. 8



FRONT END OF CHASSIS, DASH REMOVED.

BRAKES.

The foot brake pedal, untouched, is in normal position, and in that position the brakes are not applied. When the pedal is depressed the foot brakes (one acting on each wheel) are applied. The hand brake, or emergency brake lever, when forward all the way releases the brake on the transmission countershaft. This hand brake, when pulled back all the way, sets all the brakes, the four-wheel brakes and the brake on the transmission countershaft as well.

ACCELERATOR PEDAL.

At your heel is the foot accelerator plunger which controls the throttle and speed of the engine.

GEARSHIFT AND HAND BRAKE LEVERS.

In the center of the foot-board are mounted two hand levers. The one at the left is the change-gear lever. The one at the right is the brake lever. Pulling it toward you the brake lever applies brakes on all wheels and transmission (five brakes). To release, compress the handle and return the lever to the front end of the quadrant, being sure that it is in the most forward position before starting the truck. It is well to occasionally use your emergency brake lever in order to determine that it is in proper operating condition, applying brakes on all four wheels and transmission. Grasp the handle of the change-gear lever lightly and

FRONT END OF CHASSIS.

Ref. No.	Part No.	Name of Part.
1	35404-A	Change gear lever assembly.
2	32329	Brake lever trigger.
3	32330	Brake lever trigger spring.
4	32325	Brake lever.
5	35385	Gear shifter lever.
6	32317	Gear shifter lever quadrant (outer).
7	32323	Hand brake lever quadrant.
8	35385	Gear shifter lever.
9	34750	Gear shifter lever reverse lock rod.
10	32324	Quadrant bracket.
11	32580	Clutch pedal shaft and throwout shift connecting rod.
12	32664	Hand brake shaft lever.
13	32412	Brake rod.
14	32409	Brake rod (rear).
15	32650	Brake pedal pad.
16	32651	Clutch pedal pad.
17	32331	Brake lever shaft.
18	31265	Clutch pedal.
19	32542-A	Brake pedal and tube, complete.
20	31674	Clutch pedal adjusting hub.
21	32770	Clutch throwout shaft lever (outer).
22	31263-A	Clutch pedal shaft, complete.
23	32572-A	Clutch throwout shaft lever (right).
24	36324-A	Brake rod inter-connecting (complete).
25	32390	Brake rod adjusting yoke.
26	32390	Brake rod adjusting yoke.
27	32391	Hand Brake and rocker shaft connecting link.
28	32411	Brake rod adjusting yoke.

move it backward and forward until you have become thoroughly familiar with its movements (engine not running). If you grip the lever hard, the muscles of the wrist become rigid and you lose the flexibility necessary for proper shifting of gears. Never move the gear shift lever unless the clutch is fully disengaged.

GEARSHIFT LEVER.

The gearshift lever is moved into the following positions in order to make the necessary gear engagements in the transmission. The illustration on page 15 of the quadrant shows where the lever ought to be for the different speeds.

First speed, push lever away from you to first notch ahead. Second—lever away from you to the extreme rear. Third—center to the extreme rear. Fourth—center to the front. Reverse—toward you to the extreme inner front. Button on top of lever must be depressed before reverse is engaged. Neutral—in center where lever may be moved easily to left or right.

IGNITION SWITCH.

The ignition switch has two positions—"Magneto" and "Off."

CARBURETOR AIR CHOKE.

The carburetor air control is located on the steering post. To enrich mixture for easy starting in cold weather, or after car has been idle for some hours, pull up. As engine fires properly, gradually work to the lowest point of adjustment. Do not keep this choke applied any longer than necessary. See page 21 concerning use of choke in winter.

SPARK AND THROTTLE LEVERS.

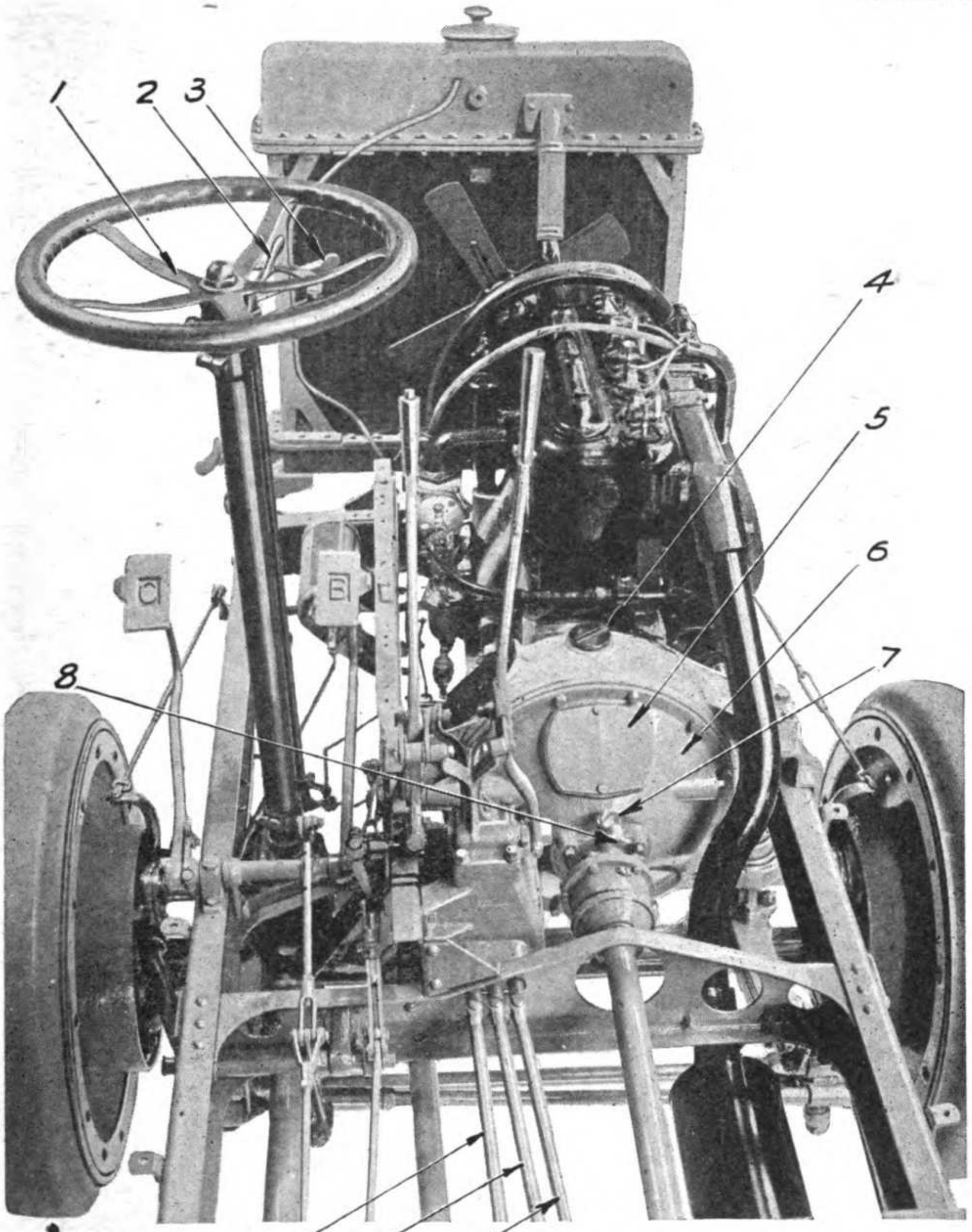
The spark lever on the steering post is the shorter of the two. For starting, usual position is one-quarter way up on quadrant. When the engine is running the spark lever must be advanced as far as possible without causing a spark knock (which must be avoided).

The throttle lever on the steering post is the longer of the two. For starting advance about two inches. When engine starts, return to normal position. Best results will be obtained by using accelerator pedal entirely, thus giving the use of both hands for the control of the truck.

GASOLINE SHUTOFF OR CONTROL VALVE.

The gasoline shutoff valve is located at the bottom of the gasoline tank. Looking at this valve from the front, the lever should stand at about a 45-degree angle to the right for reserve, and the same angle to the left for supply, and should be in an up-and-down position with the long end of the lever toward the top at about 45 degrees from center for "off" position.

Plate No. 9



VIEW FROM CENTER OF CHASSIS FORWARD, DASH REMOVED

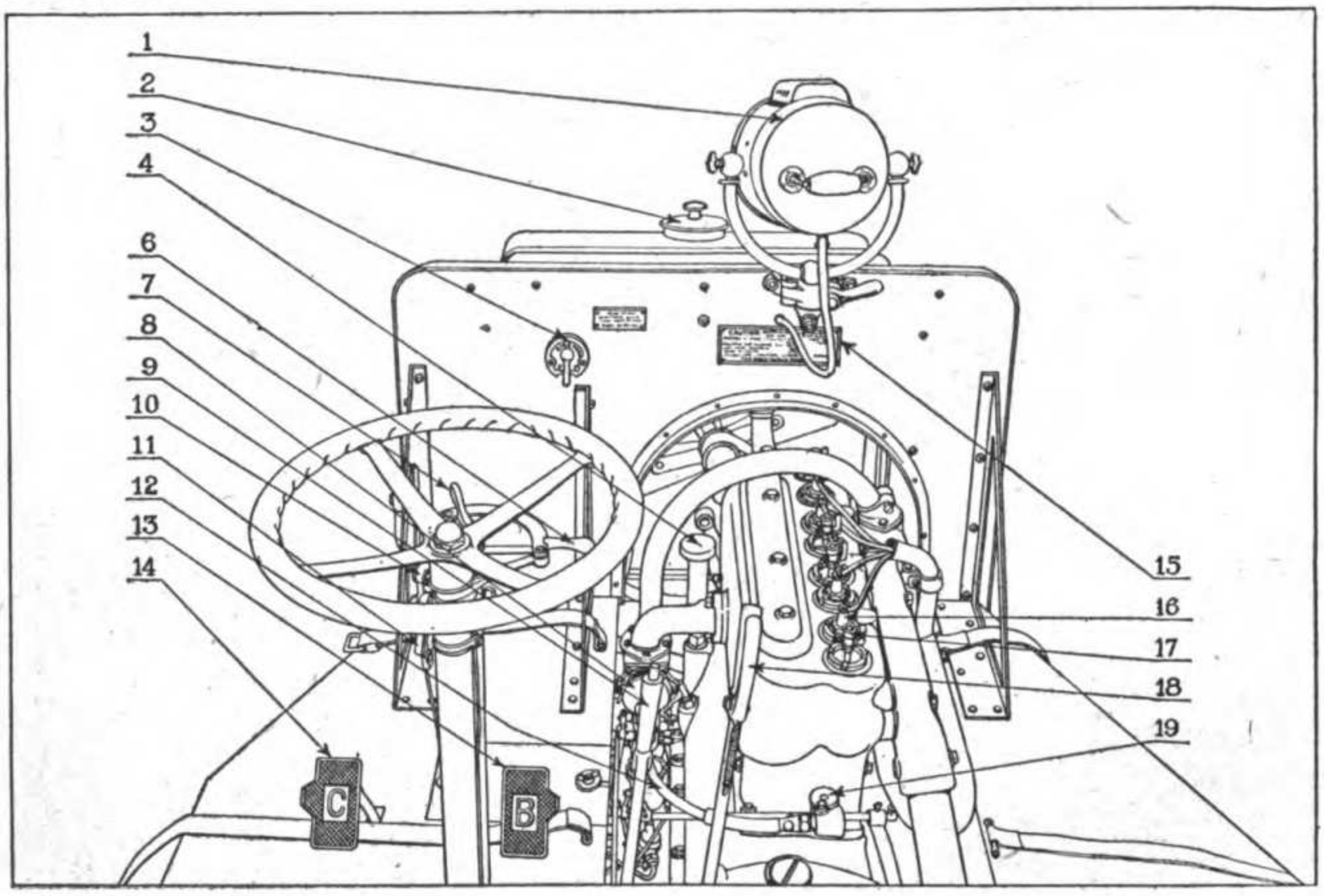
Ref. No.	Part No.	Name of Part.
1	36372	Steering wheel.
2	33779	Spark control lever.
3	33783	Throttle control lever.
4	34413	Flywheel housing cap.
5	30370	Clutch housing hand hole cover.
6	32583-A	Clutch housing assembly.
7	CU-209	Clutch shaft bearing retainer grease cup.
8	32472	Clutch shaft rear bearing retainer.
9	32166-A	Transmission operating tube assembly.
10	32166-A	Transmission operating tube assembly.
11	32166-A	Transmission operating tube assembly.

The gasoline tank is so constructed that before the gasoline will flow from the tank with this valve on reserve position, there must have been more than five gallons of gasoline in tank.

DRIVING.

In ordinary running keep the spark advanced as far as possible without causing the engine to knock. When knocking occurs retard the

Plate No. 10

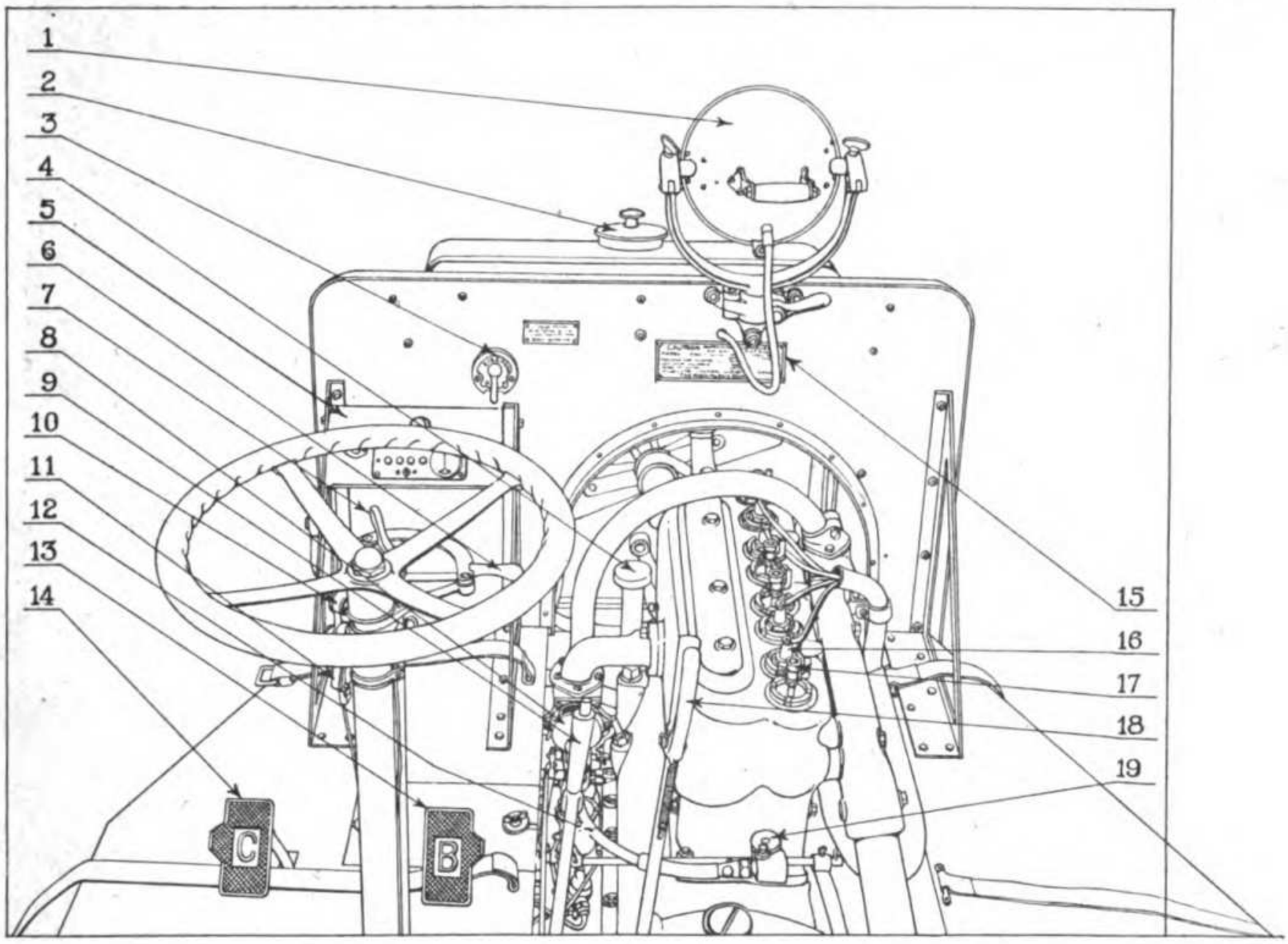


DRIVER'S COMPARTMENT. MODEL 4017-L ONLY.

Ref. No.	Part No.	Name of Part.
1	37058-A	Search lamp.
2	32183-A	Radiator filler cap.
3	35902	Ignition switch.
4	34395	Motor oil filler cap.
6	33784	Throttle lever.
7	33778	Spark lever.
8	31801-A	Governor.
9	35404-A	Change-gear lever.
10	CU-113	Steering column grease cup.
11	33662	Carburetor control.
12	32991	Governor drive casing.
13	32650	Brake pedal pad.
14	32651	Clutch pedal pad.
15	37105	Caution plate.
16	31946	Spark plug.
17	34359	Relief cock.
18	32206-A	Hand-brake lever.
19	35705-A	Governor drive gear housing.

spark. The engine speed may be controlled either by the accelerator pedal or the hand lever, the long one, under the steering wheel. In using either of these bear in mind the sensitiveness of the throttle, and do not

Plate No. 11



DRIVER'S COMPARTMENT. MODEL 4017-A ONLY.

Ref. No.	Part No.	Name of Part.
1	35270-A	Search lamp and bracket assembly.
2	32183-A	Radiator filler cap.
3	35902	Ignition switch.
4	34395	Motor oil filler cap.
5	35764-A	Instrument board.
6	33784	Throttle lever.
7	33778	Spark lever.
8	31801-A	Governor.
9	35404-A	Change-gear lever.
10	CU113	Steering column grease cup.
11	33662	Carburetor control.
12	32991	Governor drive casing.
13	32650	Brake pedal pad.
14	32651	Clutch pedal pad.
15	37105	Caution plate.
16	31946	Spark plug.
17	34359	Relief cock.
18	32206-A	Hand-brake lever assembly.
19	35705-A	Governor drive gear housing.

open the throttle wide suddenly, but gradually. Get accustomed to using the accelerator pedal, using the hand lever only for an idling point and also for traveling at a fixed speed.

SHIFTING GEARS.

Remember that the clutch should be engaged gradually, that is, allow the pedal to return to normal position slowly instead of quickly. Gradual engagement means less shock to the whole power transmitting mechanism.

You may find in starting up that after the clutch has been released the shift into first cannot be made. If this is the case engage and disengage the clutch again and try to shift. In other words, let the clutch in and out once or twice until the clutch jaws are in proper position. After meshing, engage clutch slowly to avoid starting the truck with a jerk.

To shift to any gear (or speed), the rotative speed of the two parts of the gear clutch which are to be engaged must be as near uniform as possible. When starting the truck (from a fixed position) the speed of the driving member is reduced to zero (otherwise the teeth of the clutch would clash), as the speed of the driven member is zero. This is attained by disengaging the clutch fully, at which position the clutch brake is effective. The function of the clutch brake is to overcome the inertia and internal friction of the clutch, which, otherwise, would "spin" for some time. The speed of the driving member in the transmission is therefore dependent upon the relative position of clutch disengagement, time, of course, being considered in all cases.

SHIFTING INTO FIRST SPEED.

From neutral to low, press clutch pedal down fully. Place change-gear lever in first-speed position, letting clutch in gradual, at the same time slightly speeding up engine. The change from first to second is made best at a speed of from three to six miles an hour by disengaging clutch, but not so far as to apply clutch brake, and pulling back gearshift lever quickly into second speed position, increasing engine speed (by opening throttle) to secure additional power, and engage clutch slowly. The entire operation must be completed before the truck speed has decreased materially. The change from second to third can be made best at truck speed of from six to eight miles per hour. The change from third to fourth can be made best at a speed of about ten miles per hour.

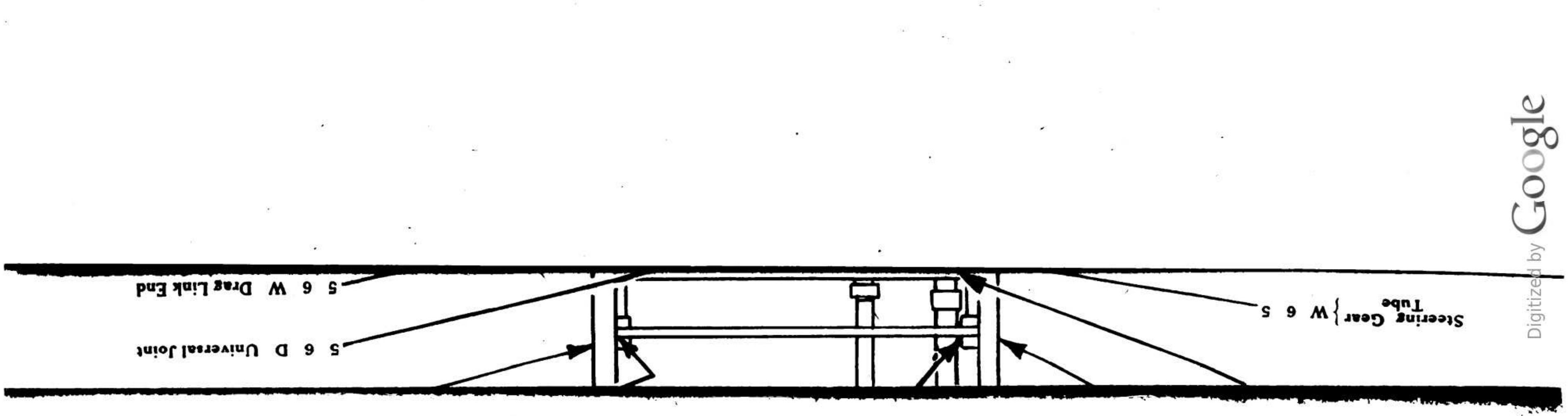
CHANGING FROM FOURTH TO THIRD.

In changing from fourth to third, disengage clutch sufficiently to shift into neutral, then engage clutch (meanwhile speeding up engine) to increase speed to that of the third speed gear, then quickly disengage clutch, engage third gear and engage clutch slowly.

In making changes from any gear to a lower one the motor should be speeded up with clutch engaged during the changing operation in order that the clutch speed may pick up to the transmission speed, thus rendering engagement easy.

WHEN TO CHANGE TO LOWER GEAR.

Fourth speed is direct drive in the transmission, no gears delivering power. It is the speed usually used on level roads. Do not attempt to change from a higher to a lower speed until the truck has slowed down to that speed. Do not try to climb steep grades or pass over heavy sandy roads



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on high gear. When the engine labors, change to a lower speed. This will save the moving parts and prolong the life of the engine.

DRIVING UP AND DOWN GRADES.

In driving down grade there are three forms of resistance that can be used to control the speed of the truck. Its momentum can be arrested by means of the brakes, the gears may be shifted into a lower speed, or the engine may be used as a brake by shutting off the ignition. The lower the gear used the greater resistance, so that the greatest possible resistance in the transmission is had with the gears in the first speed. Added resistance may be had by shutting off the ignition, and, of course, still more by using the brakes. All three forms (the gears in first, the ignition off and brakes applied) hardly need be used. The object is to refrain from using the brakes because keeping them applied wears the linings.

In ascending a grade use judgment about the ability of the truck. If it is very steep, shift to a lower gear before you get on the grade. If you think it can be done in high without the engine knocking do not shift. Make as quick a shift as possible, if it is necessary to do shifting on an upgrade. If you happen to stall the engine on the grade, shift immediately into neutral and apply the hand brake, at the same time cramping the wheels.

"RIDING" THE CLUTCH.

In driving along do not "ride" the clutch, that is, do not keep your foot on the clutch pedal. Even slight pressure on the clutch pedal causes excessive wear of the clutch bearings and may cause slight slippage.

STOPPING.

In slowing the truck down always slow down the engine first and anticipate your stop, so as to avoid excessive use of the brakes.

After the truck has been brought to a standstill, the gears shifted into neutral and the hand brake applied, turn the ignition switch to "Off" postion, retard the spark lever to one-quarter position and the throttle lever to one-quarter open, placing these controls ready for the next start.

LUBRICATING INSTRUCTIONS.

PRELIMINARY ADVICE.

Study the lubricating chart inserted after page 32 for parts that require attention. Perfect and continuous lubrication means less wear of parts, less trouble and a better running truck. Lubricant is of little value mixed with dirt, so before you oil or grease a part make sure there is no dirt on the surfaces, that not even the smallest speck of dirt gets to a moving part. Cleanliness of moving surfaces is absolutely essential. Use clean cloths to wipe these surfaces after they have been cleaned by means

of gasoline or kerosene. Make periodic lubrication a habit. Attend to certain parts daily, as indicated on the chart, to others weekly and others monthly. These are maximum periods.

SPECIFICATIONS OF LUBRICANTS.

After each part mentioned in lubricating instructions, and indicated on the lubricating chart (see chart after page 32), will be found a figure which indicates the kind of oil or grease best suited to the lubricating needs of that part. The meaning of the various figures is explained below:

2A. Motor oil, medium, specification No. 3502.
2B. Motor oil, heavy, specification No. 3502.
4. Heavy, straight mineral gear compound, specification No. 3504.
5. Light cup grease, specification No. 3505.
6. Medium cup grease, specification No. 3506.
8. Heavy, straight mineral oil, specification No. 3508.
9. Steam cylinder oil, specification No. 3509.

ENGINE.

2A. Winter.
2B. Summer, capacity 9 quarts, to be brought to level daily.

CRANKCASE CAPACITY.

Nine quarts of reserve oil are carried in the bottom of the crankcase. The amount of oil is indicated by the position of the indicator rod located on the left hand side of the engine. By unscrewing this indicator rod a few turns it may be lifted out, and the depth of the oil in the crankcase noted on the lower end of rod.

WHEN AND HOW TO DRAIN CRANKCASE.

The drain cocks and drain plugs should be inspected from time to time, as they become loose, and consequently cause loss of oil.

The crankcase is of course brought to level daily, but after about 1,000 miles of running the crankcase oil has lost some of its lubricating qualities due to the breaking down of the oil and also to contamination by water, a product of combustion, working its way past the rings. The poor oil will have a black color and will be much thinner (of lower viscosity) than fresh oil. The more frequently crankcase oil is changed, the better, but there is no need to make a useless change. The object is not to permit running for any length of time on poor oil and changes at 1,000-mile intervals usually suffice.

When the engine is cleaned and drained of its old oil, a gallon of kerosene should be introduced through the combined filler and breather cap, located at the front of the left hand side of the engine, after which the engine should be run slowly for a few seconds. Drain same thoroughly and refill with nine quarts of fresh oil as specified.

CLEANING OIL PUMP SCREEN OR STRAINER.

To clean the oil pump screen or strainer, the oil pump must be removed. Make sure that the joints and pump packings are tight, and that the oil pump is running properly after replacement. Should be cleaned each 1,000 miles.

GOVERNOR.

No. 2A weekly.

To lubricate, remove the oil filler screw, and fill chamber with lubricant. This should be done weekly. Every month remove the drain screw. Be sure the two screws below the governor shaft are kept tight to prevent oil leaking. (See page 88, Care and Adjustment of Governor.)

MAGNETO.

No. 2 every other week.

Twenty drops off the end of a toothpick of light clean mineral oil, every two weeks, distributed as follows:

One drop of oil in the oil hole on side of breaker box most convenient, lubricating surface between magneto frame end and movable breaker box, five drops of oil in the small hole at the driving end of magneto, lubricating the distributer wheel bearing, and fourteen drops in the large hole at driving end, lubricating the shaft bearing which takes all the driving load.

For small engine parts see chart inserted after page 32.
For operation of engine lubricating system see page 63.

CLUTCH.

No. 6 daily.

The clutch itself, being of the dry-plate type, needs no plate lubrication, but on the rear of the clutch housing there is a large grease cup, which lubricates the rear bearing of the clutch. This should be kept filled with fresh cup grease. A second grease cup is located on the universal joint to the rear of the clutch housing. It lubricates the clutch shaft bearings.

PROPELLER SHAFT UNIVERSAL JOINTS.

No. 6 daily.

Since all the propeller universal joints are of the same construction, they are lubricated in the same manner. To lubricate them, remove the plug at the top of each. Clean monthly with kerosene and repack with cup grease.

TRANSMISSION.

Summer, 33% of No. 2B and 67% of No. 4
Winter, 50% of No. 2B and 50% of No. 4
} every other week.

To renew the lubricant in the transmission, remove the top cover. The level of oil should reach to half the depth of the transmission.

FRONT AND REAR AXLES.

Internal drive gears { 50% of No. 6 / 50% of No. 8 } every two weeks.

To lubricate the internal gear pinion bearings of both axles, remove the outer plugs on the webs of the front and rear wheels, and fill with lubricant as above specified.

WHEEL SPINDLE BEARINGS.

{ No. 6 in summer / No. 5 in winter } weekly.

To lubricate the wheel spindle bearings, remove the inner of the two plugs, and fill with grease.

STEERING KNUCKLES.

{ No. 9 in summer / No. 2A in winter } daily.

To lubricate the lower steering pins, turn down the cups. At the top of the steering knuckle pins there are oil cups for lubricating the upper bushings.

AXLE UNIVERSAL JOINTS.

{ No. 6 in summer / No. 5 in winter } weekly.

To lubricate the axle universal joints remove the plug on the axle just inside the universal joint flanges. It is necessary to completely dissemble the axle to clean these joints.

DIFFERENTIALS.

{ 60% of No. 4 and 40% of No. 5 in summer / 25% of No. 4 and 75% of No. 5 in winter } every two weeks.

Remove the cap on top of the differential housings on the front and rear axles to inspect, and insert new lubricant. In order to clean, remove the top half of the differential housings. Remove all old lubricant, thoroughly clean with kerosene, and fill to level with new lubricant.

STEERING GEAR.

{ No. 6 in summer / No. 5 in winter } weekly.

To lubricate, remove a plug which is near the lower end of the steering column housing, and inject lubricant freely.

CONTROL SET.

No. 2A weekly.

A few drops of oil should be placed in the foot lever bearings. They should be oiled through the oil holes provided for the purpose.

SPRINGS.

Once every two months jack up the frame, and by removing the spring clips the spring leaves may be pried apart. Lubricate between the leaves with graphite. Should leaves be excessively rusted, it is well to dismantle the spring, remove the rust, and paint the leaves with graphite paint.

MAINTENANCE ROUTINE.

DAILY MAINTENANCE ROUTINE.

ENGINE.

Tighten all wiring terminals.
Tighten any loose nuts.
Clean exterior of spark plug porcelains.
Clean magneto externally.
Note tension of fan belt.
Inspect oil pump for performing its function.
Fill radiator (twice).
Fill gasoline tank.
Inspect all gasoline, oil and water lines and connections for leaks.

BRAKES.

Examine, and adjust brakes (if necessary).

GENERAL.

Clean, trim and fill all lamps and generator.
Inspect springs for breakage.
Report any breakage.
Check tool equipment.
Inspect wheel alignment and all steering connections.

LUBRICATION.

See chart after page 32.
Fill oil squirt can.

WEEKLY MAINTENANCE ROUTINE.

ENGINE.

Inspect all wires for proper support and freedom from damage.
Thoroughly clean engine externally.
Inspect for oil leaks.
Inspect control connections.
Inspect all water connections for leaks.
Remove, clean and adjust all spark plugs.

Remove magneto distributor cover and clean with gasoline and clean cloth.

Drain water and dirt from water trap in gasoline line.

Inspect carburetor control connections and connections with governor.

Do not attempt to alter adjustment of carburetor or governor unless this is shown to be necessary when truck is in service.

Inspect engine oil drain cocks and drain plugs for loss of oil.

BRAKES.

Inspect and thoroughly clean all brake connections.

SPRINGS.

Inspect center bolt of spring and spring clips for apparent tightness.

WHEELS.

Inspect tires for undue damage.

TRANSMISSION.

Clean and inspect all control connections.

WHEEL UNIVERSALS AND DRIVING PINION BEARINGS.

Inspect wheel universal joints and drive pinion bearings for excessive looseness, by inserting a screwdriver between the spring clip bolts and the axle shafts. If considerable vertical movement is possible universal joints should be examined and the proper adjustment of pinion bearings made by removal of shims from between the bearings cage and the knuckle body.

BODY AND EQUIPMENT.

Inspect body bolts, hood fasteners and all similar bolts for apparent tightness.

Inspect tool equipment for completeness.

LUBRICATION.

(See chart after page 32 for parts needing weekly attention.)

MONTHLY MAINTENANCE ROUTINE.

ENGINE.

See page 103, under Carbon Removal, for method of doing the work, and how to determine if carbon is present in quantity in the engine.

Examine and inspect engine for loose parts, leaks, noises.

Clean oil strainer.

Grind valves if necessary. See page 55 for instructions on doing the work.

IGNITION.

Clean magneto collector ring, file and adjust breaker points.

CLUTCH.

Thoroughly clean and inspect all pedal connections.

TRANSMISSION.

Clean externally and inspect for leaks, particularly in bearing covers at the front and rear ends around shafts.

STEERING.

Put two jacks under front and rear axles, near wheels, and lift wheels slightly off from the ground, then inspect all connections for wear or undue looseness.

SPRINGS.

Thoroughly clean and inspect spring shackle connections.
Inspect springs, replacing any defective parts.

DIFFERENTIALS.

Clean and inspect all differential housing for oil leaks.
Inspect all bolts for tightness.

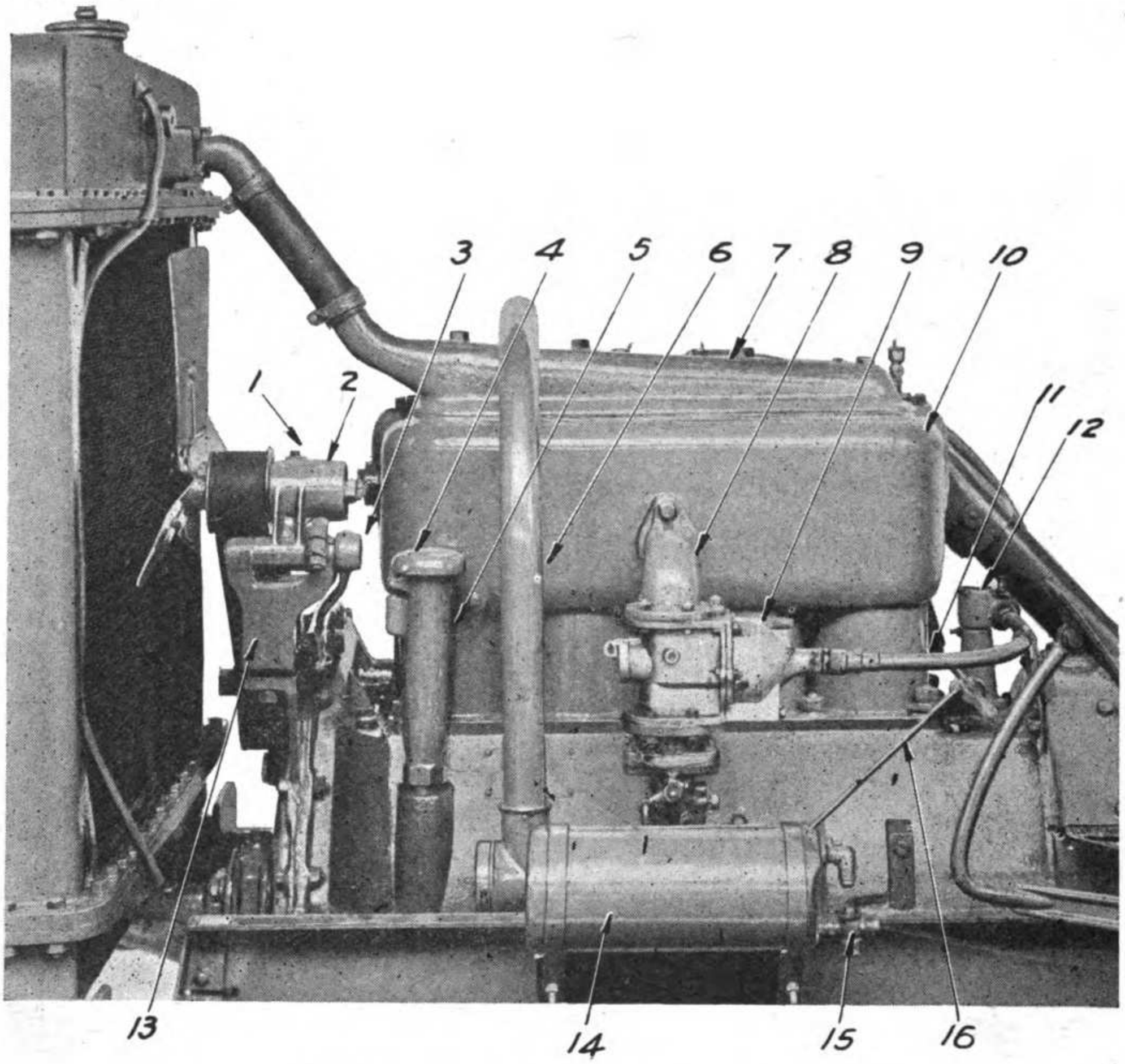
WHEELS.

Remove hub cap and inspect for supply of lubricant.
Inspect all wheels for proper relative alignment.

GENERAL.

Inspect drip pan for security.
Inspect speedometer drive for reliability.

Plate No. 13



LEFT SIDE OF ENGINE.

Ref. No.	Part No.	Name of Part.
1	PL-102	Fan shaft bearing grease plug.
2	32721	Fan shaft bearing.
3	32724	Fan belt tightening spring lever.
4	34395	Breather body cap.
5	34394	Breather body.
6	33051	Carburetor hot air tube.
7	32456	Water jacket top cover.
8	33297	Intake pipe.
9	31801-A	Governor (duplex).
10	34555-A	Cylinder.
11	32291	Governor drive cable casing.
12	35705-A	Governor spiral drive gear housing.
13	32720	Fan shaft bearing bracket.
14	33500-A	Auxiliary gasoline tank.
15	35839	Auxiliary gasoline tank shut-off cock,
16	32830	Spark rod.

CHAPTER II

ENGINE AND ENGINE ATTACHMENTS.

DESIGN, CONSTRUCTION AND OPERATION IN BRIEF.

The engine is a standard design of Buda make, having four block-cast, L-head cylinders with heads integral. The block is mounted on a cast-iron crankcase, which is in two halves, horizontally split. The cylinders are 4.25 inches dia. bore by 5.25 inches stroke, cooled by centrifugal pump circulation; lubrication is by force-feed and splash; ignition is by Eisemann magneto, and carburetion by a vertical outlet Stromberg carburetor fed by gravity. The engine is equipped with a governor. The valves and valve operating mechanism are on the right, together with the water pump, driven from the timing gears; the magneto driven by an extension of the pump' shaft, and the lighting generator with a drive taken between the pump and magneto. On the Model 4017-L there is no electric lighting generator.

ENGINE OPERATION.

The engine operates on the four-stroke cycle which is the same as that of all truck and passenger car engines made in the United States. There are four distinct strokes of the pistons necessary for the completion of a cycle, these four strokes being called: Intake, compression, power and exhaust.

Upon being cranked by hand, a piston descends while its intake valve is open, and draws into the cylinder through the carburetor and the intake pipe, a charge of gas. When piston is just past the bottom of its stroke, and again returning upwards the intake valve closes, and as the exhaust valve is at this time also closed, the gas is trapped within the cylinder and compressed by the piston's upward motion.

When piston reaches top of its stroke, the spark occurs and explodes the mixture which, due to its increase in pressure, drives down the piston with considerable force, thus storing up energy in the flywheel for the succeeding strokes.

When the piston nears the bottom of its stroke the exhaust valve opens, allowing the expanded, and now useless gases to escape, and stays open during the following upward movement of the piston, allowing the ejection of the remaining burned gases.

DESIGN, CONSTRUCTION AND OPERATION IN DETAIL.

CYLINDERS.

MATERIAL AND CONSTRUCTION.

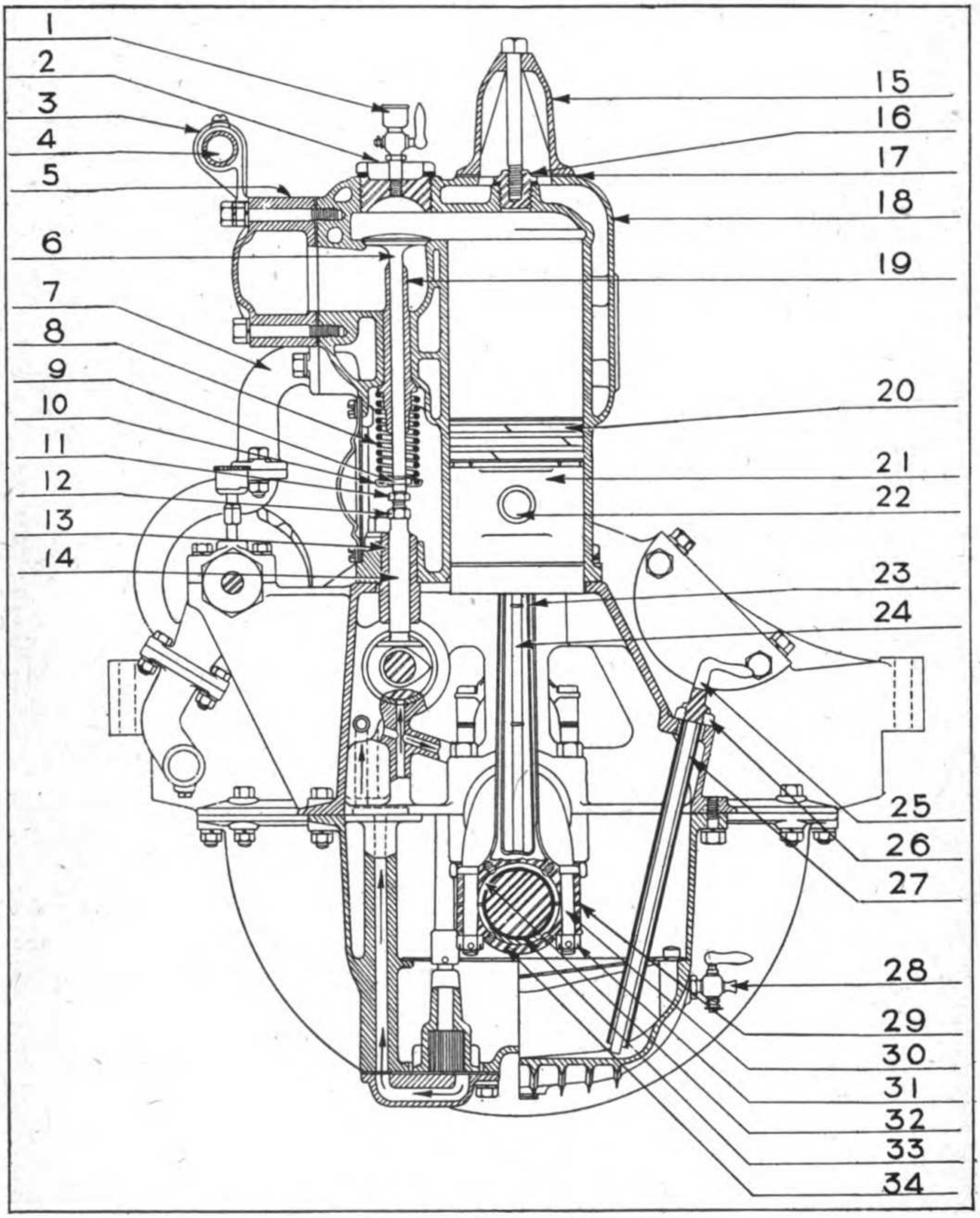
The cylinders are of gray iron, cast in block, and bolted to a cast-iron crankcase. The cylinder casting has the inlet passages cored out so that

the carburetor attached to a short external elbow, or manifold, on the left, feeds across the block through the cored passages. The block has an integral head, but uses valve plugs, so that removal of the valves is possible when the plugs are removed. The water jacket top cover with a portion of the water outlet pipe is a unit bolted to the top of the casting.

PRIMING CUPS.

There are four priming cups screwed into the valve plugs. These cups may be used for priming in winter or for testing the firing and compression.

Plate No. 14



END SECTION OF ENGINE.

IF JACKET IS CRACKED.

If a cylinder water jacket is cracked, emergency repair can be made by calking or by shellac saturated cloth strips pasted over crack, and permitted to dry before filling cooling system with water.

CYLINDER SCORED.

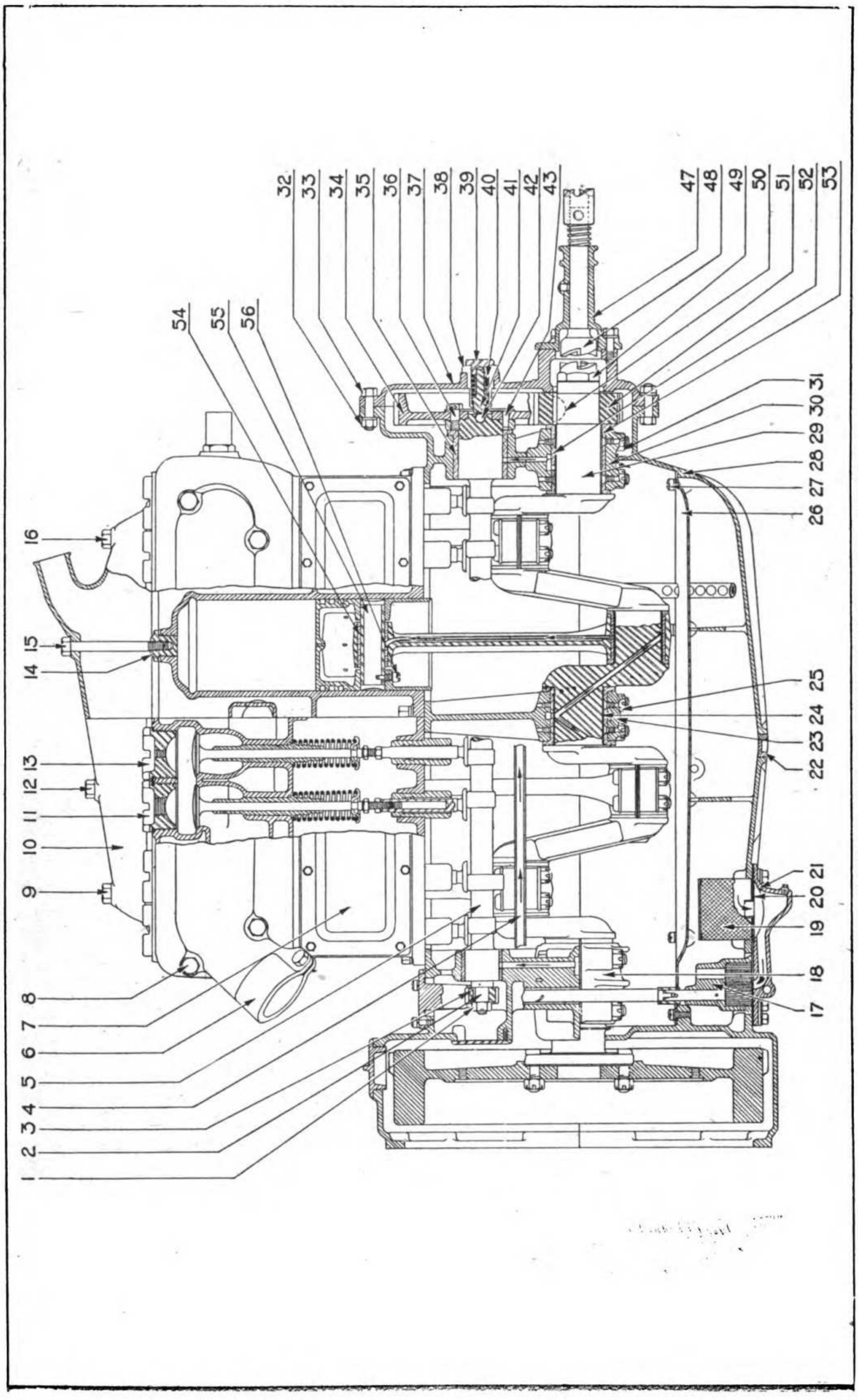
Cylinders may become scored because of engine operation for long periods when overheated, lack of lubrication, tight pistons, loose or broken wrist pin, piston out of round, connecting rod out of alignment, broken piston rings, connecting rod bearing tight (frozen), water or dirt in lubricating oil, burr on piston.

PISTONS.

The pistons are of cast iron of the usual design, with flat top, and using three diagonally-split rings. The ring grooves are 0.250 inch wide. The piston diameter at the top is 4.23 and 4.246 inches at the bottom with a top clearance of 0.020 and at the bottom 0.004 inch. The piston is 5.375 inches long. The difference in clearance between the top and bottom of the piston is due to the difference in expansion at top and bottom, the top

END SECTION OF ENGINE.

Ref. No.	Part No.	Name of Part.
1	34359	Priming cup.
2	34368	Valve chamber plug (exhaust).
3	32982	Wiring manifold bracket.
4	32981	Wiring manifold.
5	34370	Exhaust manifold.
6	35564	Valve.
7	34407	Water pipe from pump to cylinder.
8	34387	Valve spring.
9	34389	Valve spring retainer lock
10	34388	Valve spring retainer.
11	34381	Valve tappet adjusting screw.
12	34382	Valve tappet adjusting screw nut.
13	34391	Valve tappet guide.
14	34380	Valve tappet.
15	32456	Water jacket top cover.
16	34377	Water jacket plug.
17	34366	Water jacket top cover gasket.
18	34555-A	Cylinder.
19	34390	Valve stem guide.
20	34476	Piston ring.
21	34474	Piston.
22	34485	Piston pin.
23	34490-A	Connecting rod.
24	34481	Oil duct.
25	34402	Oil level gauge handle.
26	34401	Oil level gauge tube and nut.
27	34402	Oil level gauge blade.
28	CO-116	Oil level pet cock.
29	34482	Connecting rod bearing shims.
30	34484	Connecting rod bolt.
31	NU-352	Connecting rod bolt nut.
32	34479	Connecting rod bearing (upper).
33	34480	Connecting rod bearing (lower).
34		Connecting rod bearing cap.



SECTIONAL VIEW RIGHT SIDE OF ENGINE.

Plate No. 15

SECTIONAL VIEW RIGHT SIDE OF ENGINE.

Ref. No.	Part No.	Name of Part.
1	NU-354	Oil pump drive gear lock nut.
2		Shoulder for oil pump drive gear.
3	34457	Oil pump drive gear.
4		Oil distributing tube.
5	34560-A	Camshaft.
6	34370	Exhaust manifold.
7	34383	Cylinder side plate.
8	34362	Exhaust manifold screw.
9	34360	Water jacket top cover screw (rear).
10	32456	Water jacket top cover.
11	34367	Valve chamber plug (intake).
12	34362	Water jacket top cover screw (center rear).
13	34368	Valve chamber plug (exhaust).
14	34377	Cylinder water jacket plug.
15	34363	Water jacket top cover screw (front center).
16	34361	Water jacket top cover screw (front).
17	34529	Oil pump body.
18	34493	Crankshaft rear bearing cap.
19	34539	Oil pump screen.
20	34540	Oil pump screen cover gasket.
21	34528	Oil pan sediment filter.
22	PL-125	Oil pan drain plug.
23	34497	Crankshaft center bearing cap.
24	34498	Crankshaft center bearing (lower).
25	NU-354	Crankshaft center bearing cap lock nut.
26	34527	Oil pan trough.
27	SC-603	Oil pan trough screw.
28	34542	Oil pan.
29	34492	Crankshaft.
30	34495	Crankshaft front bearing cap.
31	NU-354	Crankshaft front bearing cap lock nut.
32	NU-124	Gear case cover bolt nut.
33	SC-3404	Gear case cover bolt.
34	34463	Camshaft gear.
35	34521	Camshaft front bearing.
36	SC-245	Camshaft gear screw.
37	34557-A	Gear case cover.
38	34451	Camshaft thrust spring housing.
39	34453	Camshaft thrust spring nut.
40	34452	Camshaft thrust spring.
41	34454	Camshaft thrust spring plunger.
42	BA-105	Camshaft thrust ball.
47	34550	Starting crankshaft bracket.
48	34551	Starting crank clutch.
49	34507	Crankshaft jaw.
50	KE-114	Crankshaft pinion key.
51	34505	Crankshaft pinion.
52	34509	Crankshaft front bearing (upper).
53	34496	Crankshaft front bearing (lower).
54	34478	Connecting rod bushing.
55	34485	Piston pin.
56	34486	Piston pin set screw.

getting much hotter, hence expanding more. Below the bottom ring groove are six holes, 0.156 inch diameter, equally spaced around the circumference. These holes are for draining excess oil, scraped off cylinder wall by bottom ring, back into the crankcase.

The piston bosses are reamed 1.125 inches diameter and the outer circumference of the piston at the piston pin is relieved a depth of 0.0156 inch.

PISTON TROUBLES.

The piston moving up and down in the cylinder must constantly be lubricated by a film of oil otherwise both it and the cylinder wall will be scored. If run without oil the piston will seize in the cylinder. The usual piston trouble encountered is due to excessive piston ring wear which permits oil leakage into the combustion chamber and gas leakage downward into the crankcase. Piston pin wear is not unusual. This latter causes knocking. Both are brought about by lack of or insufficient lubrication. Piston and rod may be removed through the crankcase.

PISTON PIN (OR WRIST PIN)

The piston pin is the means of fastening the upper end of the connecting rod to piston. The piston pin is held in place by a set screw, screwed into a piston boss, through which the piston pin passes. The set screw is 0.312 inch in diameter. The piston pins are of case-hardened steel 3.75 inches long and 1.125 inch in diameter, drilled hollow, inside diameter 0.8125 inch long. A hole 0.234 inch in diameter is drilled at one end of the piston pin to receive the end of the set screw previously referred to.

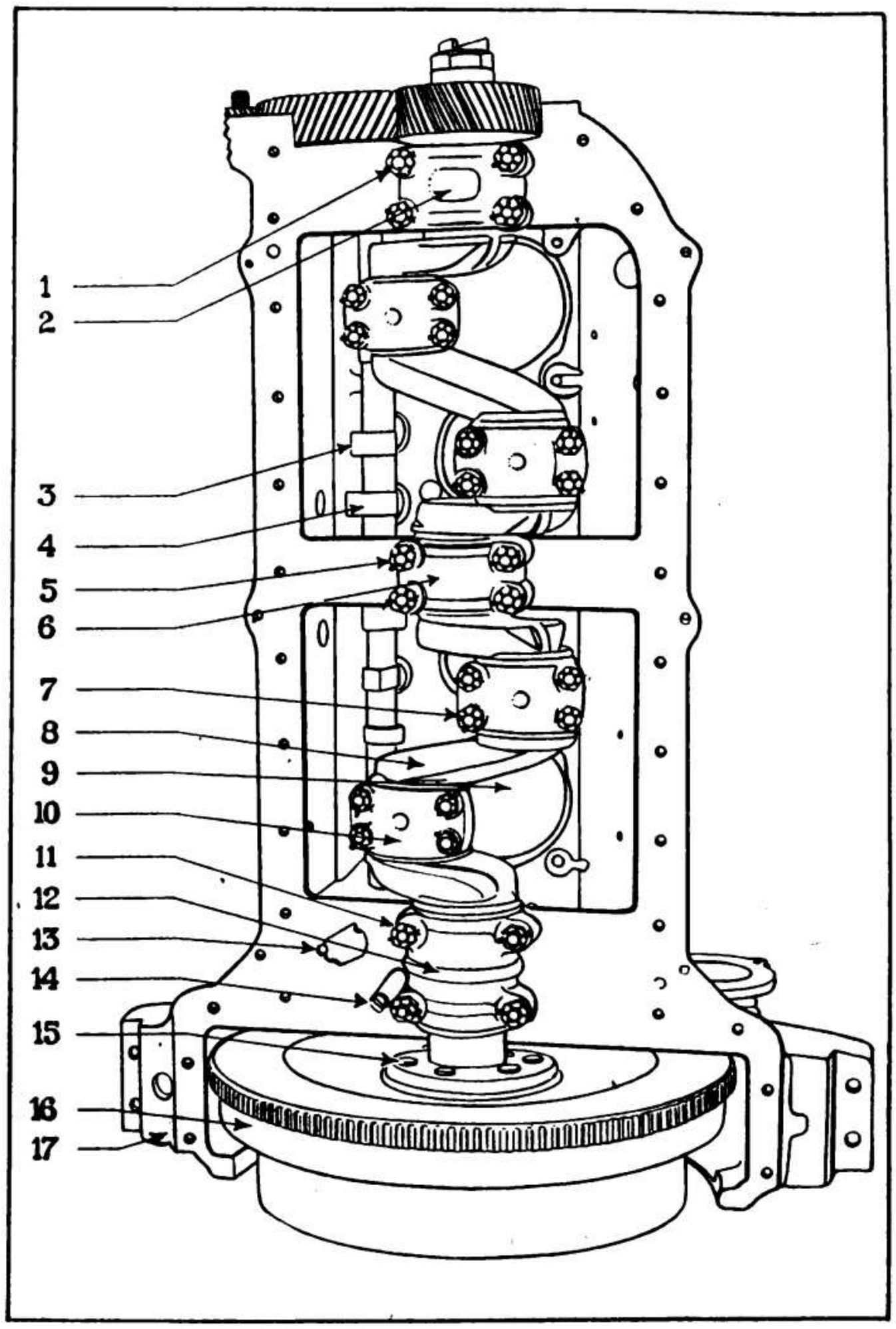
TO LOCATE WEAR OF THE PISTON PIN BEARING.

If the piston is in place in the engine and the lower half of the crankcase is down, remove a valve cap, turn engine over so that piston is on top dead center in such a position that a screw driver may be inserted in the valve cap pocket, then pry down on top of the piston, while with a bar the piston may be pushed upward from under the side of case, then by alternately moving piston up and down, any play may be detected.

TO ALIGN PISTON AT RIGHT ANGLES TO CRANKSHAFT.

With the cylinder removed and the connecting rod and piston in position, a level may be used to ascertain parallelism between the top of the piston and the top of the crankcase, which is parallel to the center line of the crankshaft. Or a pair of calipers may be used to determine uniformity of distance between the top of the crankcase and the underside of a piston ring on all sides of the piston. Or with a straightedge laid across the top of the piston lengthwise of the engine, the distance to the crankcase under straightedge may be measured at its ends.

Plate No. 16



VIEW OF ENGINE FROM BOTTOM WITH LOWER HALF OF CRANKCASE REMOVED.

Ref. No.	Part No.	Name of Part.
1	NU-354	Front bearing lock nut.
2	34495	Front bearing cap.
3		Cams.
4		Cams.
5	NU-354	Center bearing lock nut.
6	-34497	Center bearing cap.
7	NU-352	Connecting rod bearing lock nut.
8	34508-A	Crankshaft.
9		Cylinder opening.
10		Connecting rod bearing cap.
11	NU-354	Rear bearing lock nut.
12	34493	Rear bearing cap.
13		Oil lead to distributing tube.
14	34467	Oil pump shaft.
15	34473	Flywheel bolts.
16	34561-A	Flywheel.
17	34556-A	Crankcase (upper).

PISTON RINGS.

The piston rings are of cast iron, and being flexible, press against the cylinder wall and form a gastight joint, preventing the leakage of gas downward and oil upward. There are three diagonally-split, eccentric rings per piston. When compressed in the cylinder the ring has 0.016 inch clearance between the ends. Wear, resulting from service or abuse, increases this clearance. The ring dimensions are as follows: Width, 0.249 inch; thickness, 0.1875 inch; eccentricity, 0.031 inch.

INSTALLATION OF PISTON RINGS.

The piston rings should be placed up into the cylinder before they are applied to the piston, and fitted (filed), if necessary, to secure the proper gap between the ends of the ring.

Before the rings are installed on the piston they should be rotated around the piston in the piston ring grooves to insure a proper clearance up and down, which is about .001 of an inch.

The rings should be placed in grooves over skids made of three or four pieces of very thin, light gauge sheet metal, about 2 inches long by .375 inch wide, the rings being pushed down evenly all around to prevent any twisting of the ring, which might result in distortion and uneven bearing on the cylinder wall.

In fitting piston rings be sure that each ring moves freely in its groove and still has .001 inch clearance up and down. Also make certain that all dirt is removed from the groove and ring and that before the piston with rings is inserted in the cylinder, that all the ring ends are not in alignment, thus preventing a free downward path for the gas.

LAPPING RINGS.

In order to get a good piston ring fit in the ring groove it may be necessary to lap the ring on a level plate lightly sprinkled with fine emery moistened with oil. After lapping for a few seconds, clean the ring in gasoline and try for fit. Lap more, if necessary, rather than grind it too small at one operation.

PISTON RING TROUBLES.

After fitting the piston rings into the cylinder, caution should be exercised not to push up the piston too high into the cylinder, for if this is done, the top ring will expand out into the combustion chamber, and the piston cannot be pulled down again.

If this happens, the valve caps should be removed and the piston ring compressed as much as possible with the aid of screw drivers or similar tools until the piston can be pulled down past. In case it is found impossible to compress the ring sufficiently to permit the removal of the

piston down to its proper place again, the piston ring may be broken and the pieces removed.

If the rings are not stiff enough, or have insufficient wall pressure, the oil will work up past them into the combustion chamber. The bottom edge of the piston ring must in all cases be very sharp and square to scrape the oil off the cylinder wall as a piston comes down.

REMOVING PISTON RINGS.

In removing piston rings they may be slid off over skids, see page 48, or a ring spreader may be used to spread the ring after which it may be lifted over the piston top.

CONNECTING ROD.

MATERIAL AND CONSTRUCTION.

The connecting rod is used to connect the piston with the crankshaft.

The connecting rod is an I-beam forging attached at its lower end to crank pin of the crankshaft, and at its upper end to the piston pin. The upper end of the connecting rod is bored 1.375 inch to admit a bushing of phosphor bronze, which is bored 1.125 inch in diameter to admit the piston pin. The bushing is 2.125 inches long.

CONNECTING ROD BEARING.

The lower end of the connecting rod is bored 2.5 inches to receive a bearing. This bearing is of phosphor bronze, lined with white metal. Its bore is 2.125 inches. The connecting rod is 12.25 inches long center to center of bearings.

The lower end of the connecting rod is split horizontally, the bottom piece being called a cap, which holds half of the rod bearing; the other half is in the upper portion of the rod. The cap is bolted to the rod proper by means of four alloy-steel bolts and castellated nuts.

CONNECTING ROD OIL TUBE.

Along the side of the connecting rod is banded an oil tube which carries oil from the connecting rod bearing to piston pin bearing.

TO REMOVE CONNECTING ROD.

To remove connecting rod and piston, drain off oil, and remove oil pan, turn engine over by hand until lower end of connecting rod to be removed is down; remove connecting rod bearing nuts, turn engine over until rod end is under camshaft with cranks about horizontal, open pet cock, take off cap and lower rod and piston down carefully to prevent piston ring breakage.

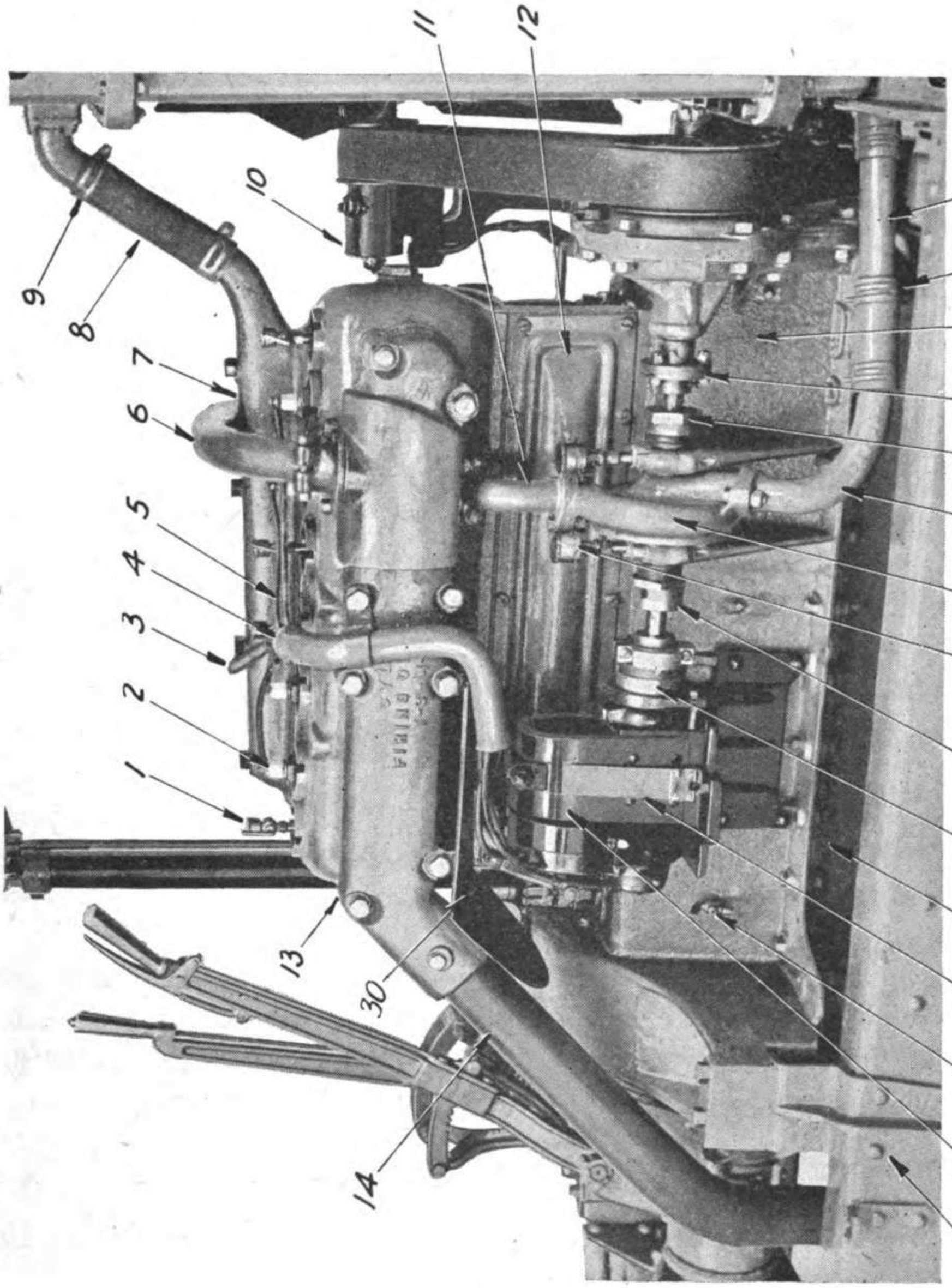


Plate No. 17

RIGHT SIDE OF ENGINE, EXTERIOR VIEW, MODEL 4017-L ONLY.

RIGHT SIDE OF ENGINE, EXTERIOR VIEW,
MODEL 4017-L ONLY

Ref. No.	Part No.	Name of Part.
1	34359	Priming cup.
2	31946	Spark plug.
3	34180-A	Magneto to sw
4	32981	Ignition wiring
5	33809	Ignition wire (
6	33051	Carburetor hot
7	32456	Water jacket t
8	32454	Radiator inlet
9	33022	Radiator inlet
10	32721	Fan shaft bear
11	34407	Water pump c
12	34383	Cylinder side I
13	34370	Exhaust manif
14	33653	Exhaust pipe.
15	32444	Motor rear sup
16	36773-A	Magneto.
17	CO-118	Oil distributin
18	35334-A	Magneto faster
19	34542	Oil pan.
20	36930	Impulse starte
21	30521	Water pump p
22	34415	Water pump g
23	35477-A	Water pump a
24	32463	Water pump i
25	34420	Water pump p
26	34444	Water pump d
27	34556-A	Crankcase, com
28	33023	Radiator outle
29	33086	Radiator outle
30	35273-A	Magneto shield

switch wire.
ing tube.
e (Cyl. No. 2).
hot air tube.
et top cover.
let hose.
let hose clamp.
bearing.
p connection to cylinder.
e plate.
nifold.
pe.
support bracket (right).
ting pipe pet cock.
stening strap (brkt. half).
rter.
p packing nut (rear).
p grease cup.
p assembly.
p inlet connection.
p packing nut (front).
p drive coupling flange.
complete.
utlet hose clamp.
tlet tube.
ield.

TO REPLACE CONNECTING ROD BEARING.

To replace a connecting rod bearing, remove oil pan, disconnect connecting rod bearing and pull out piston; take out bearing by removing countersunk screw which holds bearing in place in connecting rod and cap; replace new bearing and fit to shaft, leaving enough end play, but no looseness up and down.

In replacing connecting rod bearings (if the crankshaft is out of the crankcase) it is best to place the crankshaft in a vise and adjust the bearings to the shaft while in this position, as the work can be done more readily.

The ends and round corners of the connecting bearings may be sized before they are placed in the rod or cap. In case an end flange should be broken off the bearing liner, it may be soldered on with half and half solder, care being taken to prevent melting the bearing with the soldering iron.

The sides of the bearing (liner or bronze back) next to shaft should be filed or scraped down about .25 inch to prevent contact with crankshaft and prevent side pressure, also to aid lubrication.

After the connecting rod has been so fitted, the piston should be lined up with the top of crankcase. When the bearing has been scraped in and bears well all over, it should be adjusted just so tight that the piston and rod (when same are at an angle of 45 degrees to the vertical) will just maintain their position and slight pressure down will cause them to fall (rotate).

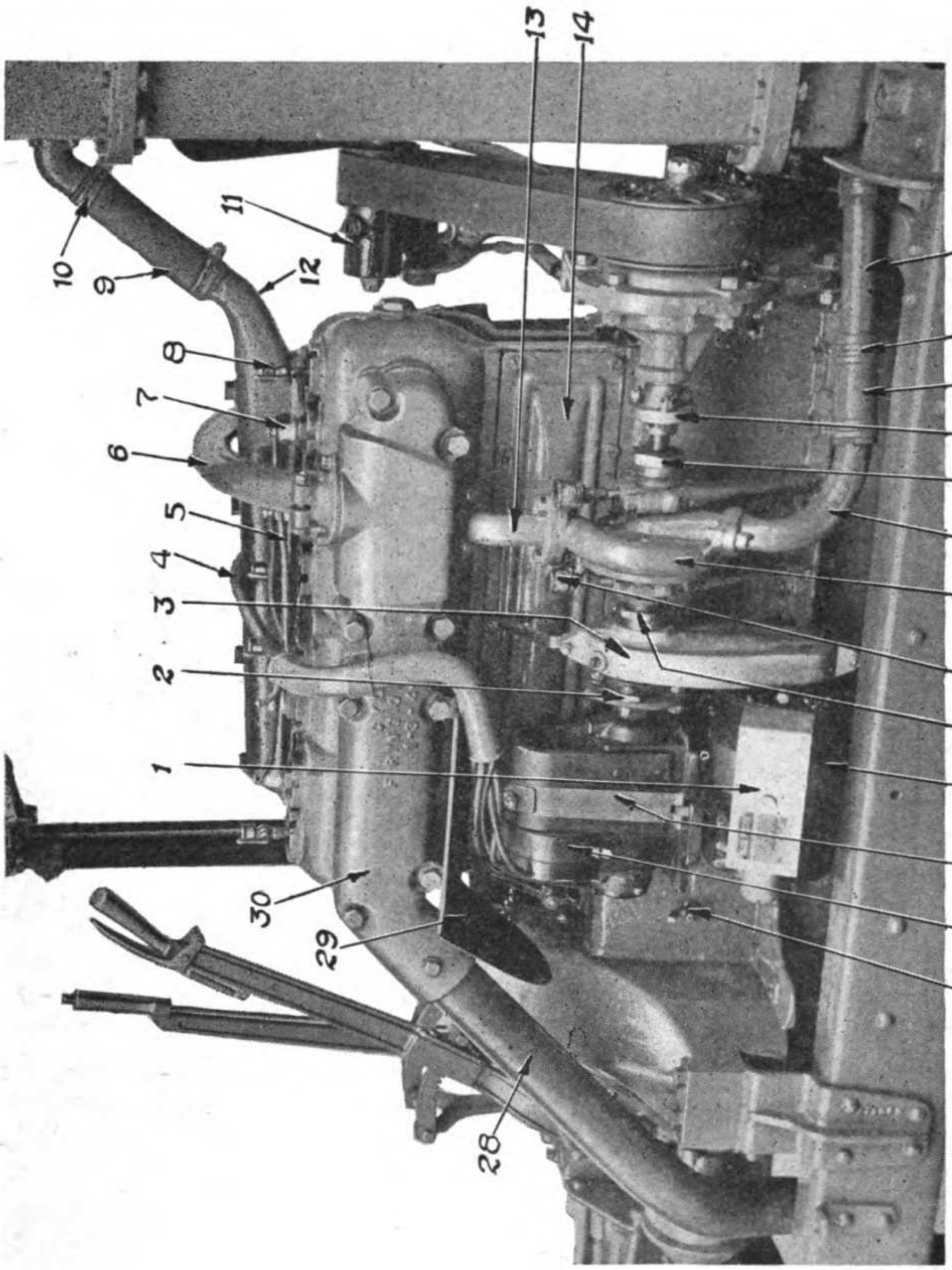
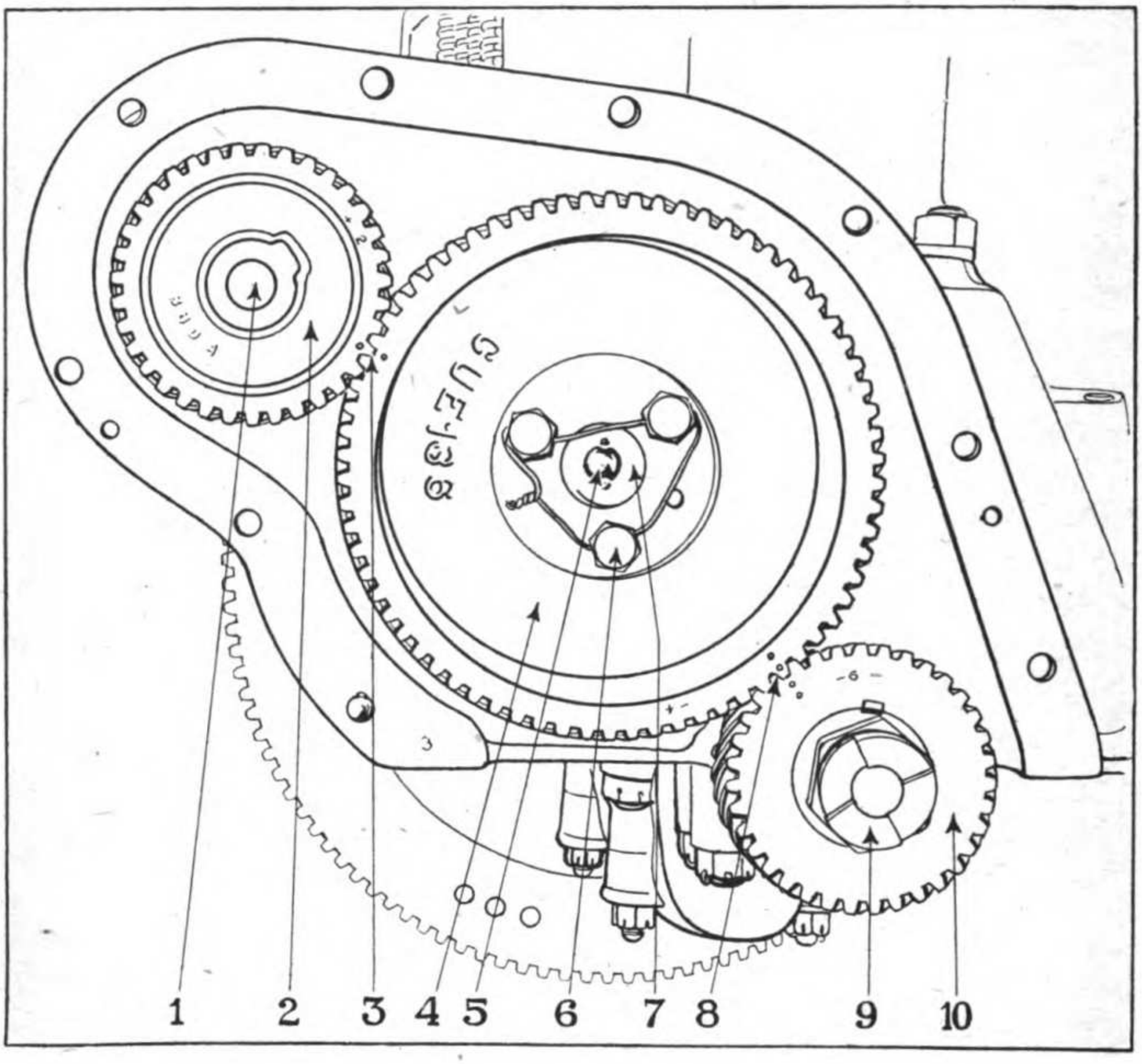


Plate No. 18 RIGHT SIDE OF ENGINE, EXTERIOR VIEW, MODEL 4017-A ONLY.

turn half way round and continue. When done correctly a light silvery color will be given to both seat and face.

In case the valves are very badly pitted, and grinding until the pits

Plate No. 19



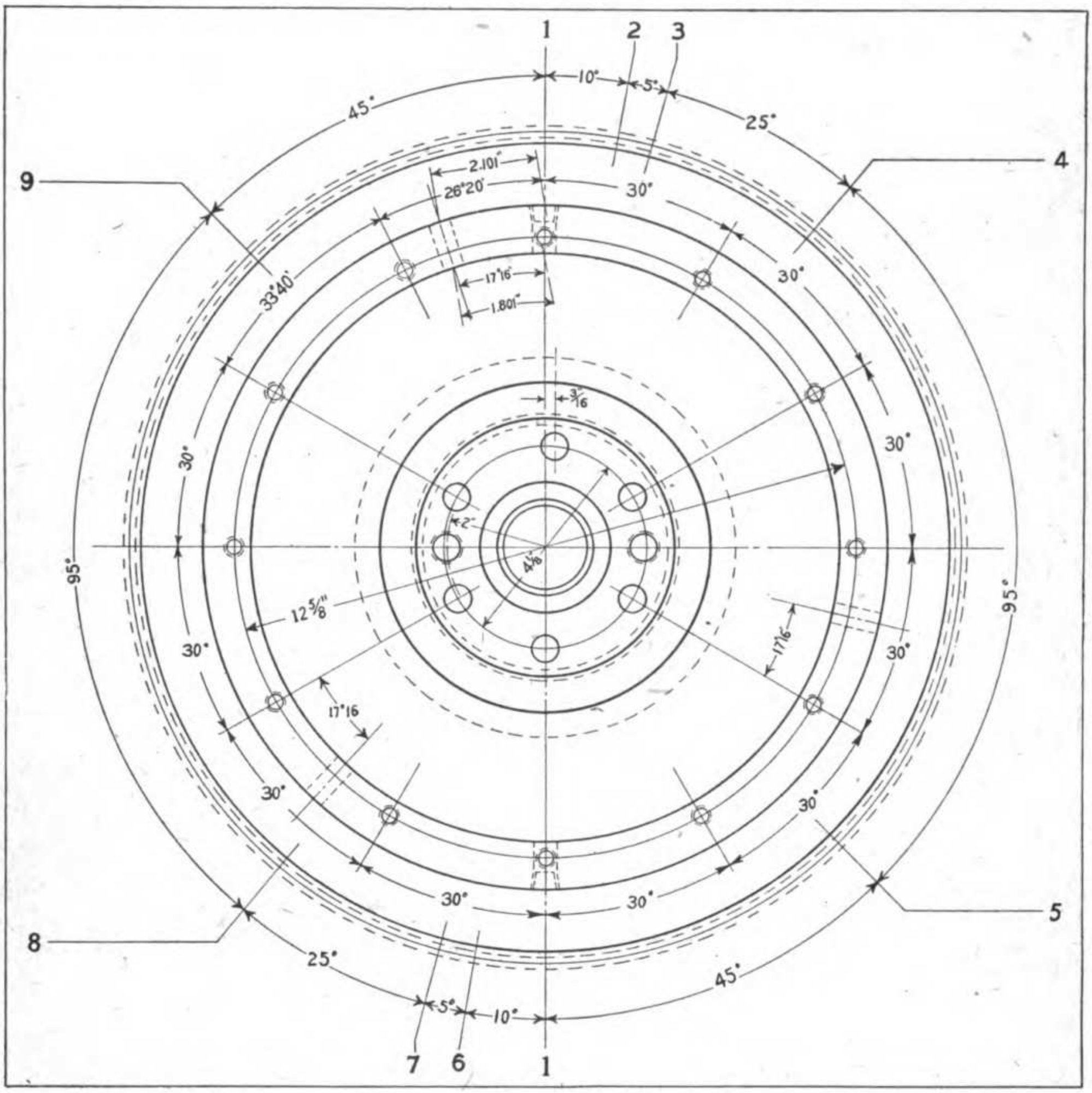
FRONT END OF ENGINE WITH GEAR CASE COVER REMOVED.

Ref. No.	Part No.	Name of Part.
1	34447	Pump shaft.
2	34446	Pump gear.
3		Marks for timing.
4	34463	Camshaft gear.
5	BA-105	Ball for adjusting end play.
6	SC-245	Camshaft gear cap screw.
7		Camshaft gear flange.
8		Markings for timing camshaft.
9	34507	Crankshaft extension.
10	34505	Crankshaft gear.

were removed would grind the valve seat down too deeply, the valve should be faced off. It should also be faced in case a ridge has been worn on valve face by the constant operation. In facing valves in lathe, a drill

Starting with cylinder No. 1, have someone crank the engine while you observe through the hole. When inlet valve of No. 1 cylinder starts to open the line next to mark N-Op should be right in the middle of the hole. Similarly when the engine is cranked further until the line N-Cl

Plate No. 20

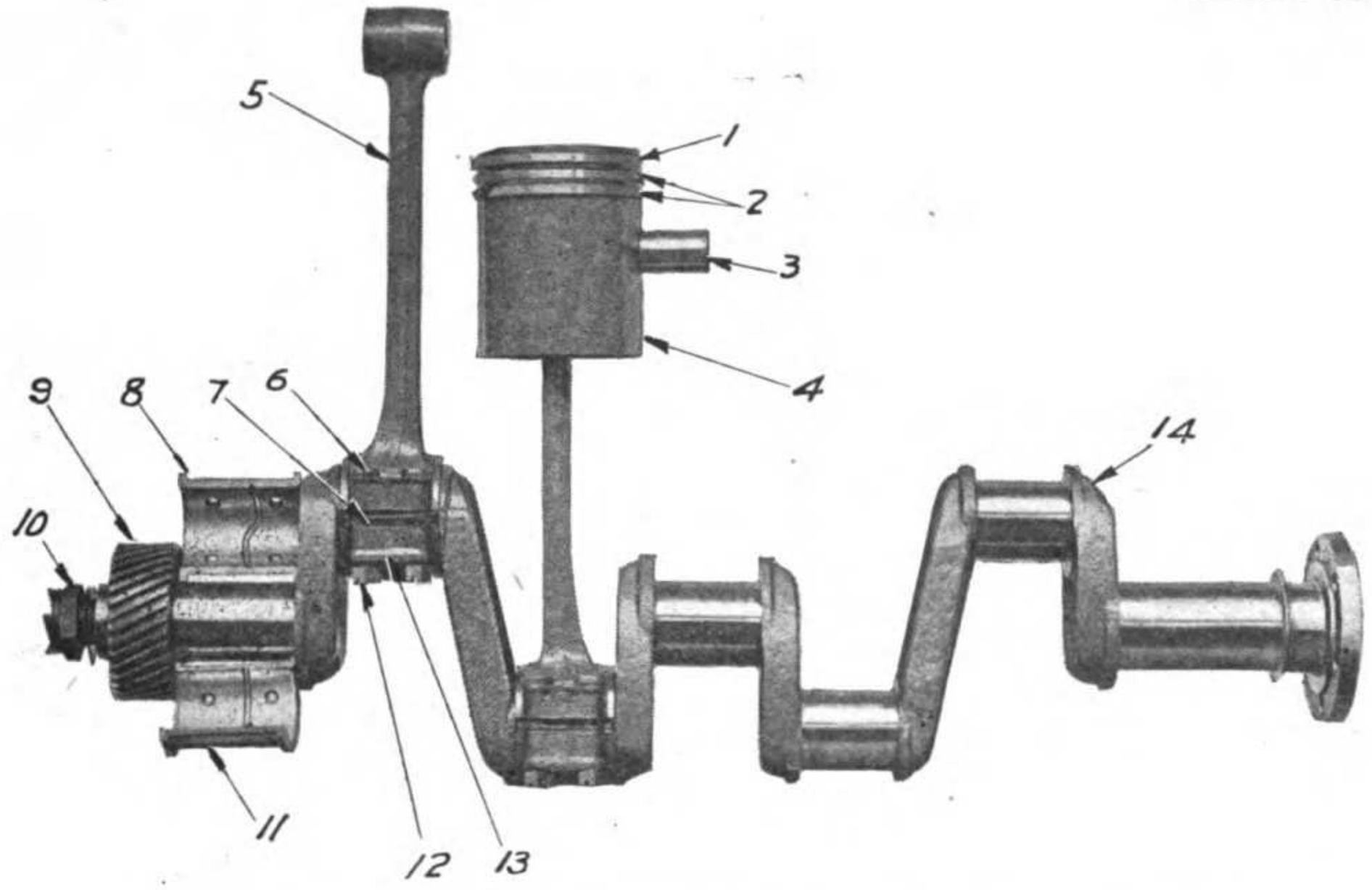


VALVE TIMING DIAGRAM.

1—Dead center.
2—Exhaust closes 1 and 4
3—Intake opens 1 and 4
4—Intake closes 2 and 3
5—Exhaust opens 1 and 4
6—Exhaust closes 2 and 3
7—Intake opens 2 and 3
8—Intake closes 1 and 4
9—Exhaust opens 2 and 3

appears in the middle of the hole the inlet valve should just close. If the valves do not open and close at the right time, a tappet adjustment may be made so they will open and close just as the opening and closing lines pass the center of the observation hole.

Plate No. 21



CRANKSHAFT WITH CONNECTING ROD AND PISTON.

Ref. No.	Part No.	Name of Part.
1	34476	Top piston ring.
2	34475	Second and bottom piston rings.
3	34485	Piston pin.
4	34474	Piston.
5	34489-A	Connecting rod.
6	34484	Connecting rod bearing bolt.
7	34483	Connecting bearing shim laminated.
8	34509	Crankshaft front bearing (upper).
9	34505	Crankshaft pinion.
10	34507	Crankshaft starting crank jaw.
11	34496	Crankshaft front bearing (lower).
12	NU-352	Connecting rod bearing bolt nut.
13		Connecting rod cap.
14	34492	Crankshaft.

The valve timing figures, that is, the time of valve opening and closing with relation to the position of the piston, are as follows:

Inlet valve opens 15 degrees or 2.159 inches on the flywheel rim after top dead center.
Inlet valve closes 40 degrees or 5.759 inches on the flywheel rim after bottom dead center.
Exhaust valve opens 45 degrees or 6.473 inches on flywheel rim before bottom dead center.
Exhaust valve closes 10 degrees or 1.439 inches on flywheel rim after top dead center.

These points or distances before and after top dead center are not stamped in figures on the flywheel, but instead, the thing that happens at the point is marked. Thus, at 15 degrees after top center the mark N-Op appears.

TO SCRAPE-IN CRANKSHAFT BEARINGS.

In "scraping in" the bearings, the first consideration is the proper meshing of the timing gears; the front bearing controls the position of the crankshaft and its gear, consequently, it should be fitted and scraped in first, the other end bearing being lined up with it at the same time. Then the middle bearing fitted in line.

In scraping in crankshaft or connecting rod bearings, the area of contact of bearing surface is the important factor. If the shaft does not bear well all over, the high spots are scraped and the cap will have to be tightened, but if the shaft bears well and evenly, the bearing need not be clamped so tightly. One bearing should be adjusted at a time, then loosened and another bearing adjusted. In this way, any chance of one bearing being too tight and another too loose is avoided. Always relieve the bearings at the upper part at the sides to prevent binding. If a bearing must be raised up a thin shim or paper should be used. A thin paste made of lamp black and oil should be rubbed on the shaft to mark its contact with the bearings so the high spots will be marked. When the three main crankshaft bearings have been adjusted and tightened, one should be able to revolve the shaft by grasping the flywheel firmly.

When the crankshaft bears evenly in its bearings, and a bearing cap becomes loose, the shaft will spring down under the impulse of the explosion, and on the return of the piston to the top dead center the shaft will spring back, hammering out or upsetting the bearing. The result of this is not only a wearing away or hammering out of the top bearing, but the wearing and the hammering out of the lower bearing as well. This condition can only be remedied by the removal of the engine from the chassis. The shaft should be removed from the engine, the bearings scraped in and readjusted. The shaft should not be sprung, but in repose when it is finally fixed in its bearings.

CRANKCASE.

The crankcase is a cast iron unit forming the body of the engine. The cylinder rests upon the top of the crankcase and the crankshaft and camshaft operate inside. At the forward end of the crankcase are the timing gears.

This crankcase is of cast iron, and is made in two parts called, respectively, upper half and lower half. The upper half contains the crankshaft and camshaft bearings, so that by detaching the lower half the bearings can easily be inspected or adjusted.

The lower half of the crankcase acts as an oil reservoir and also holds the gear oil pump. This pump is bolted in place at the lowest point in the crankcase on the right rear side. The pump is mounted above a bowl which collects all sediment from the oil which might filter through the screen. A pipe plug in the side of this bowl makes it possible to remove any sediment collected.

CRANKCASE LEVEL COCK.

On the left side of the lower half of the crankcase is a petcock for indicating oil level in the oil reservoir.

VENT AND BREATHER TUBE.

The vent and breather tube is of cast iron, and is slightly tapered. It is 9 inches long with a diameter of 1.875 inch at its upper end, and 1 inch at its lower end. The tube is screwed into the left hand front side of the crankcase, and serves to admit oil into the crankcase and relieves the air tension caused by the piston's movement.

Two conical screens, one inside the other, are placed in the breather tube. These effectively prevent the entrance of foreign matter, and in addition serve as oil strainers. Twelve .375 inch holes are drilled into the sides of the tube, which is 10.625 inches long over all and .625 inch in diameter.

TIMING GEARS (HEAD GEARS).

The timing gears are mounted in the forward part of the crankcase and are covered with a plate, called a timing gear cover. The timing gears are provided for connecting the crankshaft with the various other engine shafts, such as the camshaft and the magneto and pump shafts.

CAMSHAFT GEAR.

The camshaft gear is located on the front end of the camshaft, and meshes with the crankshaft gear. The gear is made of cast iron, and has 70 teeth (10 pitch). These teeth are cut right hand helical at an angle of 26 degrees 32 minutes. The gear has a pitch diameter of 7.824 inches, and an outside diameter of 8.024 inches, and a face 1.5 inch. It is bolted to a flange on the camshaft, the bolt holes being slotted to permit the adjustment of the gear to the proper position on the shaft. A hole is drilled through the face of the gear, and through the camshaft after adjustment. In this hole there is inserted a pin for the purpose of maintaining the adjustment.

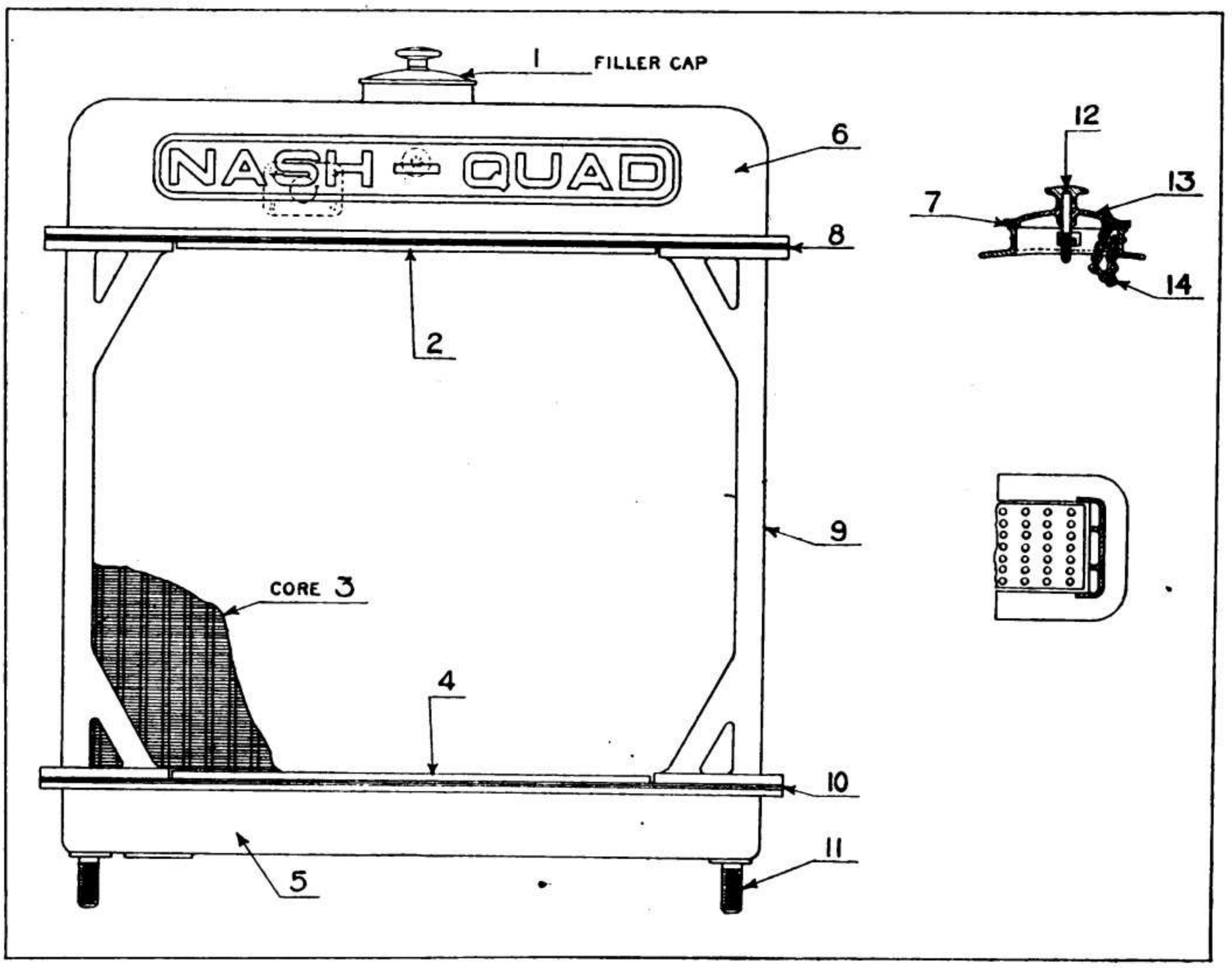
CRANKSHAFT GEAR.

The crankshaft gear is keyed to the front end of the crankshaft, and actuates the camshaft gear. It is made of carbon steel and has 35 teeth, cut left hand helical at an angle of 26 degrees 32 minutes. The pitch diameter of the gear is 3.912 inches. Its outside diameter is 4.112 and face 1.5 inch wide. The gear is bored 2 inches, and is key seated .3125 inch wide for a Woodruff key.

MAGNETO AND PUMP GEAR.

The water pump and magneto are driven by the same shaft, the pump being direct connected and the magneto driven by an extension of the pump shaft.

Plate No. 22



RADIATOR.

Ref. No.	Part No.	Name of Part.
1	32172	Radiator filler cap.
2	32169	Radiator bottom tank to core clamping strip.
3	32171	Radiator core.
4	32169	Radiator bottom tank to core clamping strip.
5	32185	Radiator bottom tank.
6	32186-A	Radiator top tank.
7	32176	Radiator filler cap gasket.
8	32170	Radiator tank gasket.
9	32178	Radiator side member.
10	32170	Radiator tank gasket.
11	31470	Radiator bottom tank support stud.
12	32183-A	Radiator filler cap stud and knob.
13	32172	Radiator filler cap.
14	32177	Radiator filler cap chain.

under these conditions. Necessarily this is a temporary arrangement, the passages being too small to supply sufficient volume at the reduced pressure.

TO THAW FROZEN PUMP.

During cold weather, after an engine has been stopped for a sufficient time to permit any water in the cooling system to freeze, the engine should not be turned over with a crank until it is ascertained that no water has collected in the water pump, and frozen the pump rotor to the pump housing. The pump may be warmed with a gasolene blow torch, hot

FAN BELT.

The fan is driven by a 2-inch by 0.156-inch endless flat leather belt, 43.75 inches long. The pulley that drives this belt is keyed to the forward extension of the water pump gear shaft. It is 5.5 inches diameter and 2.187 inches wide between its two flanges. It has an offset hub that is bored .75 inch in diameter.

FAN ASSEMBLY SUPPORT.

The fan, with its bearings and pulley, is carried by the cast fan shaft bearing spring retained to maintain proper tension of the fan belt. This bearing is hinged to the fan shaft bearing bracket.

The fan shaft bearing that carries the fan shaft ball bearings has a short arm with a hub 1.984 inch long and bored 0.875 inch to receive the hinge shaft to which it is pinned by a 0.25 inch pin. This shaft is 0.875 inch diameter and 5.375 inches long, is drilled at its center to receive the 0.25 inch pin, and keyseated and drilled at its rear end to receive a lever to the end of which is attached the fan belt tightening spring.

FAN SHAFT BEARING BRACKET.

The fan shaft bracket bearing shaft is clamped in the forked fan shaft bearing bracket, which is bolted to the engine gearcase cover. This bracket is 4.875 inches high, measured from its base to the center of its forked bearing. Each bearing is bored 0.874 inch and is 1.125 inch long. One of them is split and fitted with a clamp bolt.

The spring lever is a steel forging, 4.75 inches from center to center of its ends. One end is bored 0.875 inch, keyseated and drilled for a 0.1875 inch pin. The other end is drilled 0.25 inch to receive one end of the spring.

FAN BELT TIGHTENING SPRING.

The tightening spring consists of 22 coils of No. 12 wire (.1055 inch), wound close, and has a hook at each end. It has an outside diameter of .75 inch.

REASONS WHY FAN BELT JUMPS OFF PULLEY.

The fan belt may jump off a pulley if it is too loose, if the two pulleys are not in the same plane, or if the ends of the belt are not cut squarely, thus causing the belt to be curved. Should the fan blades strike the belt it will jump off, or an uneven place in the belt may cause it to leave the pulley.

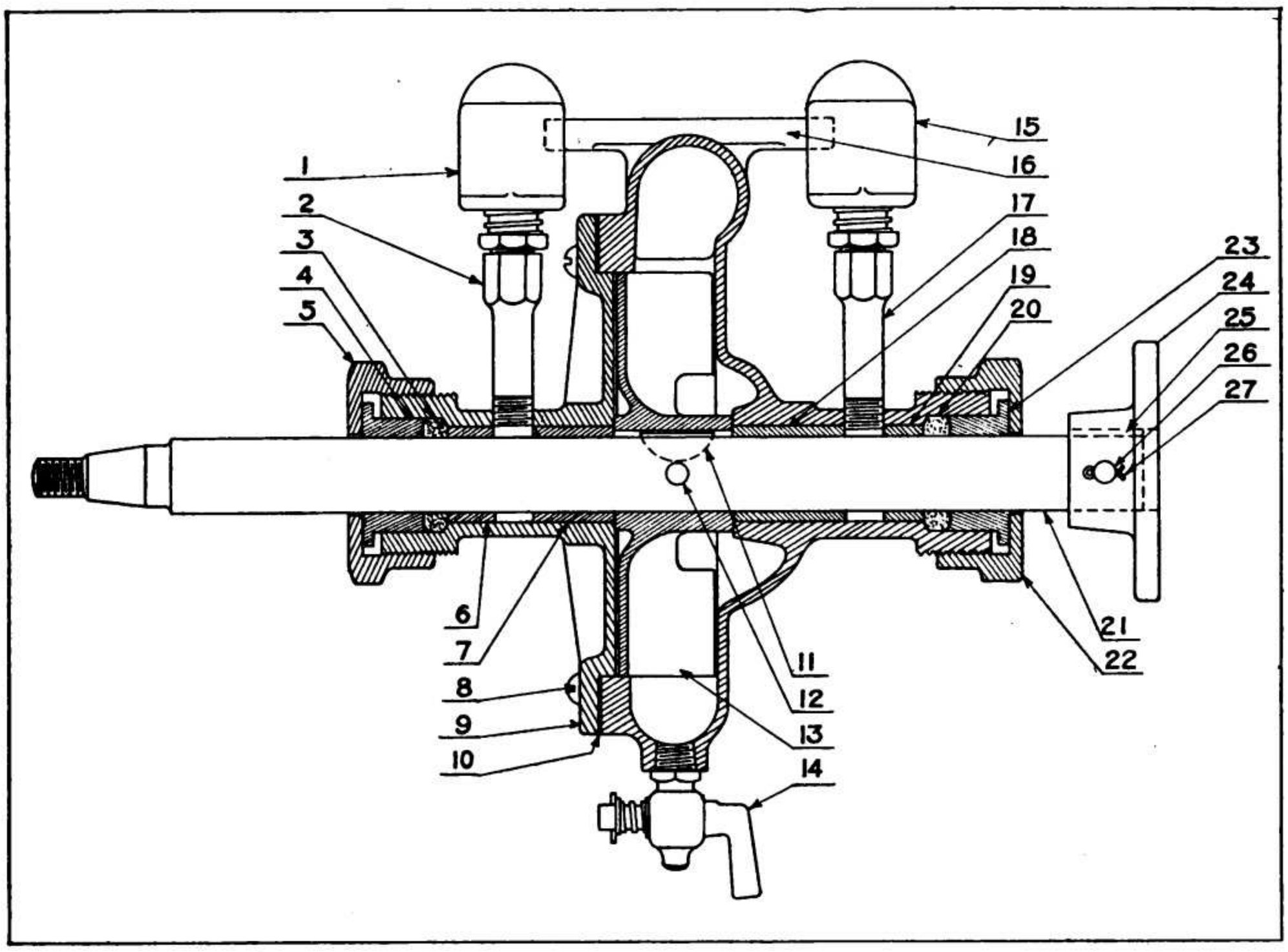
REASONS FOR FAN BELT SLIPPAGE.

A fan will not run at proper speed if the belt is oiled or greasy, if the belt is too loose, or if the fan is too tight in the bearing.

TO CLEAN COOLING SYSTEM.

The water circulating system may be cleaned by uncoupling the hose connections and thoroughly flushing the radiator and cylinder jackets

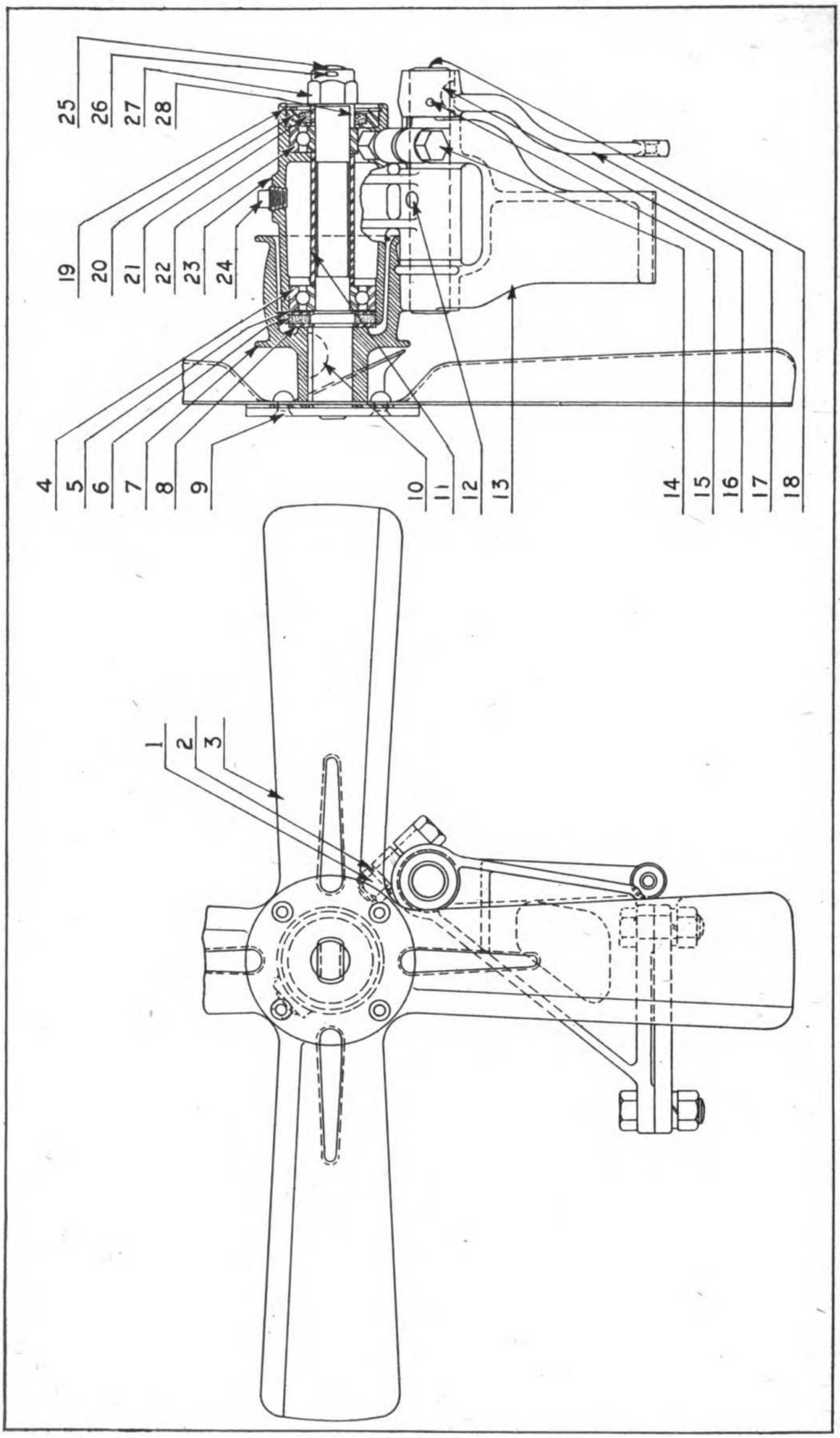
Plate No. 23.



WATER PUMP ASSEMBLY.

Ref. No.	Part No.	Name of Part.
1	34415	Water pump grease cup.
2	34416	Water pump grease cup extension.
3	34443	Water pump packing.
4	35999	Water pump packing gland (rear).
5	30521	Water pump packing nut (rear).
6	34438	Water pump cover bushing (short).
7	34441	Water pump cover bushing (long).
8	SC-405	Water pump cover screw.
9	34445-A	Water pump cover complete.
10	34442	Water pump cover gasket.
11	KE-118	Water pump impeller key.
12	PI-314	Water pump impeller pin.
13	34434	Water pump impeller.
14	CO-118	Water pump drain cock.
15	34415	Water pump grease cup.
16	34439-A	Water pump body complete.
17	34416	Water pump grease cup extension.
18	34437	Water pump body bushing (long).
19	34438	Water pump body bushing (short).
20	34443	Water pump packing.
21	30524	Water pump shaft.
22	34420	Water pump packing nut (front).
23	34433	Water pump packing gland (front).
24	34418	Water pump driven coupling.
25	KE-107	Water pump driven coupling key.
26	PI-315	Water pump driven coupling pin.
27	PI-402	Water pump driven coupling pin cotter.

Plate No. 24



FAN AND FAN BRACKET ASSEMBLY.

FAN AND FAN BRACKET ASSEMBLY.

Ref. No.	Part No.	Name of Part.
1	NU-135	Fan shaft bearing bracket clamp bolt.
1	WA-147	Fan shaft bearing bracket clamp bolt nut lockwasher.
3	32765-A	Fan blade.
4	32646	Fan shaft ball bearing.
5	32727	Fan shaft washer.
6	WA-731	Fan shaft felt washer (front).
7	32722	Fan pulley key (small).
8	33509	Fan shaft felt washer retainer.
9	RI-207	Fan hub rivet.
10	KE-111	Fan pulley to shaft key.
11	32733	Fan shaft spacer.
12	PI-213	Fan shaft bearing to shaft pin.
13	32720	Fan shaft bearing bracket.
14	SC-3535	Fan shaft bearing bracket clamp bolt.
15	PI-241	Fan belt spring lever pin.
16	KE-105	Fan belt spring lever key.
17	32724	Fan belt spring lever.
18	32723	Fan shaft bracket bearing shaft.
19	32725	Fan shaft bearing ret. lock ring.
20	32726	Fan shaft ball bearing retainer.
21	WA-704	Fan shaft felt washer, rear.
22	32646	Fan shaft ball bearing.
23	32721	Fan shaft bearing.
24	PL-102	Fan shaft bearing grease plug.
25	32735	Fan shaft.
26	PI-411	Fan shaft nut cotter.
27	NU-532	Fan shaft nut.
28	32728	Fan shaft collar.

with water under pressure. The cylinder jackets may be cleaned by removing the upper manifold and scraping or dissolving the sediment or by pouring hot washing soda solution (saturated) into the cooling system.

CARE OF COOLING SYSTEM.

When filling the radiator, use clean water as free from impurities as possible, and fill to a depth of about three inches above the top of the ribs.

Do not pour cold water into the radiator when the system is nearly dry and the motor is hot.

Empty the radiator occasionally through the drain cocks on the pump and radiator, flushing out to remove sediment.

The fan draws air through the radiator. Keep the spaces free from mud and dirt.

CAUSES OF OVERHEATING.

Overheating may be caused by insufficient water in the system, clogged passage in the radiator, water jackets, hose connections or other part of the system, running too long on retarded spark, slipping clutch, poor mixture, lack of oil, carbon deposits in cylinders, fan slipping or inoperative, dragging brakes, water pump inoperative due to sheared key, broken rotor, etc., frozen water line or portion of water in radiator frozen. See also list on page 105.

Overheating may cause severe knocking on the slightest grade and possibly on level road. If you have some distance to travel pour an excess

IGNITION SYSTEM.

The ignition system is the means of producing an electric current and causing that current (one of high-voltage and low amperage) to be sent across a gap in the spark plug so that the heat of the spark can ignite the compressed mixture in the cylinders. The ignition system consists of a current generating machine, called a magneto, a switch for diverting the current to the ground, spark plugs, one in each cylinder, for receiving the current, and the necessary wiring to and from each unit to the other.

MAGNETO.

BRIEF DESCRIPTION OF OPERATION.

A magneto is an alternating current generator which supplies current to cause a spark at the spark plug terminals, which spark fires the explosive mixture at the proper time.

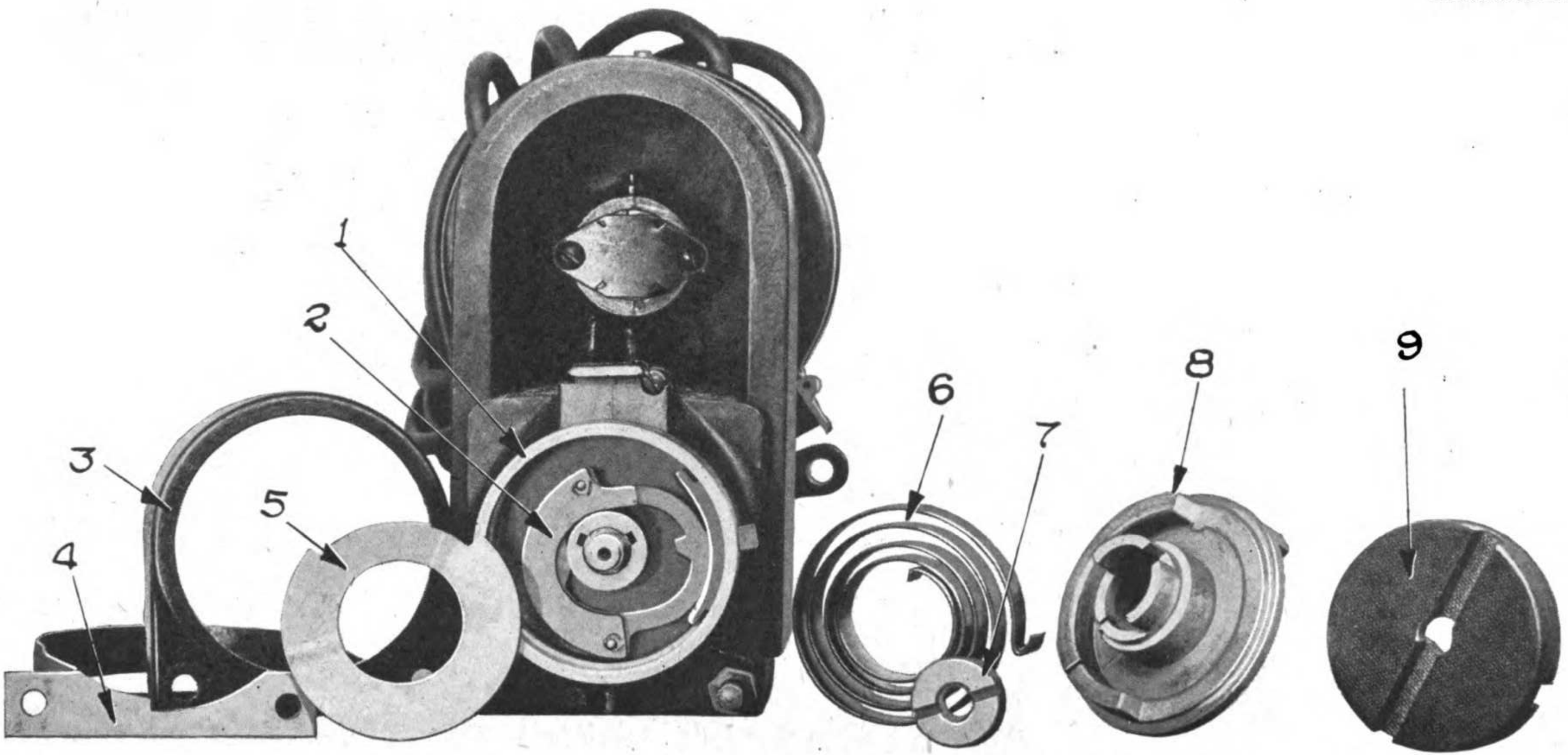
The magneto used in this truck is an Eisemann high-tension type, that is, one which does not employ an outside coil for stepping up the voltage. Both primary and secondary windings are on the armature shaft and both windings have a grounded end. The armature shaft revolving in the magnetic field existing between the permanent magnets, causes a low voltage current to be induced in the primary winding. This winding is connected with the breaker or interrupter, so that the current flow of the primary may be broken or interrupted in order to induce a current of high-voltage in the secondary winding. At the instant of interruption of the primary the secondary is induced and this is the current which flows to the distributor and thence through cables to the spark plugs.

When you throw the switch to "on" position no current passes through the switch. The primary current path after generation is through the primary winding, through the interrupter, and to ground, thus returning.

The secondary winding also is grounded at one end. The induced high-voltage current flows through the secondary winding to the distributor to the spark plugs in order, thence to ground, and the secondary winding being grounded the circuit is completed through the metal parts of the engine.

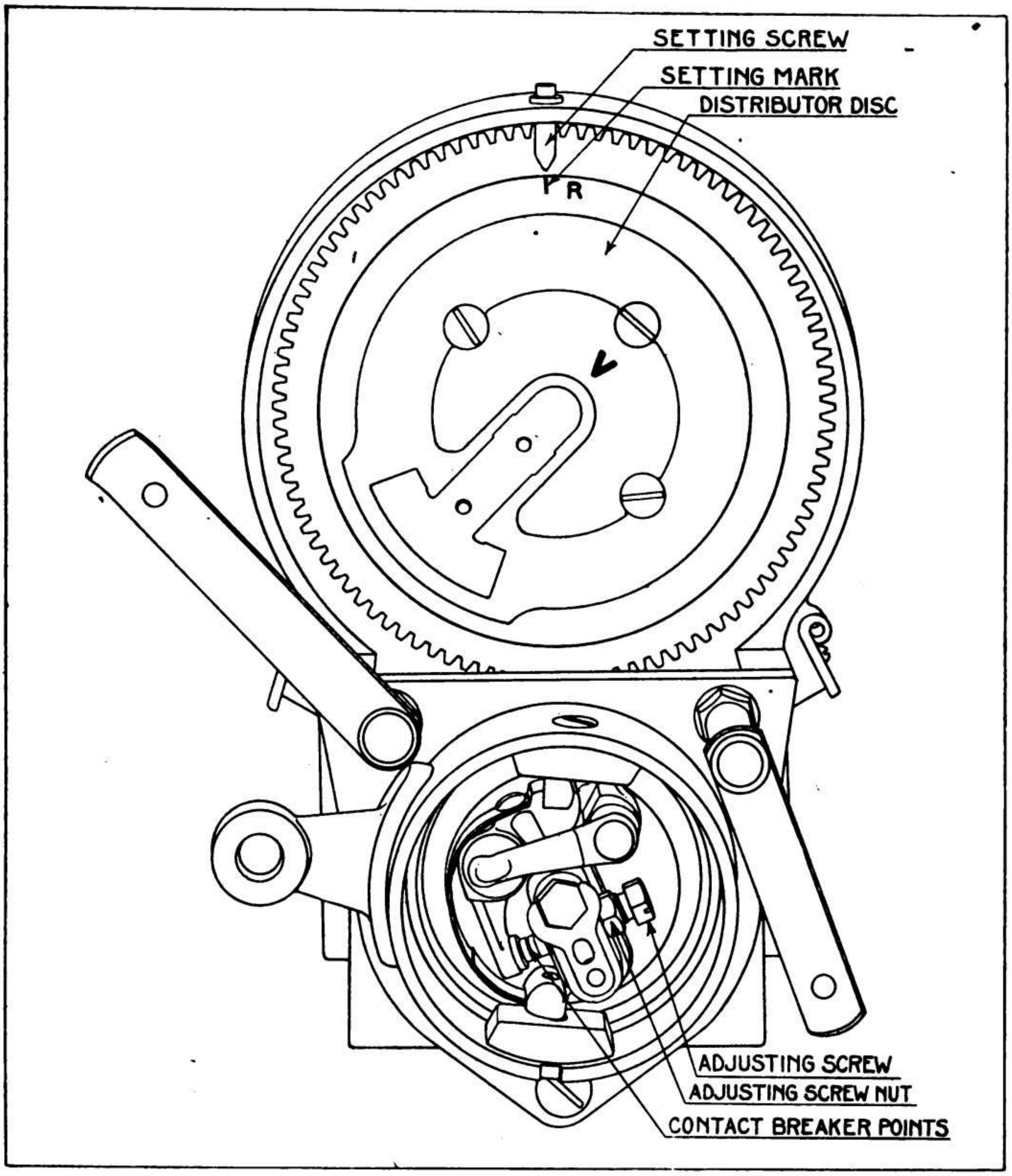
MAGNETO TIMING.

As the spark occurs when the primary circuit is broken by the opening of the platinum contacts on the breaker mechanism, it is necessary that the magneto will be so timed that, at full retard position of the timing lever body, the platinum contacts will open shortly after the respective piston of the engine has reached its highest point on the compression stroke. Turn engine by hand until piston of No. 1 cylinder is just past dead center (firing stroke), remove the distributor plate from the magneto and turn the armature shaft until the setting mark on the distributor disc is in line with the setting screw, as shown in illustration on page 76. With



MAGNETO WITH IMPULSE STARTER ASSEMBLY, MODEL 4017-L ONLY.

Plate No. 26



END VIEW OF MAGNETO SHOWING DISTRIBUTOR AND BREAKER MECHANISM.

should be approximately 0.032 inch. Also the spark plug may be short-circuited through carbon or oil, or the insulation may be cracked. Cleaning with gasolene or replacing is the remedy.

The wiring should be carefully examined and checked in accordance with the firing order of the engine. If cables are cracked, or worn, they should be replaced. All connections must be kept clean and tight.

Clean breaker contact with gasolene until the contact surface appears quite white, or if pitted, use a fine file—but very carefully—so that the surfaces remain square to each other. For this purpose a manicure file

may be used, or a special magneto file. The correct gap of the contact points is 0.010 inch and in no case should it be more than 0.012 inch. As these contacts wear away in time, they should be adjusted by giving the adjustable screw a forward turn, care being taken to securely tighten the lock nut. This can be accomplished without removing the timing lever or make-and-break mechanism.

If the platinum contact riveted to the contact arm, or that of the adjustable screw should be worn down entirely, it would necessitate a change of either or both. When the adjustable screw is replaced or adjusted, care must be taken that the lock nut is securely tightened in place.

If, after following these instructions, the engine still refuses to start, the magneto should then be tested by removing the distributor plate and resting a screwdriver on the gear casing, holding same about 0.125 inch from the collector ring. Then if, upon rotating the armature, a spark jumps across the .125-inch gap, it shows that the trouble does not lie in the magneto.

But if a spark does not jump across the .125-inch gap previously mentioned, the magneto is at fault. See page 104 for further information on ignition troubles.

A re-magnetization of the magnets will only be necessary if these have been removed from the magneto and allowed to remain a long time without both ends of the magnets being connected with a piece of soft iron—a so-called keeper. The same thing occurs if the armature is taken out of the pole pieces without a conducting rod of iron being laid across both poles. This piece must remain on the poles until the armature is again placed between the pole pieces. Often the magnets, after being removed, are put back in the wrong position and in this way the magnetic power is neutralized. To prevent this mistake all magnets are marked—the north pole being designated by the letter "N" stamped in the magnet. When replacing magnets care should be taken to place the same poles on the same side.

TO CHARGE MAGNETS.

Ordinary magnets will not become discharged, except after a long period of service, or, if they have been removed from the magneto without taking the precaution of placing an iron keeper or magnetic conductor across the two ends of the magnet.

When a magnet must be recharged and no electro-magnet for charging purposes is at hand, the work may be done with the aid of a storage battery and a length of insulated wire from 10 to 25 feet long, and of most any gauge between No. 8 and No. 22.

Attach one end of the insulated wire to the positive terminal of the storage battery and wind half the wire in the clockwise direction around the North pole of the magnet, and in an anti-clockwise direction around the south pole of the magnet (looking at the free ends of the magnet).

together and connect (as one wire) to a condenser terminal. Do likewise with the other length of wire, then roll or ball both lengths of wire together, forming a series of condenser surfaces.

TO TEST FOR SHORT CIRCUIT.

To test the ignition switch and wiring for a short circuit, simply remove the breaker box and cap with wire, and if a spark can then be secured, difficulty will be in the part removed.

TO CLEAN DISTRIBUTOR.

The distributor may be cleaned of carbon and dirt, with several drops of lubricating oil rubbed on, either with a finger or a bit of waste or cloth. This will loosen the carbon, after which the distributor may be wiped clean with a small piece of waste.

TO TIME DISTRIBUTING FINGER.

If the distributor wheel has been removed, it should be replaced with care. The distributing finger should be so timed that regardless of the amount of breaker box advance, or retard, the spark will always occur while the finger is under a carbon brush. This may be set by advancing the breaker box .5 of its full travel and rotating armature shaft in the direction of rotation (anti-clockwise) until the platinum breaker points just begin to separate. The distributor wheel should then be replaced so that the center of the distributor finger comes directly under the center of a carbon brush.

BREAKER ADJUSTMENT.

The correct opening of the circuit breaker points is from .010 inch to .012 inch. If set too wide, result will be weak spark, as the low tension winding does not have time to "build up."

TO INSTALL NEW BREAKER POINTS.

When the platinum points have been worn down by service, or excessive filing, and new ones must be installed, if it is possible to secure them already mounted, such should always be done.

If unmounted points only can be secured for replacement, they are usually supplied with a small, round teat .063 (1/16) inch diameter on the back of point. To mount point, drill a .063 (1/16) inch diameter hole, .094 (3/32) inch deep in the mounting, and solder point on (sweat on), filing off any excess solder. If soldering equipment is not at hand, the point may be mounted temporarily by squeezing teat out of round with a pair of pliers and forcing into hole.

The point should be soldered in at the first opportunity, as it may work loose and cause trouble, which is very difficult to find. After the points have been mounted they should be adjusted with a maximum break of .012 inch and the points must bear evenly all over on their face (i. e.,

A carburetor is a metering device whose function is to mechanically blend a liquid fuel with the proper amount of air to produce a mixture in such proportions that it will readily explode when compressed within the engine cylinder.

As the name implies, a plain tube carburetor is one in which both the air and gasolene openings are fixed in size; and in which the gasolene is metered automatically, without the aid of moving parts, by the suction of air velocity past the jets.

The mixture proportioning is properly maintained by the use of what is termed "the air bled jet." See illustration on page 84.

The gasoline leaves the float chamber, passes the point of the high speed adjusting needle, and raises through the vertical channel "C." Air is taken in through the air bleeder (dotted in on cut) and discharges into the main gasoline supply channel "C" through small holes located just above top of accelerating well. This air which is discharged from the air bleeder, breaks up the flow of gasoline and produces a finely divided emulsion before it reaches the jet holes in the small venturi tube "I." Upon reaching the jet holes of this small venturi tube, this emulsion is discharged into the high velocity air stream in the form of a finely divided mist.

A venturi tube is used to produce a maximum air velocity at the jet and at the same time not cause undue restriction. This high air velocity creates the suction necessary to properly atomize the gasoline. The use of a double venturi tube construction, in which the mouth of the smaller tube is located at the throat of the larger one, develops the highest degree of atomization, and at the same time the air restriction is minimized.

To prevent a lean mixture during a period of acceleration, an accelerating well is used. The reason for the necessity of its use is as follows: On suddenly opening the throttle the suction is increased at the end of the manifold through which particles of air and gasoline are flowing (to the suction). Due to the difference in inertia of air and gasoline, the flow of the air would be accelerated very much faster than the (heavier) gasoline. This would result in the air rushing ahead of the gasoline particles, increasing the proportion of air to gasolene until the inertia forces had been overcome and the gasoline particles responded completely to the increased suction.

When the engine is idling, or running at a speed which does not utilize the maximum flow of gasolene from the float chamber, the accelerator well or space "M" fills with gasoline.

When the throttle is opened, increasing the suction in the venturi tube and drawing gasoline from the main supply channel, atmospheric pressure at the bleeder exerts itself on the gasolene in the accelerating well "M," forcing it down to join the regular flow of gasoline up through "C" and out into the high velocity air stream through the small venturi tube. While the above action takes place the flow of gasoline is

more than double the normal rate of flow, thereby compensating for the lagging of the gasolene referred to previously.

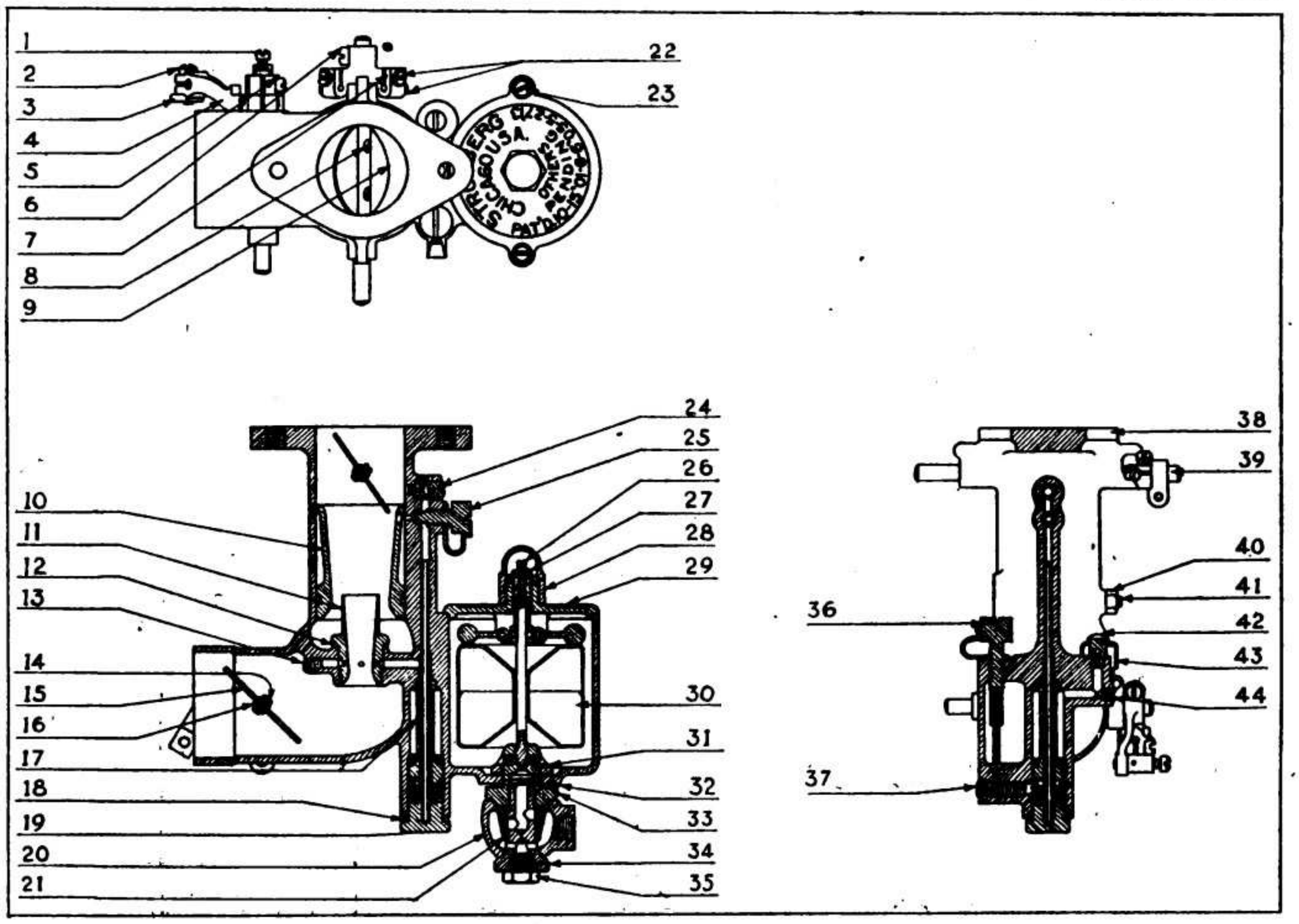
A series of air bleeder holes "H" down the inner wall of the accelerating well connect to the main supply channel, permitting a direct passage of air from the bleeder to the gasoline, giving the air bled jet feature explained above.

The smaller and fewer these holes, the faster will the well empty, due to the suction, and the larger and more holes, the slower will the well empty, as air will be bled thru them as soon as uncovered by the level of the gasoline. It is therefore apparent that the rate of discharge of the well can be regulated to suit individual requirements by inserting wells having a different number and size of holes drilled therein. The action of the well is also dependent upon the size of the hole in the air bleeder, because it is the relative areas of the bleeder hole, and the well holes, which determine the rate at which the well will empty.

When the engine is idling, i. e., when the throttle is practically closed, the vacuum existing above the throttle valve, amounting to about 8 pounds per square inch, pulls the gasoline up through the idling tube (from the float chamber passage), which is concentric and inside the main supply channel, to the idling jet "K." The position of the throttle prevents sufficient vacuum in the small venturi mouth drawing any gasoline through the main supply channel, therefore, but air exists below the throttle. The vacuum above the throttle valve which draws gasoline up through the idling tube, also draws an amount of air controlled by the position of the low speed adjusting screw, from below the throttle. This air mixes with the gasoline to form a finely divided emulsion, which is drawn into the manifold and highly atomized by the high vacuum at the idler jet. It is apparent from the above, that the idling mixture is controlled by the position of the low speed adjusting screw.

As the throttle is slightly opened from the idling position some vacuum is transferred to the mouth of the small venturi, and when the throttle is opened fully the vacuum there greatly exceeds that at the idle jet. At some intermediate position of the throttle there is a time when the suction at the idle jet is equal to that at the small venturi, and therefore at this particular time the gasolene will follow both channels to the manifold. This condition exists but a very short time, because as the throttle is opened wider, the suction at the small venturi rapidly becomes greater than that at the idle jet. The result is that the idling tube and idling jet are thrown entirely out of action, the level of the gasolene in the idling tube dropping, and all gasolene enters the manifold through the holes in the small venturi tube.

Plate No. 27



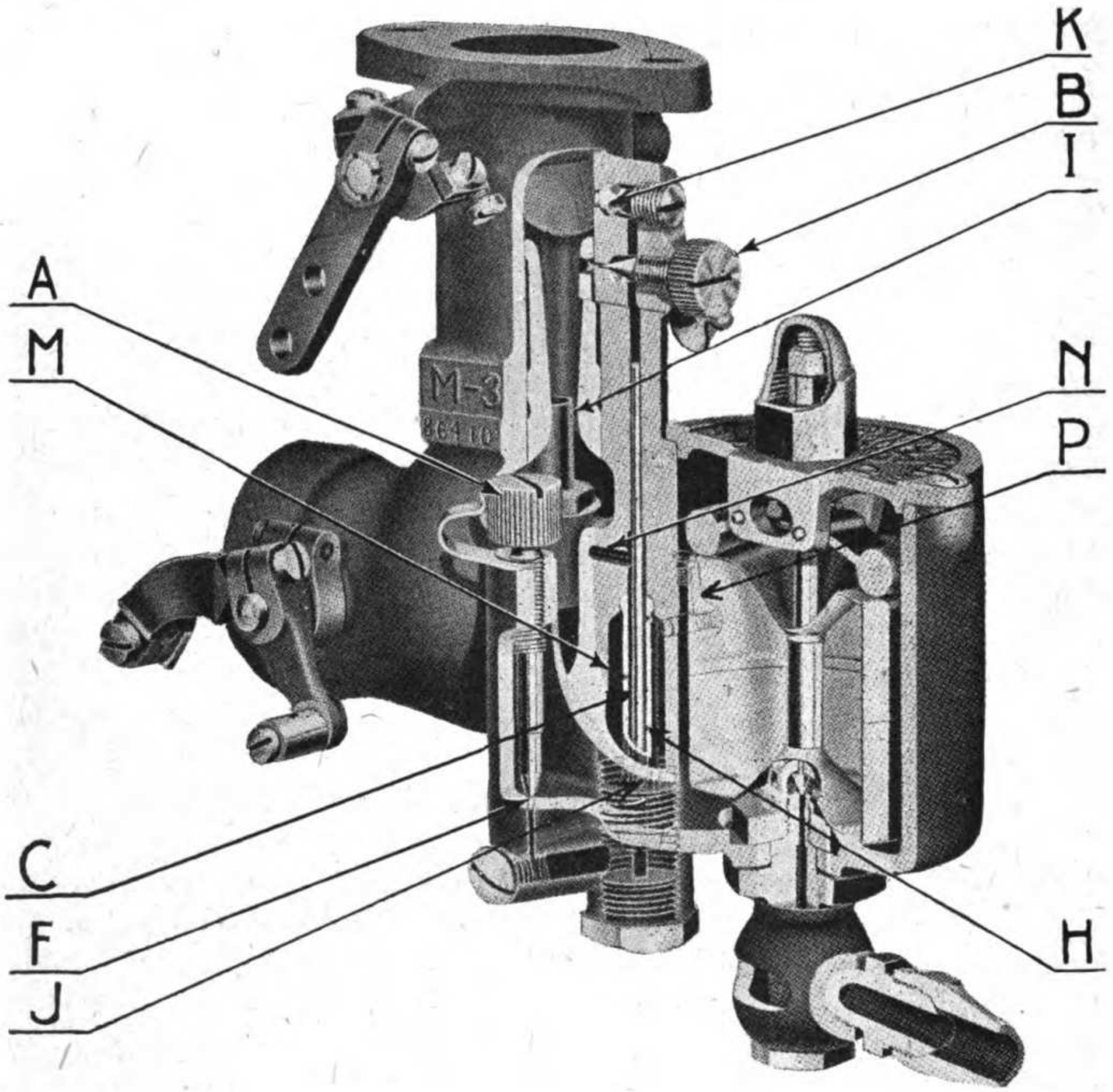
CARBURETOR ASSEMBLY.

Ref. No.	Part No.	Name of Part.
1	32932	Air lever with connection screw.
2	32971	Mixture regulator tube clamp screw.
3	NU-935	Mixture regulator tube clamp nut square.
4	30639	Mixture regulator tube holder with screws.
5	30525	Air horn lever and connection with screw.
6	32931	Throttle stop clamp screw.
7	32967	Throttle stop.
8	32969	Throttle valve screw.
9	32968	Throttle valve.
10	32972	Large venturi tube.
11	30640	Small venturi tube.
12	32975	Small venturi tube gasket.
13	32927	Air bleeder channel plug.
14	32969	Air horn valve screw.
15	32934	Air horn volve.
16	30634	Air horn stem.
17	32977	Accelerating gas well.
18	32963	Idle tube gasket.
19	32962	Idle tube with holder.
20	32950	Strainer body.
21	32949	Strainer.
22	32966	Throttle stop set screw.
23	32931	Float chamber cover screw.
	WA-122	Float chamber cover screw lock washer.
24	32960	Idle discharge jet.
25	32961	Idle needle valve.
26	32943	Needle valve.
27	32944	Needle valve lock nut.
28	32945	Needle valve cap.
29	32942	Float chamber cover with levers.
30	32941	Float.
31	32948	Needle valve seat nut.
32	32947	Needle valve seat gasket.
33	32946	Needle valve seat.
34	32953	Strainer body stud.
35	32951	Strainer body drain plug.
36	30637	High-speed needle valve.
37	32958	Main gas channel plug.
38	60638	Main body.
39	30666	Throttle bell crank stem.
40	30670	Large venturi tube set screw nut.
41	32973	Large venturi tube set screw.
42	30619	Air bleeder.
43	30631	Air bleeder dirt shield.
44	32927	Air bleeder channel plug.

CARBURETOR ADJUSTMENT.

There are two adjustments on this new Stromberg, shown in the illustration below: A, the main adjustment, controls the gasoline supply from the float chamber and regulates the mixture through the whole driving range. Turning nut A anti-clockwise, or to the left, raises the needle and gives more gas; clockwise, less. If an entirely new adjustment is necessary, turn nut A clockwise (to the right) until needle just seats, then open A three complete turns (to the left), which should give a mix-

Plate No. 28



CUT-AWAY VIEW OF STROMBERG MODEL M-3 CARBURETOR

A—High speed adjusting needle.
B—Low speed adjusting screw.
C—Main supply channel.
F—Needle valve seat.
H—Air bleeder holes (for high speed only).
I—Small venturi.
J—Opening through which gasoline passes into idling tube.
K—Idling jet.
M—Accelerating well.
N—Passage to discharge holes in small venturi.
P—Air bleeder.

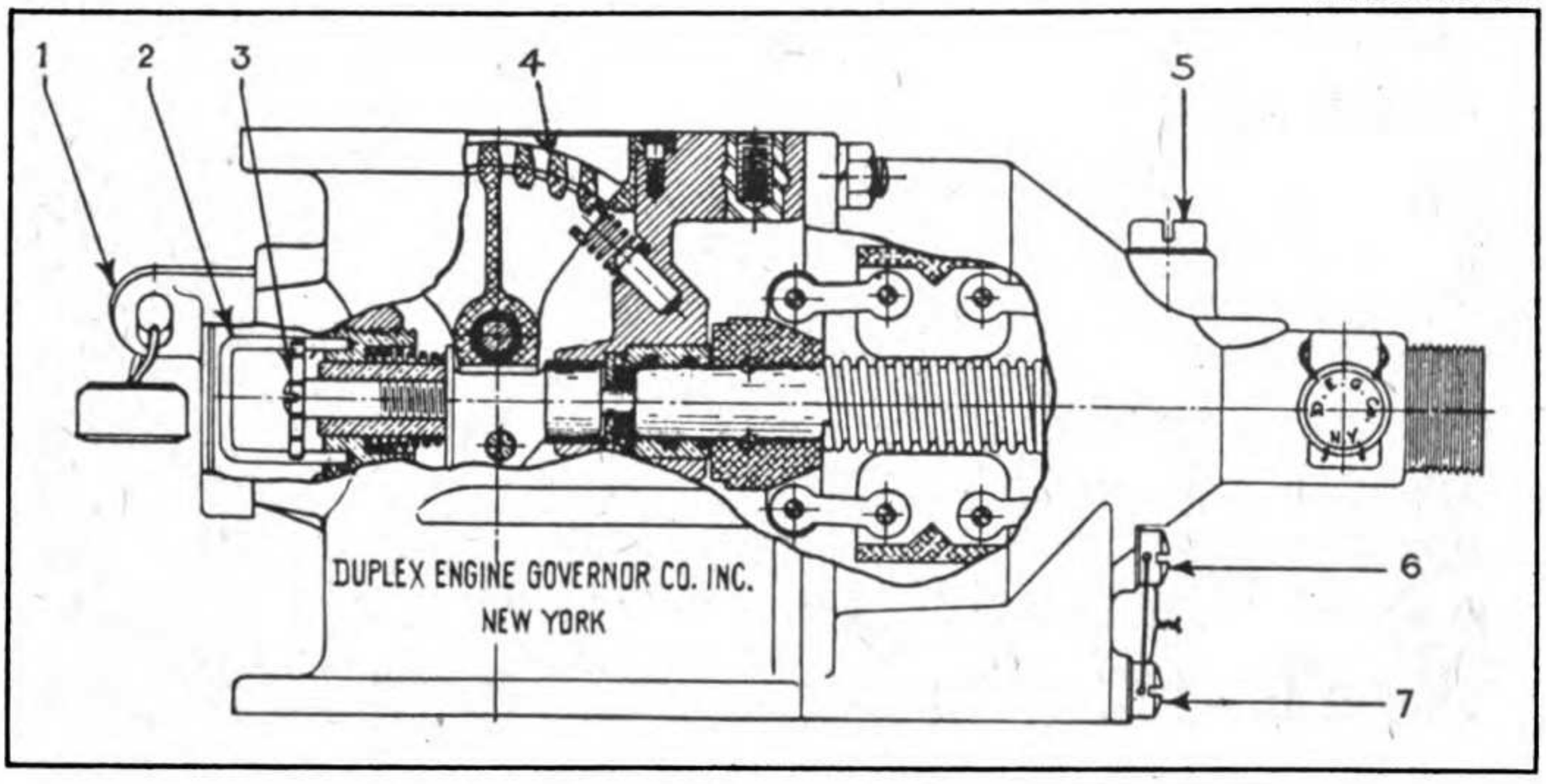
to the angle of the truck, and hold the needle valve open when the gasoline will leak out through the nozzle, and, if a truck stands with the front end downhill the nozzle openings may be below the level of the gasoline in the carburetor float chamber, then the gasoline would leak out.

GASOLINE TANK AND LINE (FUEL FEED SYSTEM).

The gasoline system or fuel feed system consists of a main tank (27 gallons) mounted under the driver's seat, feeding to an auxiliary tank (2 quarts) mounted on the left front side of engine from whence the flow is by gravity to the carburetor.

The main tank is of tern plate and is divided by means of a wall extending part way up the middle. This wall is high enough so that the volume on either side is five gallons. Each side has a .375-inch brass pipe

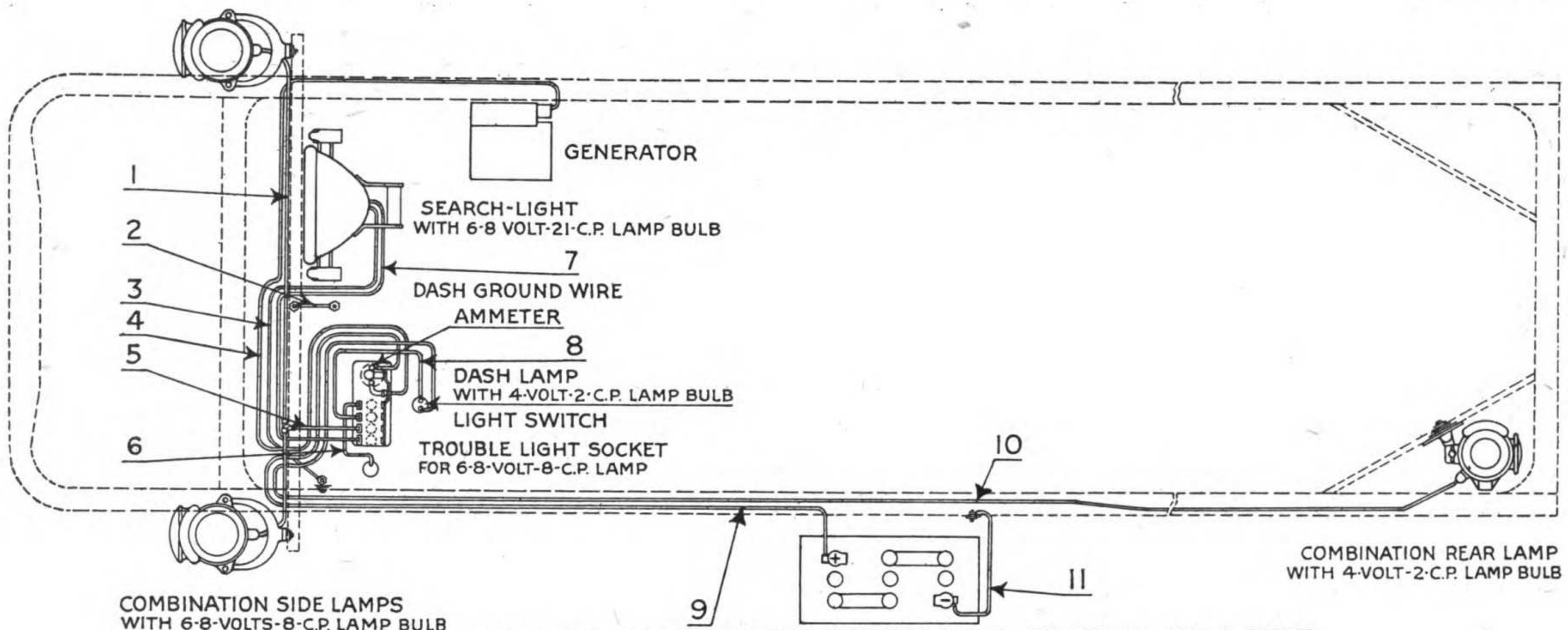
Plate No. 29



CUT-AWAY VIEW OF SIMPLEX GOVERNOR.

Ref. No.	Part No.	Name of Part.
1	34073	Locking pin.
2		Yoke.
3		Hand wheel.
4	34044	Valve seat.
5	34330	Oil filler screw.
6		Oil discharge.
7		Oil level.

running to a three-way control valve. When the control valve arrow points toward the line running from the control to the auxiliary tank the fuel from the main tank is shut off. The line from main tank to auxiliary also is of .375-inch brass tubing. This pipe enters near the top of the auxiliary tank and extends across the tank. The auxiliary tank is fitted with a vent which runs up the steering column. From the auxiliary tank there is a .375-inch tube with a shut-off valve and strainer in the line. This strainer consists of an iron bowl and a brass cap with fine mesh screen between them.



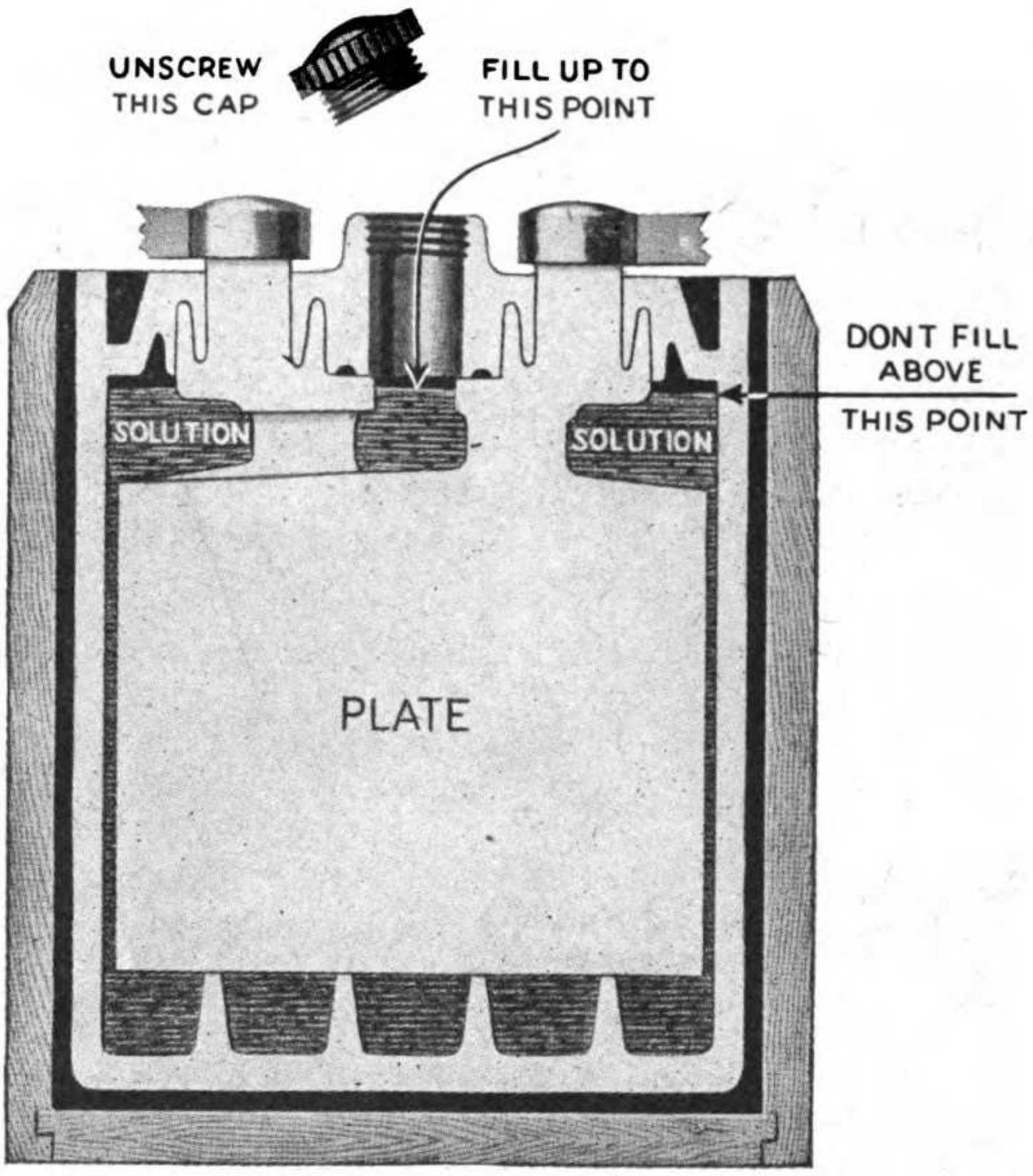
WIRING DIAGRAM ELECTRIC LIGHTING SYSTEM USED ON MODEL 4017-A ONLY.

Ref. No.	Part No.	Name of Part.
1	35723	Side lamp wire.
2	35751-A	Dash ground wire complete.
3	35755-A	Searchlight ground wire complete.
4	35719-A	Generator to switch wire complete.
5	35722-A	Sidelight wire to switch wire.
6	35748-A	Trouble lamp to switch wire.
7	35744-A	Searchlight to switch wire.
8	35848-A	Dash lamp to switch wire.
9	35715-A	Battery to ammeter wire.
10	35741	Tail lamp wire.
11	35753-A	Battery ground wire.

known as electrolyte or battery solution. This does not actually store up electricity, but produces a chemical change in the plates. When a circuit is established between the elements, the active material of the plates changes back to its original condition and an electrical current is generated.

Immediately upon receipt of the truck, the vent plugs in the cover of

Plate No. 35



SECTION THROUGH STORAGE BATTERY SHOWING CORRECT LEVEL OF ELECTROLYTE.

each cell should be removed to see that the solution fully covers the tops of the plates. If it does not, add distilled water. Do not fill the cells so full that the solution bubbles out of the vent plugs. Wipe off any excess which may appear.

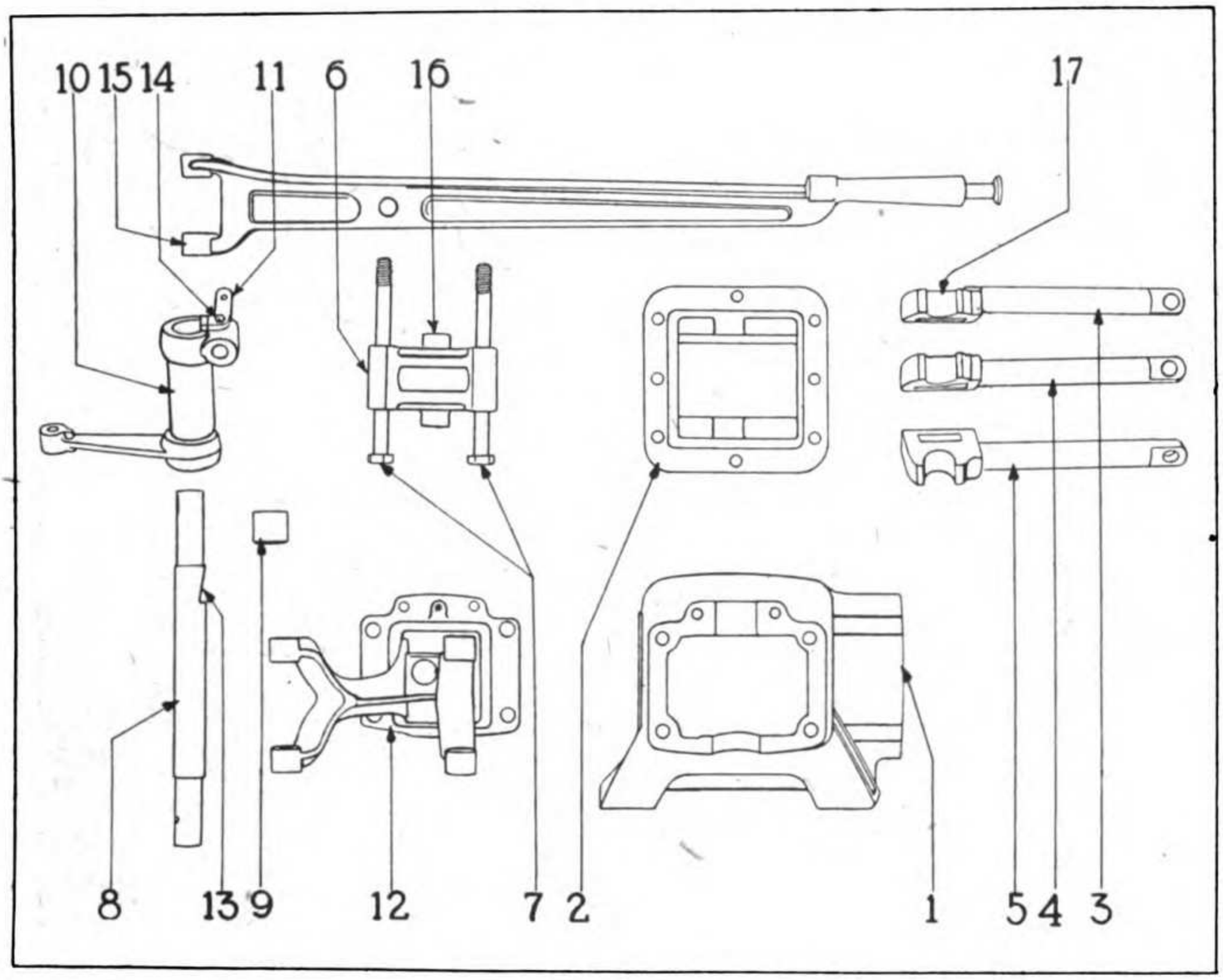
Use only clean non-metallic vessels for handling and storing water to be used for battery purposes.

Never add acid of any kind to the battery to replace evaporation, because only water and not acid evaporates.

Water for battery purposes should be distilled. The water must be free from alkali, iron or other impurities.

The battery should be kept clean and free from dirt.

Plate No. 37



HAND CONTROL GEARSHIFTING MECHANISM DISMANTLED.

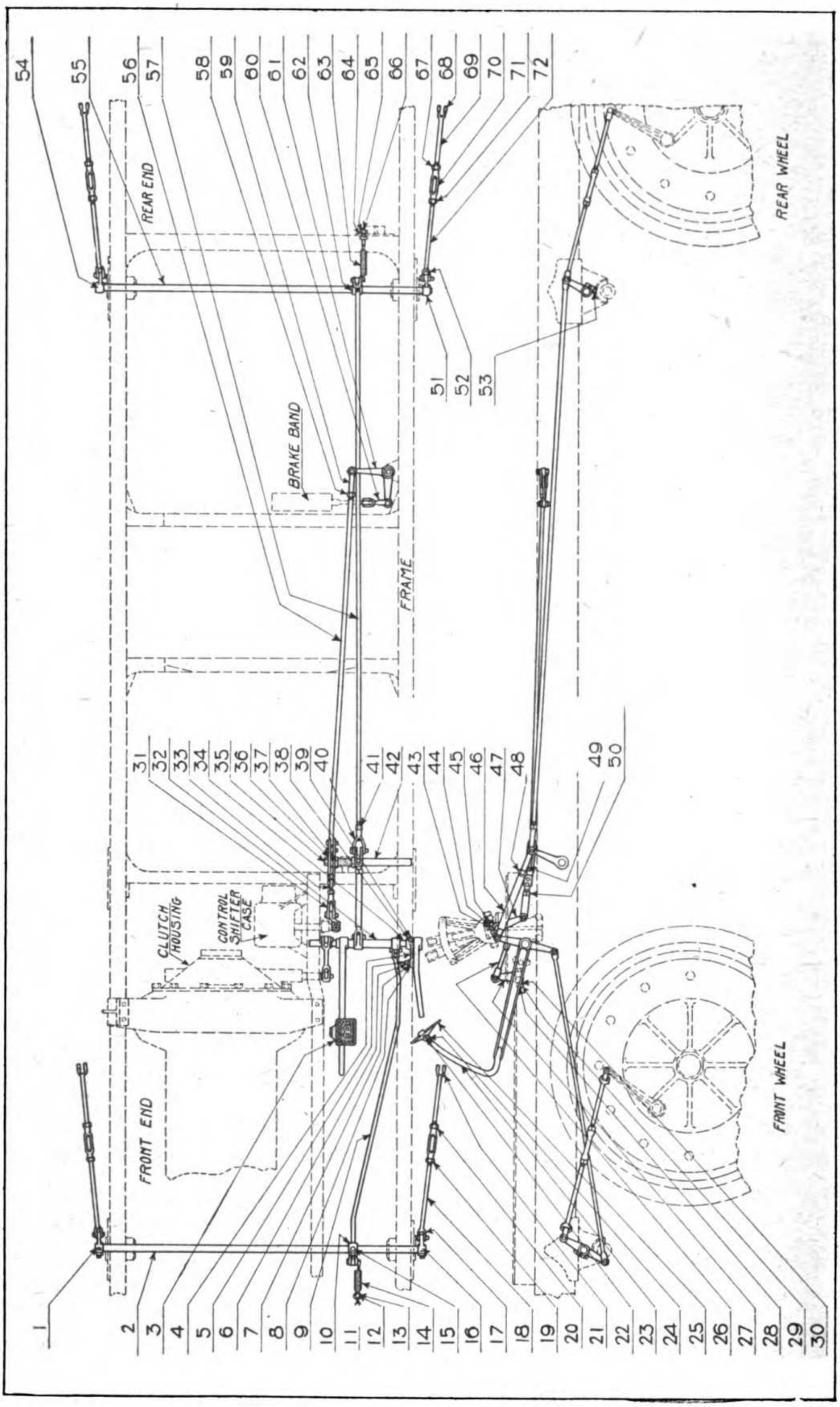
Ref. No.	Part No.	Name of Part.
1	34133-A	Shifter case.
2	32354	Shifter yoke guide.
3	32352	Reverse speed shifting yoke.
4	32351	Third and fourth speed shifting yoke.
5	32350	First and second speed shifting yoke.
6	32355	Shifter yoke interlock.
7	32597	Shifter yoke interlock bolt.
8	32331	Hand-brake shaft.
9	32322	Hand-brake shaft bushing.
10	35405-A	Control shifter lever tube.
11	34748	Operating lever reverse lock.
12	32324	Quadrant bracket.
13		Reverse notch.
14	34747	Operating reverse lock screw.
15	35385	Operating lever.
16		Lugs on interlock.
17		Notch in shifting yoke.

device. Its function is to permit the shifting of and to retain in engagement such gears as are selected by the hand-control lever. Operating rods with adjustable yokes from rigid connection between the control levers and shifter case.

GEAR SHIFTER CASE.

Beneath the gearshift lever is a cast iron case which contains three shifter yoke guides and the interlocker which prevents any two of the

Plate No. 42



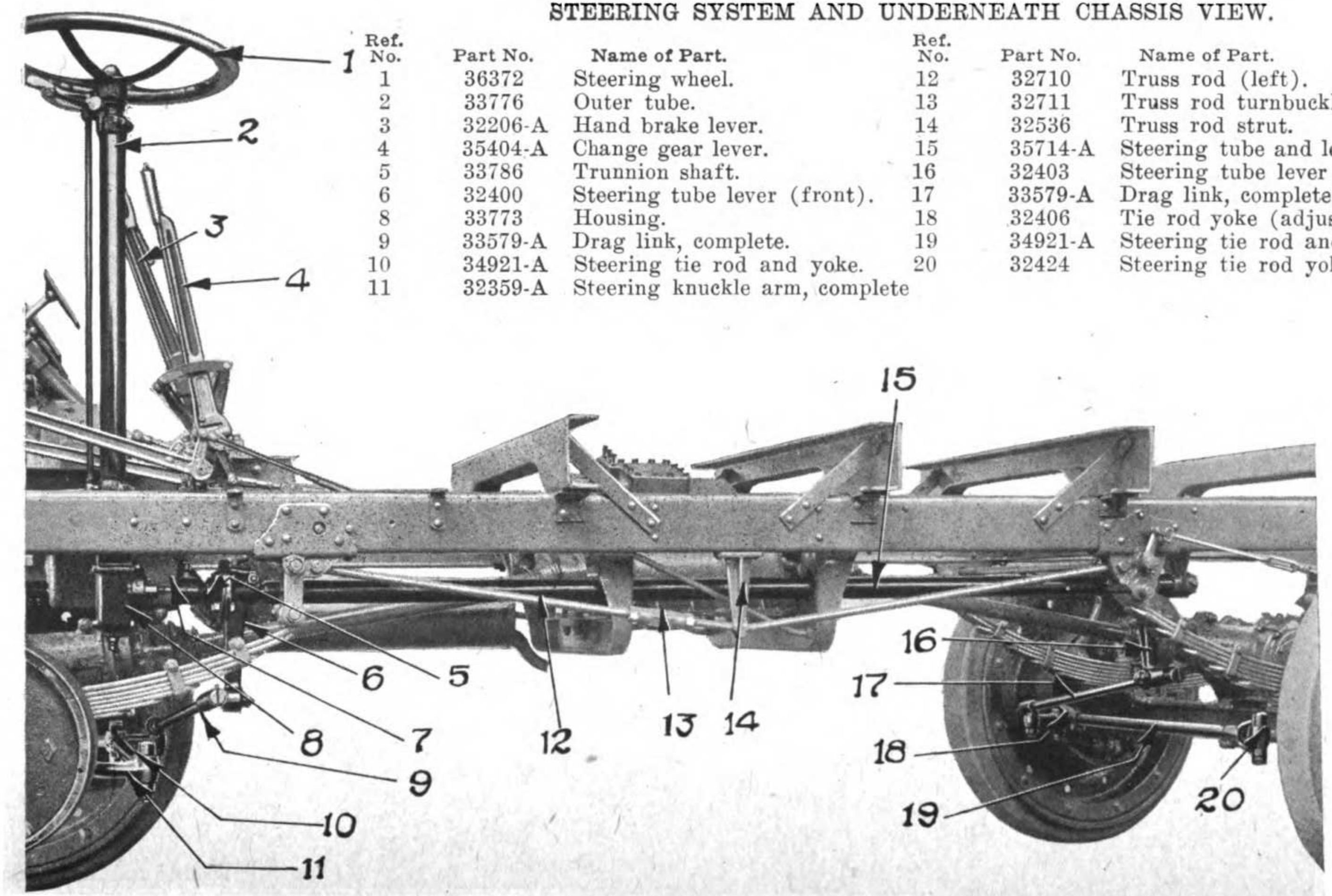
FOOT AND HAND BRAKE ROD ASSEMBLY.

FOOT AND HAND BRAKE ROD ASSEMBLY.

Ref. No.	Part No.	Name of Part.
1	31189	Brake cross shaft lever.
2	32198	Brake cross shaft.
3	32650	Brake pedal pad.
4	31674	Clutch pedal adjusting hub.
5	SC-3334	Clutch pedal adjusting hub bolt.
6	NU-112	Clutch pedal adjusting hub bolt nut.
7	WA-145	Clutch pedal adjusting hub bolt lock washer.
8	WA-1008	Clutch pedal hub bolt washer.
9	32602	Brake rod (front).
10	32197	Brake cross shaft lever (center).
11	32601	Brake pull back spring hook (front).
12	NU-128	Brake pull back spring hook nut (⅜"-24x9/16").
13	WA-146	Brake pull back spring hook lock washer.
14	32200	Brake pull back spring (front).
15	SC-3432	Brake cross shaft lever screw (⅜"-24x1¼").
16	31189	Brake cross shaft lever (outer).
17	32199	Brake rod clip.
18	32381	Brake rod end (right).
19	NU-1265	Brake rod end nut (right-hand).
20	NU-1266	Brake rod end nut (left-hand).
21	32199	Brake rod clip.
22	BO-601	Brake pedal pad bolt (⅜"-16x1⅜").
23	31265	Clutch pedal.
24	NU-303	Slotted hexagon nut (⅜"-16x11/16").
25	32651	Clutch pedal pad.
26	32580	Clutch pedal shaft and throwout shaft connecting rod.
27	32770	Clutch throwout shaft lever (outer).
28	SC-3435	Clutch throwout shaft lever bolt (⅜"-24x2").
29	NU-128	Transmission brake drum to hub bolt nut (⅜"-24x9/16").
30	WA-146	Transmission brake drum to hub bolt nut lock washer (⅜").
31	32390	Hand-brake and rocker shaft connecting rod yoke.
32	32542-A	Brake pedal and tube, complete.
33	32389	Hand-brake and rocker shaft connecting rod.
34	31263-A	Clutch pedal shaft, complete.
35	NU-149	Brake rocker shaft nut (½"-20x¾").
36	32391	Hand-brake and rocker shaft connecting link.
37	32716	Brake rocker shaft lever.
38	NU-128	Brake pull back spring hook nut (⅜"-24x9/16").
39	SC-3434	Hand-brake shaft lever bolt (⅜"-24x1¾").
40	32411	Brake rod adjusting yoke.
41	NU-135	Brake rod nut (7/16"-20x⅝").
42	32167-A	Brake rocker shaft, complete.
43	WA-146	Brake pull back spring hook lock washer (⅜").
44	NU-128	Brake rocker shaft bracket bolt nut (⅜"-24x9/16").
45	SC-3435	Clutch throwout shaft lever bolt (⅜"-24x2").
46	36324-A	Brake rod—interconnecting, complete.
47	32664	Hand-brake shaft lever.
48	NU-135	Hand-brake and rocker shaft connecting rod nut (7/16"-20x⅝").
49	32390	Hand-brake and rocker shaft connecting rod yoke.
50	NU-135	Hexagon nut (7/16"-20x⅝").
51	31189	Brake cross shaft lever (outer).
52	32199	Brake rod clip.
53	SC-3432	Brake cross shaft lever screw (⅜"-24x1¼").
54	31189	Brake cross shaft lever (outer).
55	32198	Brake cross shaft (front or rear).
56	32412	Brake rod rocker shaft to transmission.
57	32409	Brake rod (rear).
58	NU-135	Hand-brake and rocker shaft connecting rod nut (7/16"-20x⅝").
59	32390	Brake rod adjusting yoke.
60	35164	Transmission brake bell crank link.
61	32706	Transmission brake bell crank.
62	32197	Brake cross shaft lever (center).
63	32201	Brake pull back spring (rear).
64	WA-146	Brake pull back spring hook lock washer (⅜").
65	NU-128	Brake pull back spring hook nut (⅜"-24x9/16").
66	32601	Brake pull back spring hook (rear).
67	NU-1266	Brake rod end nut (left hand).
68	32199	Brake rod clip.
69	32382	Brake rod end (left).
70	32383	Brake rod turnbuckle.
71	NU-1265	Brake rod end nut (right-hand).
72	32381	Brake rod end (right).

STEERING SYSTEM AND UNDERNEATH CHASSIS VIEW.

Ref. No.	Part No.	Name of Part.	Ref. No.	Part No.	Name of Part.
1	36372	Steering wheel.	12	32710	Truss rod (left).
2	33776	Outer tube.	13	32711	Truss rod turnbuckle.
3	32206-A	Hand brake lever.	14	32536	Truss rod strut.
4	35404-A	Change gear lever.	15	35714-A	Steering tube and lever.
5	33786	Trunnion shaft.	16	32403	Steering tube lever (rear).
6	32400	Steering tube lever (front).	17	33579-A	Drag link, complete.
8	33773	Housing.	18	32406	Tie rod yoke (adjustable).
9	33579-A	Drag link, complete.	19	34921-A	Steering tie rod and yoke.
10	34921-A	Steering tie rod and yoke.	20	32424	Steering tie rod yoke pin.
11	32359-A	Steering knuckle arm, complete			



DETAIL ACTION OF STEERING MECHANISM.

The steering gear used is of Lavine make, and of the screw and split nut type. When the steering wheel is turned the screw shaft inside the steering tube or column turns, causing one side of the split nut at the bottom to move upward and the other half to move downward. This is made possible by right threading the inside of one-half of the nut and left threading the inside of the other half. Near the lower end of each half nut is a slot or wide groove to take the forked end of a trunnion shaft which connects with the longitudinal steering tube. This trunnion shaft is at right angles to the steering gear case. When one-half of the nut moves up and the other half moves down, the fork end of the trunnion shaft revolves and this movement is transmitted to the longitudinal steering tube to which the steering arms are attached. These steering arms are secured to the steering tube about the center of which they move. Movement of the steering arms is transmitted to so-called drag links, one attached to each arm by means of a ball joint. These drag links extend across the chassis at a slight angle to the rear axle and connect by means of ball joint with the right steering knuckle arms. By means of the yoked tie rods the opposite steering knuckle arms are connected.

TRUNNION SHAFT.

This shaft is made of steel and is supported in a forged hanger. It connects the steering gear with the longitudinal tube. The rear end of the trunnion shaft is splined to receive the splined end of the steering tube. The trunnion shaft is suitably supported on non-adjustable bronze bearings.

STEERING TUBE.

This tube extends from the trunnion shaft back to a rear support slightly forward of and above the rear axle in the form of a malleable iron bracket. The tube is made of steel and has the front steering arm clamped to it and the rear arm pinned.

STEERING ARMS.

These are forgings fitted at the bottom end with a ball which fits into a socket at the end of each drag link. This forms the conventional type of ball steering joint in which the socket is made up of two blocks spring backed and locked in place. Leather boots cover these grease-packed ball joints.

DRAG LINKS.

The two drag links have ball joints at each end, the joints on the left taking the ball of the tube or main steering arms. The joints on the right take the ball on the right steering knuckle arms.

TIE RODS.

The tie rod connects the steering knuckle arms of an axle, so that movement of both knuckles takes place simultaneously and at the same angle. The tie rod is yoked at either end, one of the yokes being adjustable by movement along the threaded portion of the tie rod. The yokes are attached by means of a pin to the steering knuckle arms. The adjustment may be necessary to take up play or to effect front wheel alignment.

STEERING KNUCKLE ARMS.

There are four steering knuckle arms forged of steel. Those on the right side of truck are provided with a ball stud, in addition to the hole for tie rod yoke attachment. These arms are not interchangeable.

TO ADJUST TIE ROD.

To make adjustment, loosen locknut for adjustable ball socket (on left side), remove socket plug on stationary (right side), and detach the drag link from the knuckle arm, then turn the rod in or out, as required, to make wheels track and replace all parts properly. Care must be taken not to set the ball socket adjusting plugs up too tight, as this will cause the truck to steer hard. The adjusting plugs are held in place by cotter pins, which fit into the slotted head of the plug.

TO REMOVE END PLAY IN POST.

If through wear and tear end play in the steering post has been caused, the same can be taken up by loosening the steering gearshaft locknut (No. 40, shown on page 126) and turn the steering gearshaft adjusting screw (41) up far enough to take out the play and then lock it again.

STEERING SYSTEM ADJUSTMENT.

The steering system is adjusted, after steering radius adjustments have been made and tie rods and drag links set to give the proper toe and alignment of wheels. First turn steering wheel as far as it will go to right and turning back about 1.25 turns, then attach main steering arm to splined end of trunnion shaft so that arm is in center between spring and drive shaft. This is done so that in turning the main steering arm will hit spring or drive shaft before split nuts are forced down and through housing.

The steering tie rod bolts should not be tightened too much, as yoke will be clamped to knuckle. This makes steering hard and causes unnecessary wear of parts.

STEERING PARTS WHICH WEAR MOST.

The parts of the steering system most subject to wear are the worm and trunnion blocks, steering arm bushings and knuckle pin.

REMOVING STEERING SHAFT PLAY.

End play on the steering shaft is taken up by means of an adjusting screw and locknut at the bottom of the split nut housing.

STEERING SYSTEM LUBRICATION.

The steering shaft assembly is lubricated by forcing medium weight cup grease through pipe plug into split nut housing about once a month; also by applying oil through oiler tube at top of steering post.

The trunnion shaft is lubricated by means of a grease cup on top of housing sleeve.

The top end of steering shaft is lubricated through oil hole. It is important to keep same well lubricated.

TO INSTALL NEW STEERING COLUMN.

In installing a new steering column, first disconnect air vent tube, gas and spark connections, remove plate fastened to floor boards, remove floor boards, disconnect trunnion shaft from pitman arm, unbolt from bracket, remove and replace, making necessary adjustments so that pitman arm will be proper distance from spring.

DIFFICULT STEERING.

The steering may be difficult because of wheel out of alignment, wheel bearings too tight or broken, steering knuckle arms badly bent, tie rod bent, drag link bent, dead head bent, hard-working gear at bottom of steering column, lack of lubrication, or depressions in knuckle pin roller bearing cup, due to lack of lubricant and improper adjustment.

STEERING SYSTEM FAILURE.

If steering wheel fails to steer truck, first see if splined end of trunnion shaft is O. K. Shearing is possible here if not kept tightly clamped to shaft, then examine drag links.

TIGHT STEERING SYSTEM.

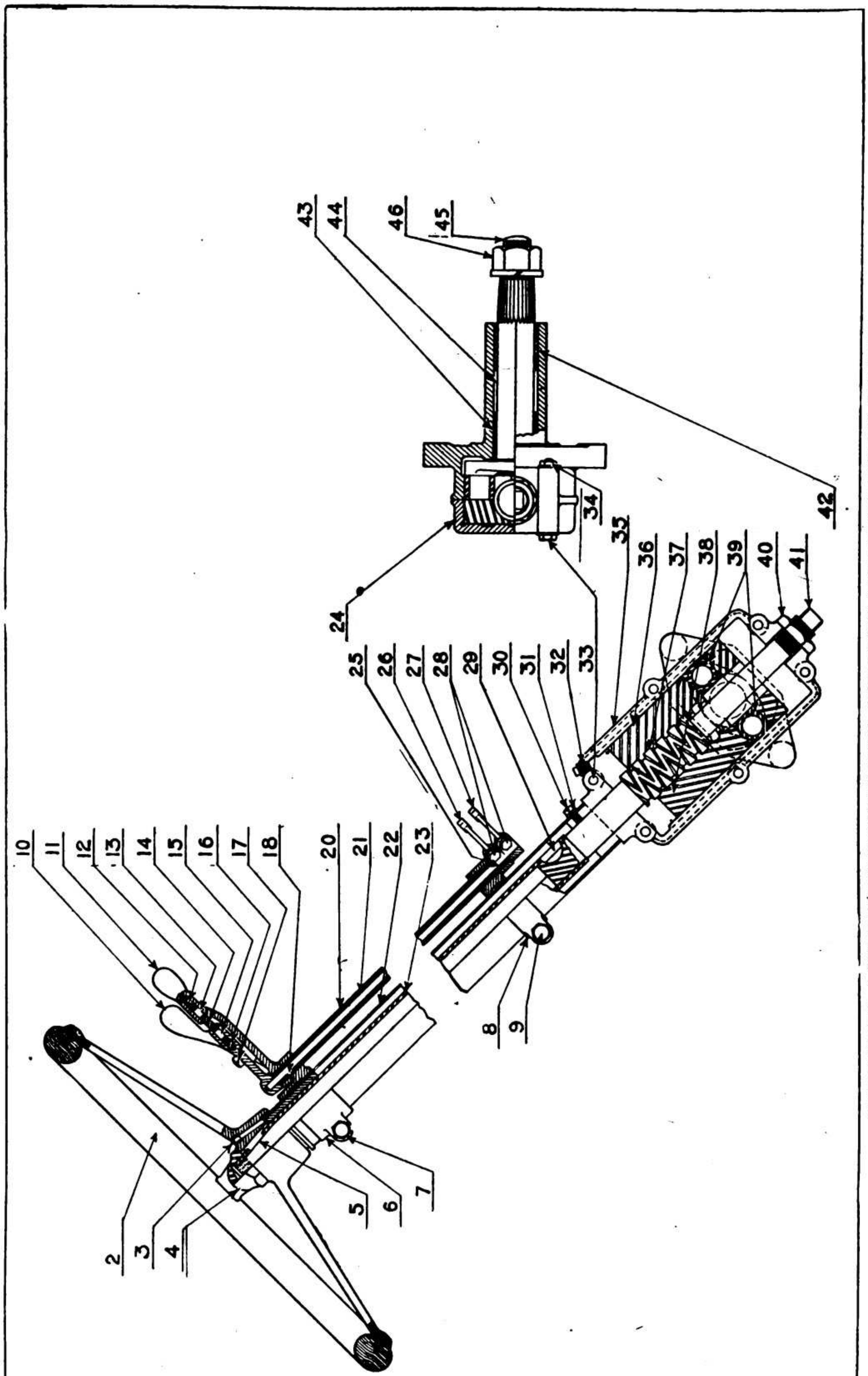
If truck steers hard, first check up adjustment of top of steering column, then look over steering knuckle pins, then to the rods and drag link to see if they are too tight.

It is dangerous to hit a curb with front or rear wheels, as it might cause damage to steering spindle or arms, bend tie rods or other steering connections.

ALTERING TURNING RADIUS.

If the 50-foot turning circle is not small enough, the set screw which limits the turn of wheels on each of the knuckle plates may be turned in, but in no case should they be turned so close that truck will turn in less than 48 feet. If truck is in such a position that in steering away from an object or edge of a road, the rear wheels may have a tendency to run too close to the object, the end of the drag link should be discon-

Plate No. 44



STEERING ASSEMBLY INCLUDING COLUMN AND TRUNNION SHAFT.

STEERING ASSEMBLY INCLUDING COLUMN AND TRUNNION SHAFT.

Ref. No.	Part No.	Name of Part.
2	36372	Steering wheel.
3	OI-122	Oiler.
4	33789	Wheel nut.
5	KE-222	Wheel key.
6	32770	Control rod bracket (upper).
7	SC-3404	Control rod bracket clamp screw.
8	33771	Control rod bracket (lower).
9	SC-3404	Control rod bracet clamp screw.
10	33779	Spark control lever (upper).
11	33784	Throttle control lever (upper).
12	33781	Throttle control lever plunger spring.
13	33780	Throttle control lever plunger.
14	33777	Sector.
15	33780	Spark control lever plunger.
16	33781	Spark control lever plunger spring.
17	SC-321	Sector screw.
18	36841-A	Spark control lever & rool assembly.
20	33785	Oil tube.
21	33782	Spark control rod.
22	33776	Outer tube.
23	33790	Worm & tube.
24	33775	Housing cover.
25		Throttle tube bushing (lower).
26	33783	Throttle control lever (lower).
27	33778	Spark control lever (lower).
28	SC-3302	Spark and throttle lever clamp screw.
29		Worm tube key.
30	SC-601	Outer tube to housing screw.
31	WA-144	Outer tube to housing screw lock washer.
32	PL-103	Housing cover grease plug.
33	SC-226	Housing cover bolt.
34	NU-118	Housing cover bolt nut.
35	33773	Housing.
36	33791	Worm nut (R. H.).
37	33790	Worm & tube.
38	33792	Worm nut (L. H.).
39	33787	Trunnion shaft blocks.
40	33769	Adjusting screw nut.
41	33768	Adjusting screw.
42-43	33774	Housing bushing.
44	33786	Trunnion shaft.
45	PI-413	Trunnion shaft nut—cotter.
46	NU-515	Trunnion shaft nut—castle.

nected and the set screws turned out to the point where they will bear on the stops on the axles, keeping rear wheels parallel with frame and using front steer only. Immediately on clearing the object the rear steer should be hooked up and proper adjustment of set screws made again.

STEERING WITH TWO WHEELS ONLY.

Should it become necessary at any time to steer either on the front or rear wheels only, it is possible to do so. By disconnecting the lower steering mechanism from the longitudinal steering tube, that steering unit which is to remain stationary may be easily locked by set screws.

CHAPTER IV

CLUTCH.

FUNCTION, CONSTRUCTION, OPERATION AND CARE.

The clutch is a device which serves to connect and disconnect the engine from the power transmitting mechanism. It clutches or presses against the flywheel when engaged and when disengaged (released) by means of a pedal, it is drawn away, allowing the engine to revolve freely, doing no work to drive the truck. The clutch is necessary in order to remove the driving force of the engine when gear changes are made. The clutch is located in the flywheel and is suitably housed by a cast iron case, which is bolted to the flywheel housing.

CONSTRUCTION (REFER TO ILLUSTRATION, PAGE 130).

The clutch is of the dry plate type and consists of a malleable iron driving disc engageable with two driven fiber rings, the disc being between the two rings.

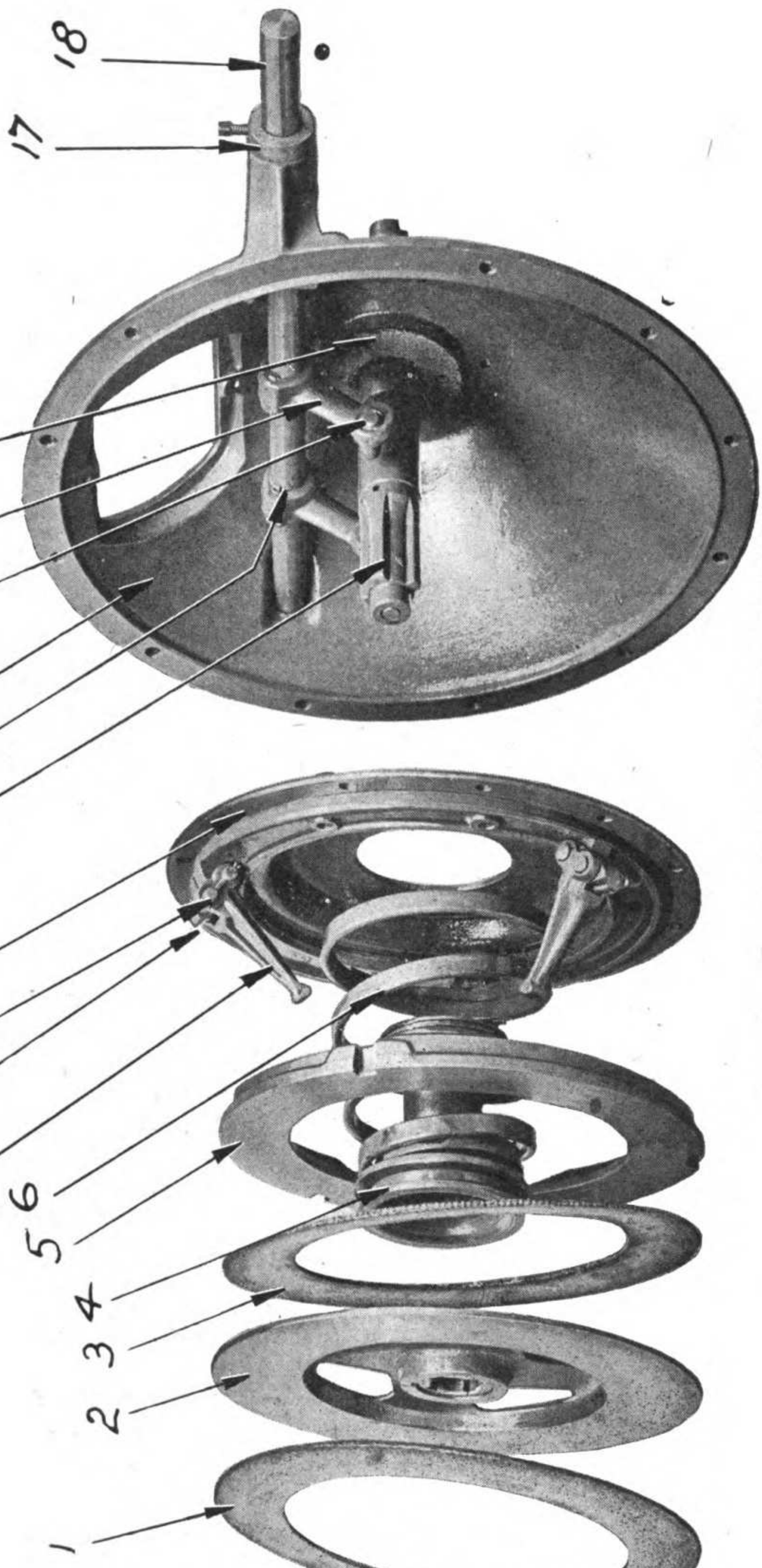
The iron disc or driving member is mounted on the spline end of the clutch shaft. When the clutch is engaged, all of it revolves as a unit, providing the engine is running.

The rear fiber ring is next to the clutch adjusting ring, which is connected by three levers to the clutch operating collar. Resting against this collar is a heavy conical spring, which supplies the pressure to keep the rings and the disc engaged. The rear end of the spring is supported by a heavy steel disc known as the clutch cover, which bolts to the rear rim of the flywheel.

Supported by the center of the shaft there is the clutch throw out sleeve, which has a ball bearing mounted on either end. The forward bearing presses against the clutch lever operating collar; the rear bearing against a ring secured on the threaded portion of the clutch throw out sleeve. This ring in turn connects with the clutch pedal, which operates the clutch. The back end of the ring further acts as a clutch brake, operating by revolving against a lining riveted to the inside face of the clutch housing hub. The brake prevents clutch spinning on disengagement.

CLUTCH DRIVE PLATE.

The drive plate is of malleable iron 11.875 inches outside diameter, .156 inch thick, and is bored 1.875 inch. It has two key seats which permit of it being keyed to a steel bushing called the drive plate center.



CLUTCH AND CLUTCH HOUSING ASSEMBLY.

Plate No. 45

CLUTCH AND CLUTCH HOUSING ASSEMBLY.

Ref. No.	Part No.	Name of Part.
1	33077	Clutch flywheel.
2	32999	Clutch drive plate.
3	33077	Clutch flywheel.
4	33078	Clutch lever operating collar.
5	32996	Clutch adjusting ring.
6	31305	Clutch spring.
7	33121	Clutch lever.
8	31647	Clutch lever thrust block.
9	31648	Clutch lever thrust block pin.
10	32998	Clutch cover.
11	32550	Clutch shaft.
12	KE-111	Clutch throwout shaft lever key.
13	32476	Clutch housing.
14	32470	Clutch throwout shaft lever pin.
15	32572-A	Clutch throwout shaft lever (right).
16	32471	Clutch brake lining.
17	34032	Clutch throwout shaft collar.
18	32579	Clutch throwout shaft.

The outside of this center is grooved to fit in the key seats notched in the drive plate. The inside of the drive center is key seated in four places to fit on the splined end of the clutch shaft.

CLUTCH SHAFT.

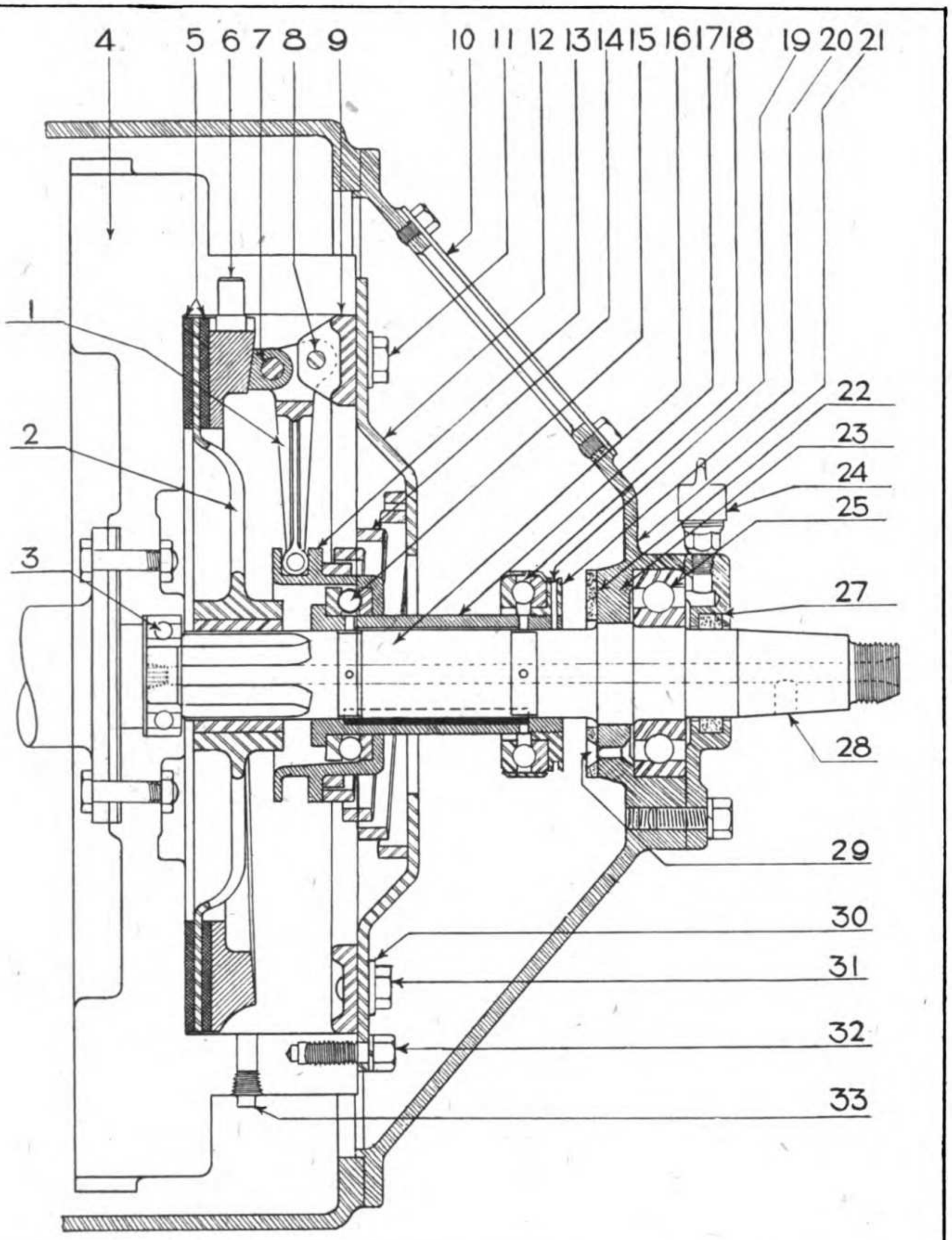
The shaft is of steel and is 12.375 inches long. The clutch shaft is the driving shaft of the clutch, connecting at its rear end through two universal joints with the transmission. Its front end is splined for a distance of 1.75 inch.

The entire center of the shaft is drilled out to a diameter of .312 inch for the distribution of grease. This grease, which lubricates the shaft, seeps through two holes, each .187 inch in diameter and 2.812 inches apart, drilled in the shaft 3.312 inches from its front end. It is on this end of the shaft that the drive plate is placed.

The front end is turned down to enter the bearing carried in the hub of the flywheel.

The rear end of the shaft is threaded and connected through a universal joint and propeller shaft with the transmission. The hole drilled through the entire center of the shaft is plugged at this end to prevent leakage of the grease. The end is also tapered for 1.875 inch, and the tapered portion is key seated .375 inch wide by .187 inch deep to receive the key holding the universal joint in place. A key .25 inch wide, 3.312 inches from the end of the shaft, keys the clutch throw-out sleeve to the shaft, preventing rotation of the sleeve on the shaft, but permitting free movement lengthwise.

Plate No. 46



SIDE SECTIONAL VIEW OF CLUTCH.

FIBER RINGS.

There are two fibre rings, one next to the flywheel, the other against the clutch adjusting ring. They are .11.875 inches outside diameter, 8.375 inches inside diameter, and .125 inch thick.

CLUTCH ADJUSTING RING.

One face of the clutch adjusting ring rests against the fiber ring; the other face, which constitutes three incline planes, rests against the three cast iron clutch lever thrust blocks.

SIDE SECTIONAL VIEW OF CLUTCH.

Ref. No.	Part No.	Name of Part.
1	33121	Lever.
2	32999	Drive plate.
3	31843	Clutch shaft and flywheel bearing.
4	34561-A	Flywheel.
5	33077	Facing.
6	33029	Flywheel and clutch pin.
7	31648	Clutch lever roller pin.
8	31648	Clutch lever pin.
9	32997	Clutch adjusting ring.
10	30370	Hand hole cover.
11	SC-237	Clutch lever supporting ring clamp screw.
12	32998	Clutch cover.
13	33078	Clutch lever operating collar.
14	31305	Clutch spring.
15	33079-A	Lever operating collar bearing.
16	32550	Clutch shaft.
17	33115	Clutch throwout sleeve.
18	33119	Throwout sleeve thrust bearing.
19	33117	Brake flange lock ring.
20	33116	Brake flange.
21	32476	Clutch housing.
22	32471	Clutch brake lining.
23	32476	Clutch housing.
24	CU-209	Rear bearing grease cup.
25	32261	Rear bearing.
27	WA-413	Clutch shaft felt washer.
28		Oil hole for clutch shaft and bearings.
29	R-1306	Clutch brake lining rivet.
30	31644	Lever support screw washer.
31	SC-237	Lever support screw.
32	SC-3402	Clutch cover screw.
33	PL-102	Clutch drain plug.

This ring, by pressing against the fiber ring, engages the clutch.

It is of cast iron, 11.875 inches outside diameter and 8.375 inches inside diameter.

The outside rim of the clutch adjusting ring is notched in three places, .500 inch by .3125 inch to receive keys, which hold it in place inside of the flywheel rim.

THRUST LEVER CLUTCH BLOCK.

The thrust lever clutch blocks, of which there are three, rest against the rear face of the clutch adjusting ring. The three clutch levers are attached to them by .375 inch pins. These levers are 3.75 inches long, and have two .375 inch holes drilled .75 inch apart to allow the attachment of the lever to the clutch lever thrust block, and to the clutch supporting ring. The bottom ends of the levers are rounded to fit in the groove cut in the lever operating collar. These levers serve to actuate the clutch lever thrust blocks in the clutch lever adjusting ring.

CLUTCH SUPPORTING RING.

The rear upper ends of the levers just mentioned are attached to the clutch supporting ring by means of lugs cast on the ring. The ring is

bolted to the clutch cover by .437 inch bolts. This ring is of malleable iron 11.984 inches outside diameter, 9 inches inside diameter, and .468 inch thick.

CLUTCH LEVER OPERATING COLLAR.

The lower or rounded end of the clutch levers slip into a groove in the clutch operating collar, which collar is supported by a ball bearing on the clutch throw out sleeve, and serves to operate the levers and so the clutch.

It is made of malleable iron, cup shape with a groove .468 inch wide cut around its entire circumference at its forward end. The collar is 4.25 inches in diameter at its grooved end and 3.06 inches bore.

CLUTCH SPRING.

The forward end of the clutch spring rests against the shoulder of the clutch operating collar, and its rear end is supported by the clutch cover. The pressure of the spring keeps the clutch in engagement.

The spring is conical in shape, 7.25 inches long when free, has an outside diameter at its rear end of 6.50 inches, and an inside diameter at its forward end of 3.625 inches.

CLUTCH COVER.

The clutch cover bolts to the flywheel and to the clutch supporting ring. It is made of steel .187 inch thick, an outside diameter of 13.375 inches, with its center bored out 4 inches.

Two slotted holes 10.5 inches from center to center are cut through the face of the clutch cover. They are .5 inch wide by 4 inches long. The bolts which attach the clutch supporting ring to the cover pass through these slots.

The means of adjusting the friction power of the clutch is provided by these bolts. By moving them in either direction the clutch supporting ring is rotated, which in turn moves the clutch levers and thrust blocks on the incline planes of the clutch adjusting ring, and so either relieves or increases, as the case may be, the pressure of the clutch spring.

CLUTCH THROW-OUT SLEEVE.

The clutch throw out sleeve is keyed to the center portion of the clutch shaft in such a manner as to allow longitudinal motion on the shaft. Its rear end is threaded to receive a nut, which holds in place a ball thrust bearing, against which the clutch throw out shaft lever bears.

When this lever is operated to throw out the clutch, it slides the sleeve backwards, compressing the clutch spring and so disengages the clutch.

The sleeve is 4.0625 inches long, is made of malleable iron, and has a 1.5 inch inside diameter.

HOW TO REMOVE CLUTCH.

First remove hand hole cover. It will then be necessary to loosen the clutch by disengaging and then "lock out" the spring by placing a space block between the cover and throwout bearing.

Next remove screws which hold clutch cover to flywheel.

It will then be necessary to disconnect the front universal of the propeller shaft. Then remove cap screws holding the clutch housing to the engine. When these are taken out the clutch throw-out sleeve can be removed by taking out the clamp bolts in the clutch throw-out yoke. The clutch can now be removed.

The clutch pilot bearing (the one nearest the engine) is not provided with any method of lubrication, except that it is packed with grease when installed. It only comes into use when clutch is disengaged.

The clutch shaft should be set in direct line with the crankshaft, the two shafts having space enough between to make it impossible for them to come in contact.

TO ADJUST CLUTCH.

To adjust clutch open plate in housing, disengage clutch, loosen two adjusting cap screws in slots, and turn adjusting plate clockwise to tighten, and counter clockwise to loosen, about a half inch at a time is usually sufficient; tighten adjusting cap screws and replace plate in housing. Further adjustment is obtained after slot adjustment is used up by moving cap screws to next holes. There are three in each slot.

TO CLEAN CLUTCH.

To clean clutch, squirt kerosene from oil gun through hand hole cover over plates with clutch disengaged. Turn engine over by hand and let clutch in and out to cleanse thoroughly. Drain through plug hole in flywheel drum and flush out with kerosene. Use kerosene rather than gasoline, as it does not cut lubricant on pilot bearing or injure surface of Raybestos plates.

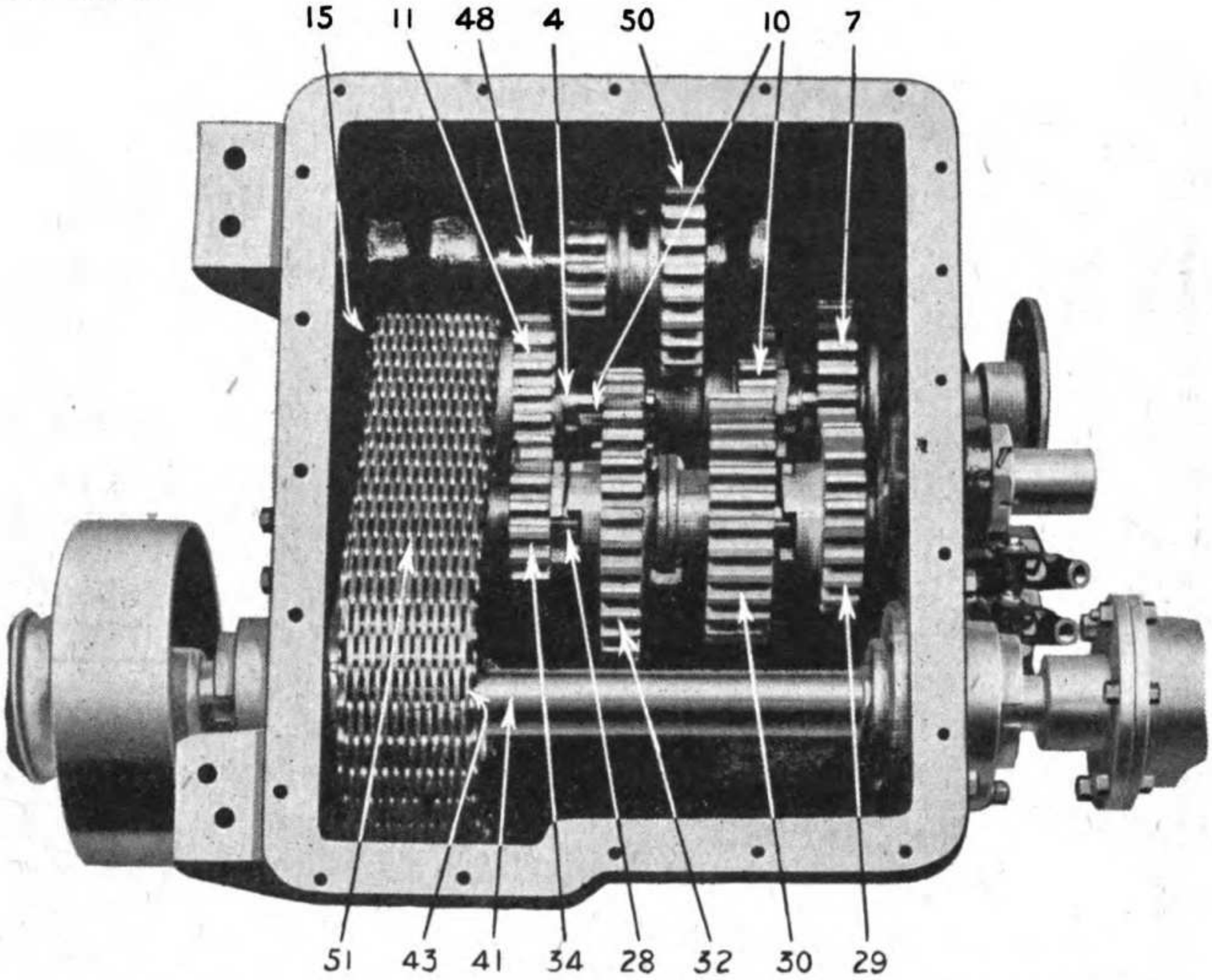
CLUTCH SLIPPING.

The clutch usually slips because of gum or oil on the friction surfaces, but slipping also may be caused by worn bearings, insufficient spring pressure, worn discs, clutch out of alignment with flywheel, improper adjustment.

CLUTCH GRABBING.

When the clutch grabs it takes hold suddenly, starting the truck with a jerk and putting unncessary strain on the power transmitting mechanism. The grabbing may be caused by too much spring pressure, facings dry and rough, end play in the crankshaft, out of alignment of clutch shaft, adjustment too tight, or engaging too suddenly.

Plate No. 47



TRANSMISSION WITH COVER REMOVED SHOWING CONSTRUCTION.

Ref. No.	Part No.	Name of Part.
4	35037	Splineshaft.
7	32221-A	Transmission third-speed drive gear.
10	32265	Transmission splineshaft sliding gear.
11		Transmission drive sprocket gear (included with 35040-A).
15	35040-A	Splineshaft drive sprocket.
28	32287	Transmission layshaft.
29	32289	Transmission layshaft third-speed gear.
30	32224-A	Transmission layshaft second-speed gear.
32	32223-A	Transmission layshaft first-speed gear.
34	32288	Transmission layshaft drive gear.
41	35315-A	Transmission countershaft.
43	32303	Countershaft drive sprocket.
48	36247	Reverse gear shaft.
50	32217-A	Reverse gear.
51	32226	Silent drive chain.