

AIR CLEANER (VORTOX)  
(Group 280093)

The air cleaner is connected to the carburetor by the bracket (5) and hose (10). Gasket (4) is placed between air cleaner head and the bracket. It is very important that this gasket (4) is in perfect condition at all times to prevent air leaks; this also applies to the hose connection (10). Air will always enter where it has the least resistance, and any air that enters at these two points will not pass through the air cleaner and will not be cleaned.

We cannot over-emphasize the importance of properly caring for the air cleaner. It is one of the important safeguards of the motor, and if given the proper attention will add many hours to its life.

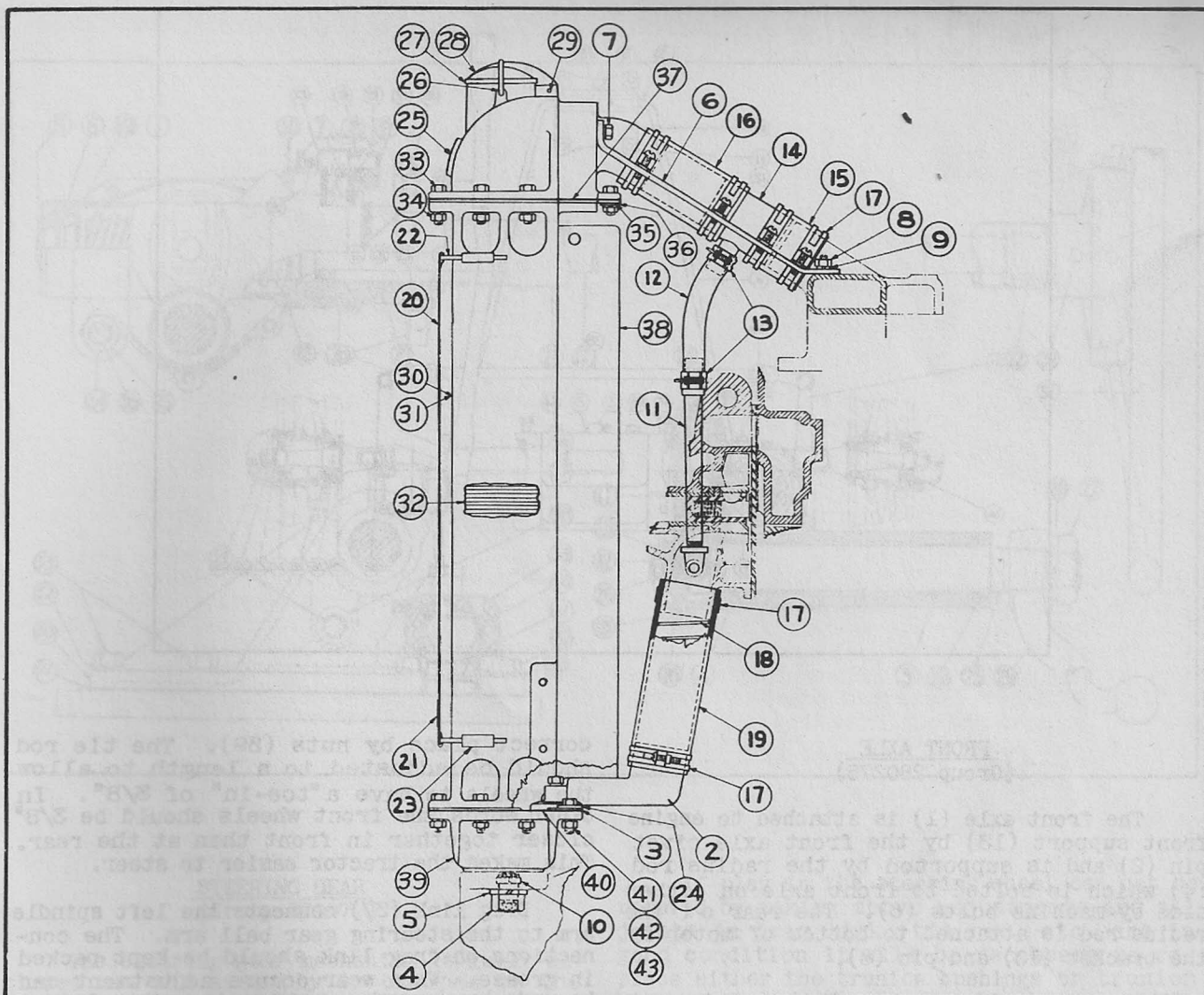
The oil level must be maintained to the level of the bead line stamped on the wall of

the oil cup. This oil must be light enough so that it can be picked up by the swirling air; also light enough so it can flow back into the cup from the filter element in the body of the cleaner. If the oil being used is too heavy to be picked up by the swirling motion of the air current, at the temperature in which the motor is being operated, add enough kerosene so it can be picked up freely.

Remove the air cleaner at least once a season and wash out thoroughly with gasoline.

AIR CLEANER (DONALDSON)

The care of this cleaner is the same as that for the Vortox and it became effective on units with the following serial numbers: U 13007; UC 2700; M 4303, M 4341 to M 4615 inclusive and M 4626 and after; 42 speed patrol 3226 T; U 40 power unit; 1251 U and 1393 U and after.



**RADIATOR**  
(Group 280250)

The radiator is of the tubular type and consists of six major parts, the top tank (25), bottom tank (39), side frames (30 & 31), core (32) and shroud (38).

By removing capscrews that hold the tanks, side frames, and core together, the radiator can be disassembled for the repair of any individual part. Always use new gaskets when reassembling.

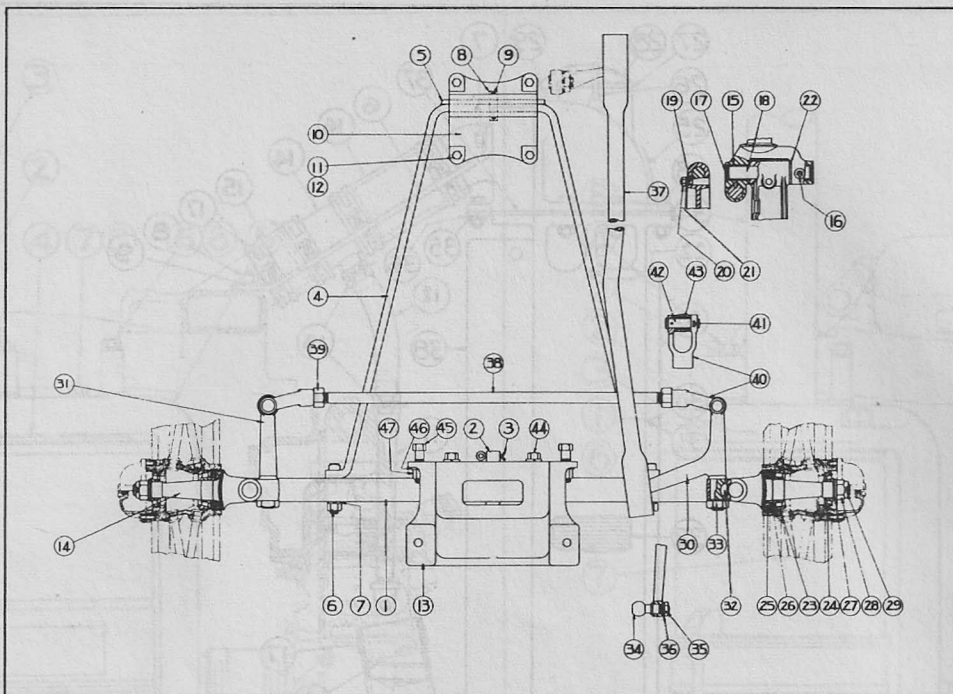
A drain cock (10) is located on the bottom of the radiator. This drains the radiator but does not completely drain the cylinder block. Drain the cylinder block as instructed under Cylinder Block and Oil Pan (Group 280523).

If dirt, weed seed, lint, or other foreign particles collect around the radiator tubes, between the cooling fins, it will restrict the amount of air passing through the core and cause the motor to overheat. This can be dislodged by the use of a steam jet, water pressure, or compressed air. Sometimes

it is necessary to loosen the accumulation with a small wire before it can be forced out. Be very careful that the tubes are not damaged with the wire.

If grease or oil has entered the cooling system in any way, it will collect particles from the water, such as dirt, rust, et cetera and adhere to the sides of the radiator tubes and cooling jacket of cylinder block. As this coating is a poor conductor of heat, the heat generated in the motor will not be readily absorbed by the cooling solution, neither will it be dissipated from the cooling solution to the air currents passing through the radiator core or around the motor. In event of this difficulty some solvent should be used that will dissolve or loosen this coating and then flush the cooling system thoroughly. There are several solvents on the market that are very good for this purpose, and they should be used as the manufacturers recommend.

The radiator hose should be maintained in good condition. Many times the inside of the hose will disintegrate and obstruct the flow of the cooling solution while the outside is undamaged.



**FRONT AXLE**  
(Group 280275)

The front axle (1) is attached to engine front support (13) by the front axle pivot pin (2) and is supported by the radius rod (4) which is bolted to front axle on either side by machine bolts (6). The rear of the radius rod is attached to bottom of motor by the bracket (10) and pin (8).

Front wheel spindles (14) are interchangeable and bushings (15) are installed in either end to make the bearings for spindle pins (18) which are held in place by taper lock studs (19). Expansion plugs are installed in both top and bottom of spindle to prevent dirt from entering the bearings. Thrust washers (22) are inserted between axle and bottom of spindle.

To remove spindle drive out lock stud (19) using care not to damage threads. Remove top expansion plug and drive pin (18) down. Bushings (15) can be driven out and new ones pressed in. Do not drive in. To do so will swell end of bushing. The bushing must be reamed to 1.002" so they can turn freely on pins after being installed in spindle. When installing pin (18) be sure the flat place on pin is in line with the hole for lock stud (19).

The spindle arms (30 & 31) are held to spindles by keys (32) and nuts (33). These nuts must be kept tight. Bushings (43) are installed in spindle arms and are replaceable. They should be reamed to .753". Tie rod yokes are connected with spindle arms by pins (42).

Tie rod yokes (40) are threaded and screw on tie rod (38). They are locked in

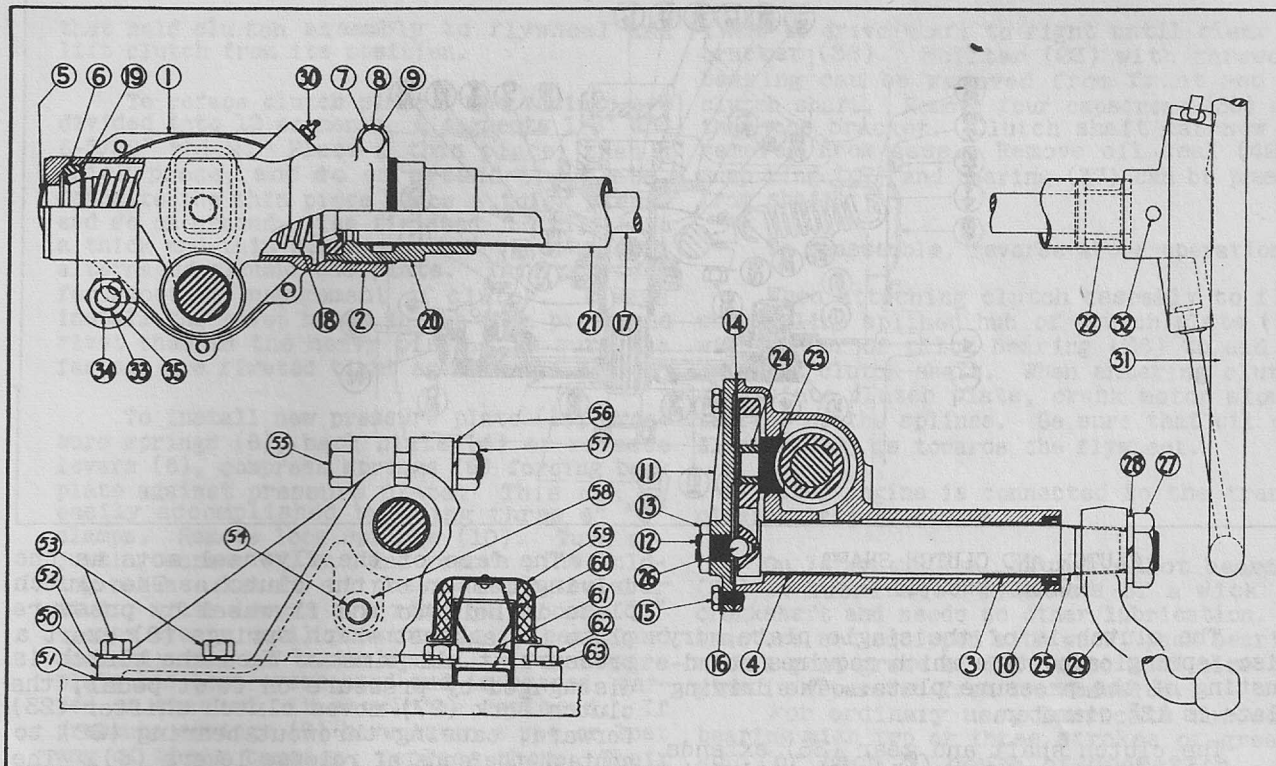
correct place by nuts (39). The tie rod should be adjusted to a length to allow the wheels to have a "toe-in" of 3/8". In other words the front wheels should be 3/8" closer together in front than at the rear. This makes the tractor easier to steer.

Drag link (37) connects the left spindle arm to the steering gear ball arm. The connections on drag link should be kept packed in grease. When wear occurs adjustment can be made by removing cotter in ends of drag link and tightening the screw plug.

The front wheels are carried on taper roller bearings (23 & 24) and are adjusted by loosening or tightening nut (28). Felt washers (25) fits over spindle and in hub of wheel on inside to prevent grease leaking out or dirt entering. Between felt (25) and bearing (23) is felt retainer washer (26).

When necessary to change cone and roller assembly, change the cup also, otherwise the new cone and roller assembly will wear rapidly. The old cups can be easily driven out by entering a punch from opposite end of hub and driving against the back of cup. Use a piece of brass when driving in new cups to prevent damage.

The proper care and lubrication of front wheel bearings cannot be over-emphasized. New felts should be installed for each 60 days of operation. Test bearings for end play after each two weeks of operation, and adjust them if play has developed. Lubricate daily when working under average conditions, and twice daily if in very dusty or sandy conditions, with grease gun until grease shows up at inside of hub. After adjusting be sure to install cotter pin to hold nut from backing off.



STEERING GEAR  
(Group 280077)

The steering gear mechanism is fully enclosed and the assembly is clamped to the transmission case cover.

The housing holds approximately one pound of grease and #120 gun grease should be used.

The worm shaft (17) is mounted on two taper roller bearings (19). If end play is noticeable in the shaft it can be adjusted by loosening lock nut (8) and tightening adjusting screw (20). Do not take up on adjusting screw enough to retard the free turning action of the gear.

The trunion shaft (25) is carried on bushings (3 & 4) which can be replaced if they become worn. Oil seal (10) prevents grease leakage at outer end. To adjust end play in trunion shaft loosen lock nut (13) and tighten adjusting screw (12). By this adjustment the face of trunion is forced against sliding block (23) which causes a closer mesh of threads between worm and sliding block.

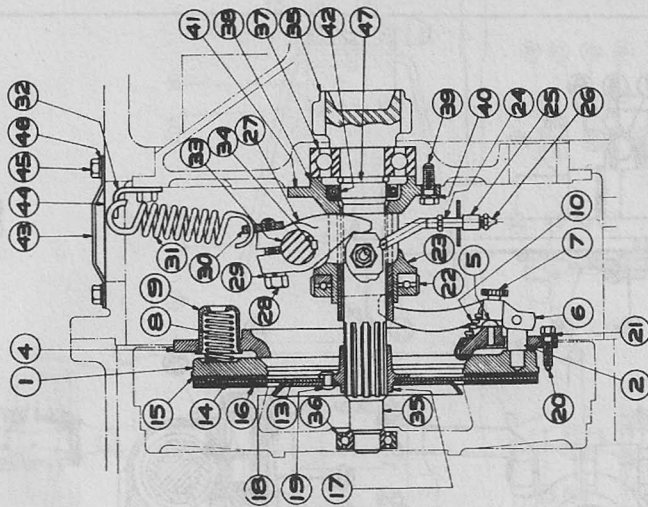
When making adjustments it is always best to have the front end of tractor jacked up and turn the steering wheel from one extreme to the other to be sure that the gear works smooth and free.

If play in the steering wheel can not be removed by making above adjustments and all joints in drag link, tie rod, etc. are in good condition it will be necessary to replace either the trunion bushings or trunion block or both. The trunion block can readily be replaced by removing housing cover (11) and have the wheels in the straight ahead position.

To remove trunion shaft, remove nut (27) and ball arm (29), housing cover (11) with adjusting screw assembly. When reinstalling ball arm (29) be sure steering wheel is in mid-position and front wheels straight. Otherwise tractor will not turn as short one way as the other.

To remove the worm shaft (17) loosen clamp screw nut (8) and back out adjusting screw (20). The entire column, shaft, worm and bearing assembly can now be removed. If necessary to change bearings, the bottom bearing can be driven off. To remove top bearing it is first necessary to remove steering wheel and column. There is a bushing (22) located in the upper end of column. This can be replaced if shaft is loose in top of column.

The worm (18) and shaft (17) are furnished as a unit. Due to the extreme care necessary in assembling these two parts it cannot be done in the field.



CLUTCH AND CLUTCH SHAFT  
(Group 280271)

The clutch is of the single plate, dry disc, springloaded type which requires no adjusting of the pressure plate. The driving plate is 12" diameter.

The clutch shaft and gear (35) extends from pilot bearing (36) in the flywheel into the front end of the transmission case and is carried at the rear end on ball bearing (37). This bearing is held in position on shaft by snap ring (47). Ahead of snap ring (47) is oil seal (42) to prevent transmission lubricant from leaking into clutch housing. Always install this type oil seal with the open side toward the oil supply. This assembly is held in position by clutch shifter bracket (38) and four cap screws (39). A recess is machined in the back of the shifter bracket that registers with a hole in transmission case head to allow the lubricant that works through bearing (37) to return to the transmission case. When installing, be sure these two openings register. The clutch shifter bracket extends forward over the clutch shaft and makes the bearing for clutch shifter (23). Throwout bearing (22) is pressed on the forward end of shifter (23) with the free rolling side to the front. The shifter and bearing are lubricated through grease fitting (26) and tube (24) and is reached through hole in left-hand side of case just below end of clutch fork shaft (33). The clutch fork (27) which bears against shifter (23) is attached to shaft (33) by cap screw (28) and Woodruff key (34). Spring (31) extends from spring clip (30) on cap screw (28) to spring bracket (32) at top of case and relieves the throwout bearing of the weight of clutch pedal.

The splined center (17) of clutch plate (13) works on splined end of clutch shaft. To the clutch plate is riveted the clutch facings (14 and 15). Three lever studs (2) are pinned to pressure plate (1). The back plate (4) carries the nine pressure springs and cups (8 and 9). The pressure plate and back plate assembly are held together by three release levers (6).

The face of the flywheel acts as the driving member of the clutch. The clutch plate is held to the flywheel by pressure plate (1) against which springs (8) exert a pressure at all times. When the clutch is disengaged by pressure on foot pedal, the clutch fork (27) moves clutch shifter (23) forward, causing throwout bearing (22) to contact the ends of release levers (6). The continued forward movement of the shifter forces the pressure plate back against the spring tension, releasing the pressure on clutch plate and allows the engine to run free.

**Clutch Adjustment.** The only adjustment necessary is to provide play for the clutch pedal. That is, when the clutch pedal is depressed there should be a little movement of the pedal before the clutch starts to disengage. This play is determined by the space between throwout bearing (22) and ends of release levers (6) when clutch is engaged, which should be 1/4". To make this adjustment, remove inspection cover (43) from top of clutch housing. See that throwout bearing is as far back as it will go, then move adjusting screws (7) in or out until the required clearance is obtained. Be sure that the clearance on all three levers is the same. As wear occurs, this clearance will become less and adjustment is necessary.

To reface the clutch plate or replace other parts of clutch assembly, it is necessary to separate the engine from the transmission. To remove the clutch, remove drag link from steering gear ball arm. Disconnect main fuel line at fuel filter, magneto ground wire from switch at dash and govern control rod from cross shaft at dash. Remove gas tank. Block up solidly beneath rear end of engine and front end of transmission. A chain hoist can be used to good advantage to swing rear end of motor instead of blocking it. Block between front support and front axle, both sides, to prevent motor tipping sideways. Remove all cap screws that hold engine block and transmission case together. Move engine forward far enough to clear end of clutch shaft. Remove nine cap screws (20)

that hold clutch assembly to flywheel and lift clutch from its position.

To reface clutch plate. The facings are divided into 12 segments, 6 segments  $1/8$ " and  $6-5/32$ " thick. Place a thin piece, then a thick piece, and so on around the plate. Opposite the thin piece place a thick piece, and so on around. The finished job will have a thick and thin piece riveted together and alternated around the plate. This provides for smoother engagement of clutch. Always install the rivet heads in the thin piece and rivet them in the heavy piece. Be sure the facings are riveted tight against the plate.

To install new pressure plate (1), pressure springs (8), back plate (4) or release levers (6), compress springs (8) forcing back plate against pressure plate. This can be easily accomplished by using three 4" "C" clamps. Remove lock springs (10). Turn adjusting screws (7) out and remove pins holding release levers to pressure plate lever stud. After levers are removed, loosen "C" clamps evenly until pressure is released and assembly can be taken apart. If pressure plate has been overheated and is scored, warped or cracked, it should be replaced. If pressure springs (8) have taken a set or lost any of their tension, replace them. Their condition can be determined by checking them against a new spring. Examine ends of release levers for excessive wear, also the rounded points of adjusting screws (7). If these parts are worn to a noticeable extent, a good adjustment cannot be maintained.

With engine separated from transmission, clutch shaft (35) may be removed by removing cap screw (15), clutch lever (14) and key from end of clutch fork shaft. (Refer to Group 280074). Remove spring (31) and cap screw (28). Drive clutch fork shaft to right, exercising caution not to swell or burr end of shaft or lose expansion plug from hole in right-hand side of case. Remove key (34) when free of clutch fork (27) and then con-

tinue to drive shaft to right until clear of bracket (38). Shifter (23) with throwout bearing can be removed from front end of clutch shaft. Remove four cap screws (39) and then the bracket. Clutch shaft can now be removed from case. Remove oil seal (42), snap ring (47) and bearing (37) can be pressed from shaft.

To reassemble, reverse above operations.

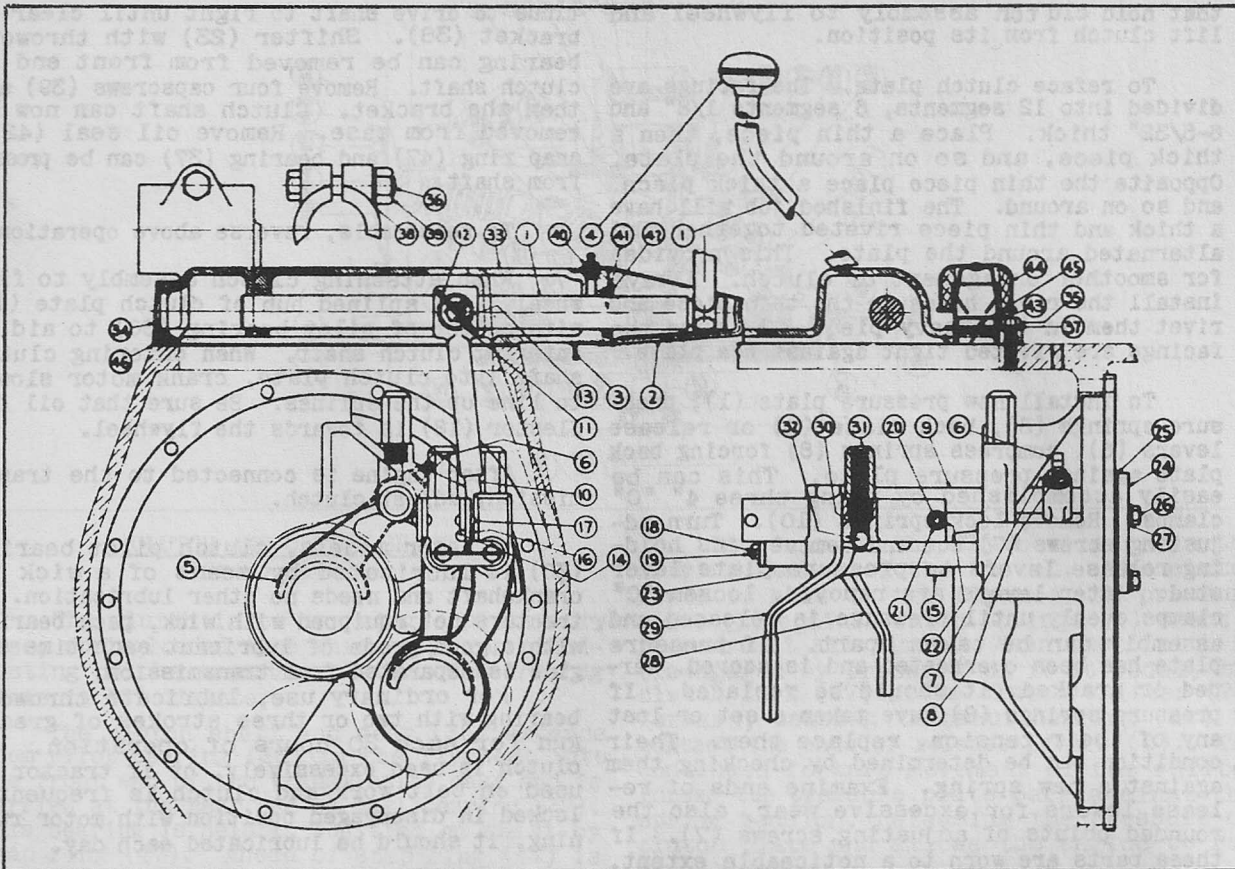
When attaching clutch assembly to flywheel, line splined hub of clutch plate (13) with center of pilot bearing (36) to aid in entering clutch shaft. When entering clutch shaft into clutch plate, crank motor slowly to line up the splines. Be sure that oil deflector (18) is towards the flywheel.

After engine is connected to the transmission, adjust clutch.

On later models, clutch pilot bearing (36) is lubricated by means of a wick in crankshaft and needs no other lubrication. On tractors not equipped with wick, pack bearing with a good grade of lubricant each time engine is separated from transmission.

For ordinary use, lubricate throwout bearing with two or three strokes of grease gun for each 30 hours of operation. If clutch is used excessively, or if tractor is used on belt work and clutch is frequently locked in disengaged position with motor running, it should be lubricated each day.

If clutch slips or becomes sluggish in action because of grease on clutch facings, remove inspection cover (43) and give facings a bath of gasoline. (An oil can may be used for injecting the gasoline). Do this with motor running and engage and disengage clutch several times while applying gasoline. This will have a scrubbing effect on facings and remove the grease. It is better to lock clutch in disengaged position for a few hours after the washing operation so it can thoroughly dry out.



**GEAR SHIFT**  
(Group 280406)

The gear shift hand lever shaft (1) is installed in the transmission case cover. Felt ring (42) held in position by retainer (41) prevents grease leakage from around shaft.

Gear shift lever (10) is attached to shaft (1) by set screw (11).

Gear shifter fork shafts (23) are held stationary in transmission case by set screws located in the front transmission head. Gear shifter forks (28 & 29) work on shifter shaft and are held in position by retainer (31), spring (30), and ball (32) which engages in grooves in shafts.

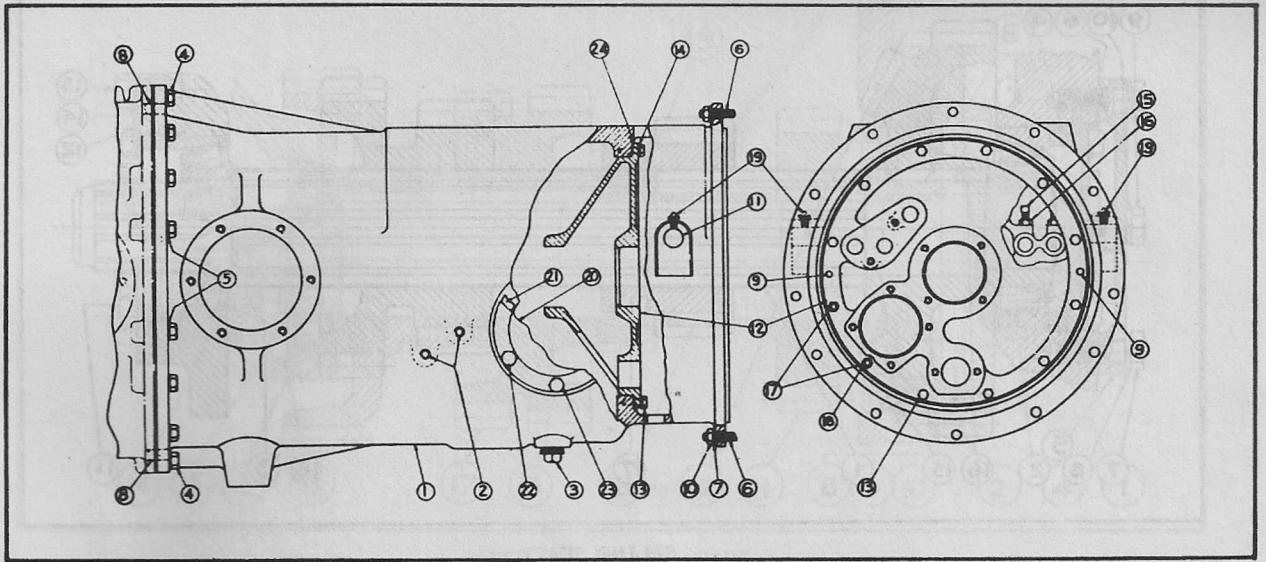
Fourth speed shifter fork (5) is held to

fourth speed shifter shaft (9) by set screw (6). When shifting into or out of fourth gear, both shaft and fork move and the ball retainer which is held in transmission head engages with a groove in shaft to hold it in correct position.

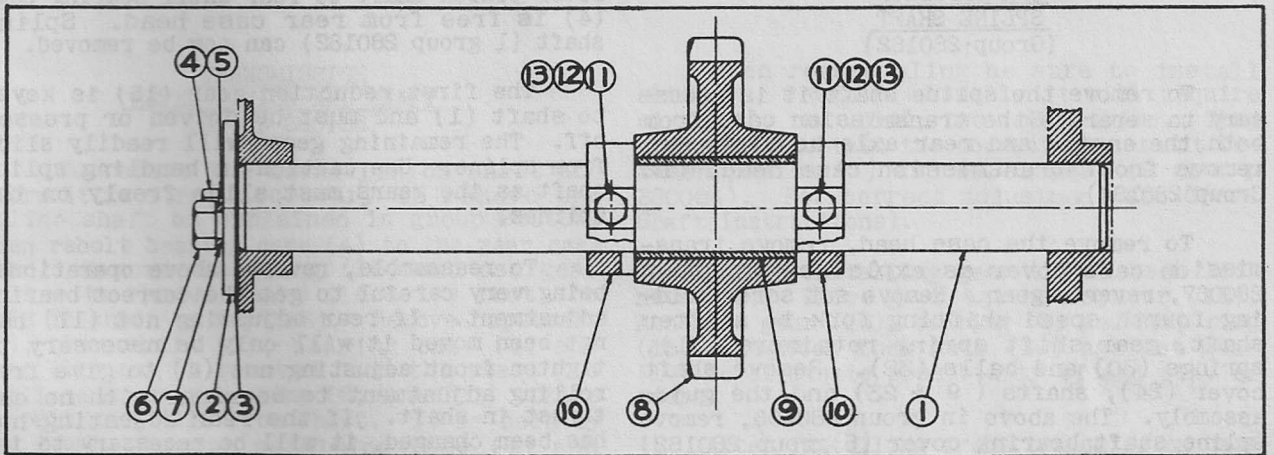
To remove gear shifter fork shafts see instructions for Transmission Spline Shaft Group 280182.

On steel wheel tractors, the fourth gear is locked out and it should not be unlocked unless rubber tires are installed.

To unlock fourth speed gear, remove transmission case cover. Loosen lock nut and back out set screw (6) about one-fourth of an inch, then turn shaft (9) one-half turn and tighten set screw (6). Be sure set screw enters hole in shaft.



**TRANSMISSION CASE**  
(GROUP 280184)



**REVERSE SHAFT**  
(GROUP 280067)

**TRANSMISSION  
REVERSE SHAFT**  
(Group 280067)

To remove any of the transmission gears other than the clutch shaft and pinion or reverse gear, the transmission case must be separated from engine and the rear axle housing. The transmission case head must also be removed.

Removal of clutch shaft and pinion is explained in instructions for clutch and clutch shaft, (Group 280271).

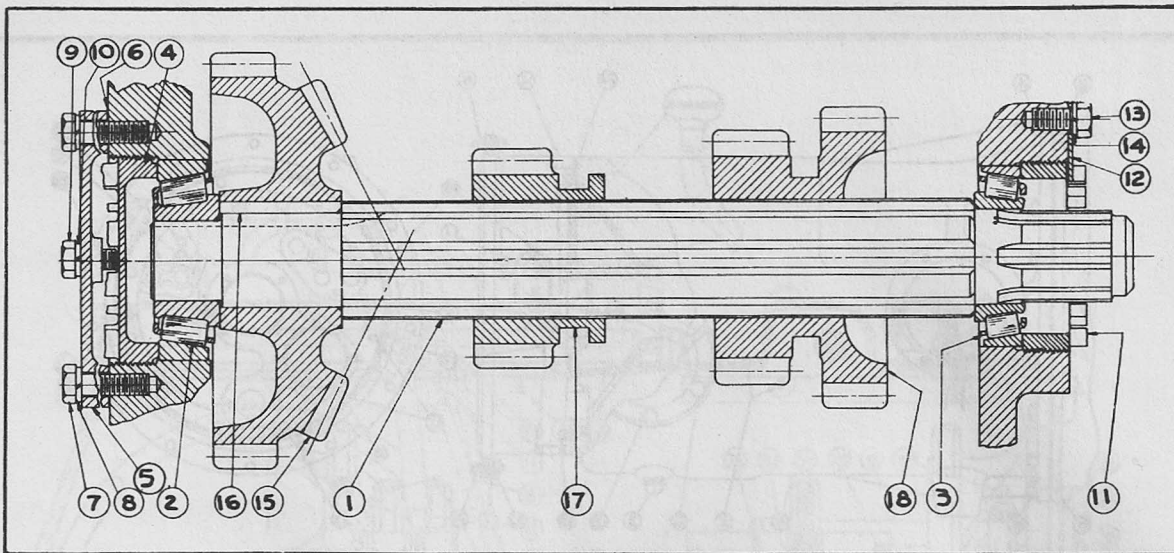
To remove reverse idler gear (8) (Group 280067), separate the engine from transmission. Disconnect governor control rod from cross shaft at dash, steering drag link from ball arm, steering column from wheel guard

front support. Remove foot pedal from clutch pedal, front floor plate, transmission case cover with steering gear and gear shifting mechanism and belt pulley or belt pulley opening cover. Remove cap screw (6), two cap screws (4) and shaft cover (2), Group 280067. Pry forward on gear (8) with a bar through belt pulley opening. When the shaft is started, remove bolts (11) and then pry shaft far enough forward to permit gear to be removed from end of shaft. The gear can then be lifted out of transmission case cover opening.

Bushing (9) is a press fit into gear and when replaced, must be reamed to fit shaft. The normal clearance is from .001" to .002".

When reinstalling this assembly, be sure gasket (3) is in good condition.





SPLINE SHAFT  
(Group 280182)

TRANSMISSION  
SPLINE SHAFT  
(Group 280182)

To remove the spline shaft it is necessary to separate the transmission case from both the engine and rear axle housing, and remove front transmission case head, (12 Group 280184).

To remove the case head, remove transmission case cover as explained in group 280067, reverse gear. Remove set screw holding fourth speed shifting fork to shifter shaft, gear shift spring retainers (31), springs (30) and balls (32). Remove shaft cover (24), shafts (9 & 23) and the guide assembly. The above in group 280406, remove spline shaft bearing cover (5 group 280182) and adjusting nut (4). Drive forward on spline shaft (1) until front bearing cup is driven from transmission head. Do not damage end of shaft while driving. Remove fourth speed coupling (14 group 280183). Drive reverse shaft to rear far enough to clear the case head. Remove all capscrews holding case head in case. Drive forward on case head with block of hard wood until it is free of dowel pins, then by tilting top forward it may be lifted from case.

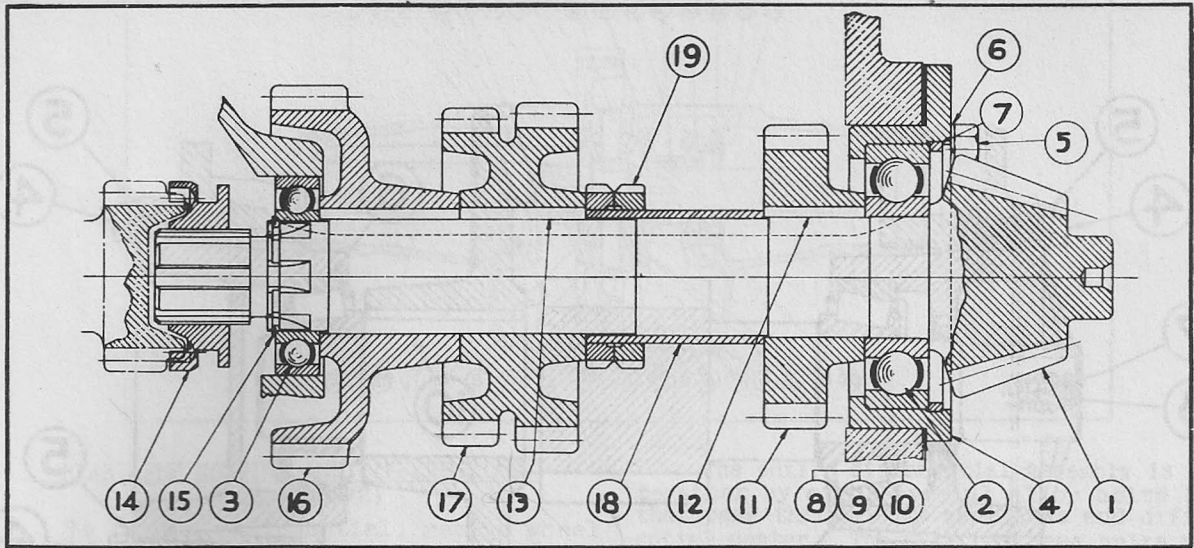
After removing the case head, remove the four capscrews (5 group 280183) and drive

bevel pinion shaft to rear until bearing cage (4) is free from rear case head. Spline shaft (1 group 280182) can now be removed.

The first reduction gear (15) is keyed to shaft (1) and must be driven or pressed off. The remaining gears will readily slide from spline. Use caution in handling spline shaft as the gears must slide freely on the splines.

To reassemble, reverse above operations, being very careful to get the correct bearing adjustment. If rear adjusting nut (11) has not been moved it will only be necessary to tighten front adjusting nut (4) to give free rolling adjustment to bearings with no end thrust in shaft. If the rear adjusting nut has been changed, it will be necessary to install the belt pulley to get correct mesh between the first reduction gear and the belt pulley gear. The inner ends of the teeth on the gears should be even and the spline shaft bearings adjusted to give .005" back lash between the gears. If necessary to loosen one of the adjusting nuts when making this adjustment tap the shaft on the opposite end to drive the bearing cup into position.

The splined end on the rear end of spline shaft is for the power take off connection. (Refer to power take off instructions.)



BEVEL PINION AND SHAFT  
(Group 280183)

TRANSMISSION  
BEVEL PINION AND SHAFT  
(Group 280183)

To remove the bevel pinion shaft and gears it is first necessary to remove the spline shaft as explained in group 280182, then rebolt bearing case (4) to the rear case head. Remove snap ring (15) and use gear puller to remove gears (16 & 17) that are held to shaft by key (13). Remove capscrews (5), then shaft (1), bearing case (4) and gear (11) can be removed from the rear. Do not lose or damage shims (8, 9 & 10). Drive or pull gear (11) from shaft. It is held by key (12). Remove retaining ring (7) and bearing case (4). Bearing (2) can be pressed from shaft.

When reassembling be sure to install shims (8, 9 & 10). Usually it will require six .005", two .014", two .031" shims. They are used to obtain the correct adjustment between pinion (1) and bevel gear (9 group 280064). For correct adjustment see Cross Shaft Instructions).

Before installing gear (17) loosen lock nuts (19). Drive gear against spacer (18). Assemble gear (16), bearing (3) and snap ring (15). Tighten lock nuts (19) against gear (17) to eliminate possibility of end play of gear.

After installing front transmission case head be sure fourth speed coupling (14) is in position..