

*Sears, Roebuck and Co.*

*Engine Department*

Chicago, Ill.

Thank you for your order for an engine. We will ship at once, as explained in the catalog.

The engine we are sending you has been carefully tested and will be all ready to run when it reaches you.

We are enclosing an instruction book, giving full information about the care and operation of the engine. Please read the first three pages carefully, follow the instructions, and you will obtain satisfactory results.

Be sure to keep this instruction book for future reference.

Yours truly,

SEARS, ROEBUCK AND CO.

Enc.  
L4830

# **Instruction Book and List of Parts**

## **Model E Gasoline Engines**

**Give Number and Horse-Power of  
Engine When Ordering Parts.**

Do not return any parts of your engine to us unless we ask you to do so. Write us first, giving number of part you want, and we will mail part at once. By doing this you will obtain quicker service.



## To Get the Engine Ready to Run

Remove the plugs from the oil holes in the main and connecting rod bearings, clean them out thoroughly, also all other oil holes. Fill the grease cups with the sample grease we furnish and screw the top of the cups down until the grease starts to come out of the bottom. Then put the cups in place on the engine and turn the top down two full turns, which forces the grease into the bearing. Turn the flywheels around two or three times to work the grease into the bearings.

**Oil all moving parts,** looking engine over carefully to be sure you have found all the oil holes. Turn flywheels until end of piston is out of the cylinder as far as it will come and put oil on the end of the piston to be sure it is properly lubricated before starting. Also oil the connecting rod bearing inside of the piston. Do this every time you start the engine. Oil the valve stems, and put a few drops on the igniter parts and work these parts by hand to be sure they are free from paint.

Fill water hopper with clean water and the tank in the base with gasoline. Always strain the gasoline through a chamois skin to prevent dirt or water getting into the tank. Don't begrudge the time it takes to do this, because it may prevent considerable trouble.

Screw the lubricator into the pipe on top of the water reservoir, fill it with oil from sample can we furnish with the engine. Raise the lever on the top of the lubricator straight up and adjust it so the oil will drop. To increase the flow of oil turn the adjusting collar, just under the lever, to the right; to decrease the flow turn it to the left. For quantity of oil to use see below.

### INSTRUCTIONS FOR OILING ENGINE.

When using engine we recommend that the lubricator be set so as to feed the following quantities of oil:

Horse-Power	On Full Load	On Light Load
1½ and 2½	20 drops per minute	10 drops per minute
5 and 7	40 drops per minute	20 drops per minute
9 and 12	60 drops per minute	30 drops per minute

### NEVER USE STEAM ENGINE OIL ON A GASOLINE ENGINE.

Use the best grade of gas engine oil and grease, like the samples we furnish. If a dark oil is used, there is carbon in it that will collect on the inside of the cylinder and on the igniter points and cause trouble.

### CAPACITY OF GASOLINE TANKS.

The gasoline tank is located in the base and is filled through the filler pipe on the side of the engine base. The 1½ horse-power tank holds 1½ gallons; 2½ horse-power, 1¼ gallons; 5 horse-power, 2¾ gallons; 7 horse-power, 5½ gallons; 9 horse-power, 7¾ gallons; 12 horse-power, 11¾ gallons.

## TO START 1½, 2½ AND 5 HORSE-POWER ENGINES.

**First.** Open the needle valve on mixer two full turns to the left, close the air damper (see Figure 2), turn on the oil by raising the lever on the lubricator and be sure the oil is dropping properly.

**Second.** Place the timing lever "J" (Figure 7) in the starting position. This retards the spark and prevents the engine from kicking back when you start it.

**Third.** Turn the flywheels to the right until the detent blade (Figure 4, page 8) on the governor can be pushed in behind the catch block on the cam rod and hold it there.

**Fourth.** Place the starting crank on the shaft that extends through the flywheel on the governor side and turn the wheels around to the right rapidly five or six times; release the detent blade, but continue to turn the flywheels until the engine starts.

**Fifth.** As soon as engine starts open the air damper, change the timing lever "J" (Figure 7) to the running position and close the fuel valve slowly until the point is reached where the engine runs with the least number of explosions and without black smoke appearing at the exhaust or a popping sound at the mixer, the latter being caused by an insufficient supply of fuel, and smoke at the exhaust by too much fuel.

In cold weather it may be necessary to leave the air damper closed for a short time until the engine gets warmed up.

### TO STOP THE ENGINE.

Shut off the gasoline by closing the needle valve on the mixer. Turn the small lever on top of the lubricator down, which shuts off the oil, and drain the water out of the cylinder in cold weather.

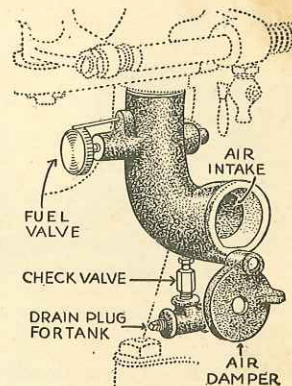


Figure 2.

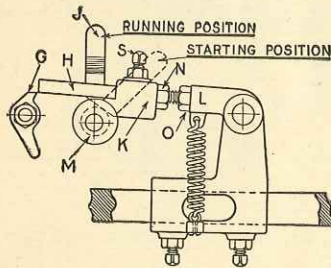


Figure 7.



## TO START 5, 7, 9 AND 12 HORSE-POWER ENGINES.

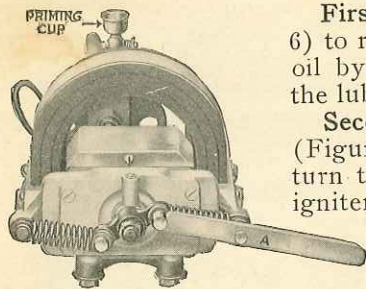


Figure 6.

**First.** Open the priming cup (Figure 6) to relieve compression and turn on the oil by raising the small lever on top of the lubricator.

**Second.** Place the timing lever "J" (Figure 7) in the starting position and turn the flywheels to the right until the igniter trips, then stop.

**Third.** Prime the cylinder by putting about 2 teaspoonfuls of gasoline into the cylinder through the priming cup. Then close the cup.

**Fourth.** Open needle valve on the mixer two full turns to the left, close the air damper and then turn the flywheels to the right one-half turn, or until the crank is on the outer dead center, as shown in Figure 11.

**Fifth.** Use tripping lever "A" (Figure 6), which you will find on the magneto, and cock the springs as shown.

**Sixth.** Take hold of a spoke in the flywheel at the top with your right hand and put your right foot on a spoke at side nearest the magneto, pull with your right hand and push with your foot, giving the flywheels a quick turn back toward the cylinder, at the same time pushing down on the tripping lever "A" with your left hand, and the engine should start.

A little practice may be needed to do this just right, but in a short time you will find you can start the engine on the first trial.

**Seventh.** As soon as engine starts open the air damper on the mixer, shift the timing lever "J" to the running position and close the fuel valve slowly until the point is reached where the engine runs with the least number of explosions, as explained on page 3.

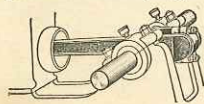


Figure 11.

## TO STOP THE ENGINE.

Shut off the gasoline by closing the needle valve on the mixer. Turn the small lever on top of the lubricator down, which shuts off the oil, and drain the water out of the cylinder in cold weather.

## THE WATER IN THE HOPPER SHOULD BOIL.

The hotter the water gets the better the engine runs because the gasoline vaporizes more readily and the engine will use less gasoline. The cylinder is cooled by the water circulating around it and the heat passes off in the form of steam, so if the water boils you need not be alarmed. Keep the cylinder properly lubricated and the reservoir full of water and there will be no danger of your engine overheating. **IN COLD WEATHER DRAIN THE RESERVOIR AT NIGHT TO PREVENT FREEZING.**

## TO START IN COLD WEATHER.

All gasoline engines are harder to start during cold weather than in warm weather, because gasoline does not vaporize as readily in cold weather. You can overcome any difficulty from this cause in starting by pouring a couple of gallons of warm water in the water reservoir; this warms up the cylinder, causing the gasoline to vaporize more readily. (Be careful if engine is real cold not to use water too hot, as the sudden change may crack the cylinder.) It is also advisable to open the fuel valve farther than you generally do, and be sure to close the air damper when starting and leave it closed for a few minutes until the engine gets warmed up. A teaspoonful of gasoline in the cylinder through the priming cup, if the engine has one, will help. Work the intake valve in and out before starting, as this will remove any frost that may have collected on the valve stem and allow valve to work easily.

## HOW TO ADJUST THE FUEL VALVE.

The mixing valve (Figure 2) is of the suction feed type, gasoline being drawn from the tank in the base by the suction of the piston. The air and gasoline are mixed in this valve to form the explosive gas.

When you start the engine, open the fuel valve two full turns to the left, close the air damper and turn the flywheels to the right; this draws a supply of gasoline from the tank and primes the valve. After the engine is running open the air damper and close the fuel valve slowly until the point is reached where the engine runs with the least number of explosions and without black smoke appearing at the exhaust, or a popping sound at the mixer, the latter being caused by an insufficient supply of fuel, and smoke at the exhaust by too much fuel.

If it is ever necessary to take the mixing valve and feed pipe off the engine, be very careful not to lose the valve out of the check valve, because if this valve is not in place your engine will not get any gasoline. To drain gasoline from tank remove drain plug. (See Figure 2.)

## OUT OF GASOLINE.

If your engine is running all right with the fuel valve set at the right point, and it starts to misfire, runs irregularly and explodes through the air inlet or gasps for breath, the supply of gasoline is low and the tank should be refilled.

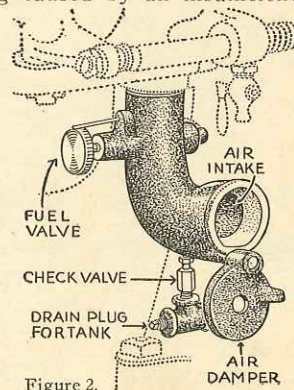


Figure 2.



## WHAT MAKES THE ENGINE RUN.

The power of a gasoline engine is furnished by an explosion of gas inside the cylinder. This gas is made by gasoline and air being drawn in through the mixing valve by the suction of the piston. To ignite this gas an electric spark is furnished by the magneto.

To get the most power from the engine the explosion should take place when the piston reaches the end of the compression stroke, or is in the cylinder as far as it will go, so the piston will be pushed out of the cylinder with the full force of the explosion. To get this condition, it is necessary that the electric spark take place at just the right time.

### TO SEE THAT SPARK TAKES PLACE AT PROPER TIME.

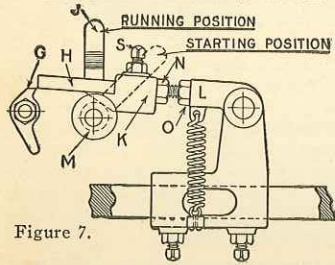


Figure 7.

**First.** Adjust the screw "E" (Figure 9) until it just touches the push finger "G." Tighten locknut "P."

**Second.** Turn flywheels to the right until the piston starts back into the cylinder on the compression stroke, then continue to turn them slowly until the word **Spark** on the rim of the flywheel is opposite the top of the cam rod (Figure 13). This is the point at which the spark should be made.

**Third.** Place the tripping lever "A" (Figure 6, page 3) on the magneto and cock the springs as shown. Be sure the timing lever "J" (Figure 7) is in the running position.

**Fourth.** See that the screws which fasten the clamp to the push rod are tight and that the screw nearest the cylinder head is in the hole in the bottom of the cam rod. Then adjust the length of push rod "H" (Figure 7) until the end of the rod touches the push finger "G." and tighten locknut "O."

**Fifth.** Loosen set screw "S," move wedge "K" on the push rod toward the magneto until the lower edge of the end of the rod "H" is just even with the upper edge of the magneto push finger "G" as shown, tighten set screw "S," then the locknut "N."

**Sixth.** Be sure the magneto wire is fastened to the terminal (Figure 12, page 7). Turn the flywheels to the right to see if the magneto trips off when the word **Spark** on the flywheel is opposite the top of the cam rod (Figure 13). If not, adjust the wedge "K" (Figure 7) carefully until it does.

To make engine fire earlier, move wedge "K" toward magneto. To fire later, move wedge "K" away from magneto.

**IMPORTANT.** The adjusting screw "E" as shown in Figure 9 should always be set so you can slip a piece of paper between the screw and the push finger "G" when the spring arm "C" is in a horizontal position.

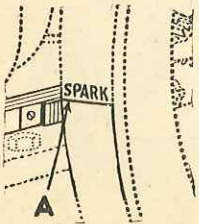


Figure 13.

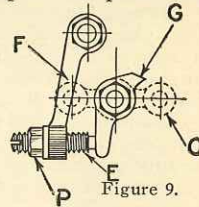


Figure 9.

## THE WEBSTER MAGNETO.

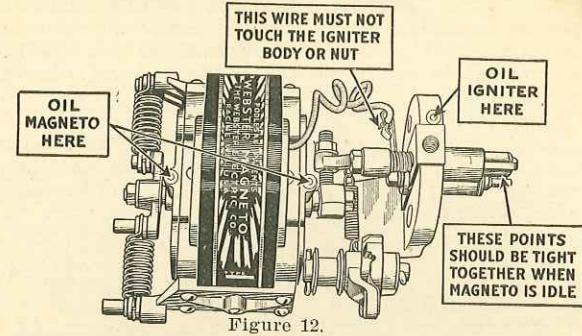


Figure 12.

### HOW TO TEST THE MAGNETO TO SEE IF IT IS FURNISHING A SPARK.

Remove the magneto and the igniter plug, as shown above, from engine, without taking the magneto off the bracket.

See that the igniter points are together. If the points are apart, adjust them by loosening locknut "P" and turning adjusting screw "E" (Figure 9, page 6) until the igniter points are together. This is very important as the magneto will not give a spark if these points are separated. They must be tight together. Oil the magneto and take hold of spring arm and rock it back and forth until it works freely.

Trip the magneto with tripping lever the same as when starting the engine. If no spark occurs at igniter points it may be that the insulation on the stationary electrode is broken and should be replaced. (See list of repairs, page 16, 47E353 and 47E359.)

### CARE OF MAGNETO.

The two main bearings of the magneto have wick oilers fed from reservoirs that should be filled with sewing machine or cream separator oil once every two weeks. To fill oilers just press down on oiler cap, which is held in place by a spring. Oil trip roller frequently and the four spring roller pins whenever you use the engine.

Use very light oil on the magneto and igniter, and if electrode should stick clean it with kerosene. Igniter points may be cleaned without removing the igniter by sliding the movable electrode back and forth from the outside.

Never remove the magnets from the magneto, as they will immediately lose much of their strength; and do not take the magneto apart, as there is nothing inside that can get out of order. We do not guarantee the magneto if you take it apart. If you think there is anything wrong, write us.



## IF YOU CANNOT START ENGINE, READ THE FOLLOWING:

A gasoline engine is very easy to handle if you understand just how it works. If you should have a little trouble at first, don't blame the engine, but remember it is new to you and that it will take you a week or so to learn just how to handle it. Study this book and your engine carefully and it will be only a short time until you will know how to take care of the engine as well as the experts at our factory.

Just before we shipped your engine it was gone over carefully and run to be sure that all parts were in proper adjustment and in perfect condition, so that when the engine reached you there would be no trouble in your running it provided you did not change any of the parts from the way they were set when the engine reached you.

To be sure that you have done everything necessary to start the engine, please check over the points as follows:

**First.** Be sure the tank is full of gasoline.

**Second.** See if the gasoline flows to the mixing valve. Dirt sometimes gets into the gasoline pipe and collects on the fuel valve or under the check valve. To clean the fuel valve, take it out and wipe off the point. To clean the check valve, loosen the nuts just above the valve with a wrench, remove the valve and clean with gasoline.

If you find the mixing valve or check valve is dirty, drain the tank by removing the plug and strain the gasoline through a chamois skin, which will keep out the dirt and water.

**Third.** Be sure the magneto wire is properly attached, in good condition and that it does not touch any part of the engine except the binding post.

**Fourth.** Refer to page 7 and test the magneto to be sure it is sparking properly and at the right time (page 6).

**Fifth.** See if the igniter snaps at the right time and that all parts of the igniter or magneto work freely.

**Sixth.** If you have changed any adjustment on the engine or have had any part of the engine off, read the information we give about that part in this book to be sure the part is in proper adjustment.

**Seventh.** If, after following the above instructions and going over the adjustment of each part according to the instructions in this book, you still cannot get the engine to run, write us a letter, tell us just what you have done, just how the engine acts, and we will tell you by return mail just what to do.

Keep the engine clean and well oiled, keep the bearings tight and see that all bolts and nuts are tight. If you go over the engine with the care that any piece of machinery should have, you will have no cause to complain and will get satisfactory service.

Don't call in an engine expert under any circumstances unless you know him well and have the utmost confidence in his ability, as the so called gasoline engine expert usually does not know as much about the engine as you do and he may do the engine more harm than good. A neighbor who has a gasoline engine can usually help you out quicker than any expert. If not, go to your nearest garage, or write us and we will advise you by return mail.

## THE GOVERNOR.

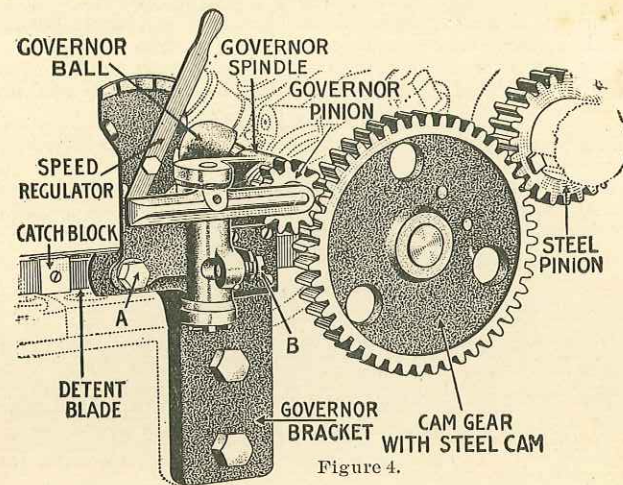


Figure 4.

The governor controls the speed of the engine and is of the hit and miss fly ball type. When the engine runs above its regular speed the balls on the governor widen their circuit, which presses in on the pin going through the governor spindle. This forces the detent blade in so that it catches behind the block on the cam rod and holds the exhaust valve open, at the same time stopping the spark and cutting off the supply of gasoline, until the speed of the engine is reduced to where it should be, then the detent blade flies out again, releasing the cam rod and the engine takes up its regular operations.

Always keep the speed lever set in the notch to the right, as this runs the engine at its regular speed, where it will give its full power. If you reduce the speed of the engine you also reduce the power it will develop. Never slow the engine down on a heavy load if you want less speed. (See rules for determining the size of pulleys on page 11.) If you set the speed lever in the center notch it gives a reduction in speed of from 50 to 60 R. P. M. and the notch to the left a reduction of from 100 to 125 R. P. M.

### HOW TO ADJUST THE DETENT BLADE.

When the exhaust valve is wide open and the detent blade is pushed in behind the catch block on the cam rod, there should be only the thickness of a postal card between them. When adjusting the detent blade, leave the speed lever in position, as shown at top of this page; the detent blade should stand about  $\frac{3}{4}$  inch away from the catch block.

To adjust the detent blade loosen the locknut "A," and screw the adjusting screw "B," either in or out, until you have the blade where it should be, then tighten the locknut.



## TO TAKE OFF THE GOVERNOR BALLS, SPINDLE OR PINION.

If you find it necessary to take the governor apart, first take off the governor pinion. To do this hold the flywheels stationary, which locks the gears, then take a wrench, stand on the governor side of the engine and turn the governor balls to the right, as the pinion is put on with a right hand thread. The governor spindle screws into the governor pinion.

### THE DETENT CATCH BLOCK.

The catch block on the cam rod is made of tool steel and should last a long time. If the block should wear on one side so it does not hold the detent blade properly, file off the point of screw where it is riveted on side of rod next to the engine, remove the screw with a screwdriver and turn the catch block around, using the other side. After both sides of the block are worn, buy a new one. (See 47E054 in list of repairs, page 14.)

### THE CAM ROD SPRING.

The cam rod spring holds the cam rod and roller against the cam on the cam gear. As this spring does a lot of work it may wear out; if it does, buy a new one. (See 47E059 in list of repairs, page 14.) To put on a new spring remove the cylinder head, slip the spring over the end of the cam rod and replace the cylinder head. If necessary to repack cylinder head see page 20.

## HOW TO TAKE OFF A FLYWHEEL OR PULLEY.

To take off the flywheel loosen the bolt and drive an iron or wooden wedge into the slot, one on each side of the hub. This will loosen the flywheel so it can be removed. To take off the pulley on the 1/2 horse-power engine loosen the set screw with a screwdriver and drive the pulley off.

On the larger engines all you have to do is loosen the nuts, take out the bolts or cap screws and the pulley will come off.

If you have to drive the flywheel or pulley off the shaft, use a piece of hardwood against the hub of the wheel and do not drive too hard. A number of light blows will loosen the flywheel without danger of breaking.

## TO REMOVE GASOLINE TANK.

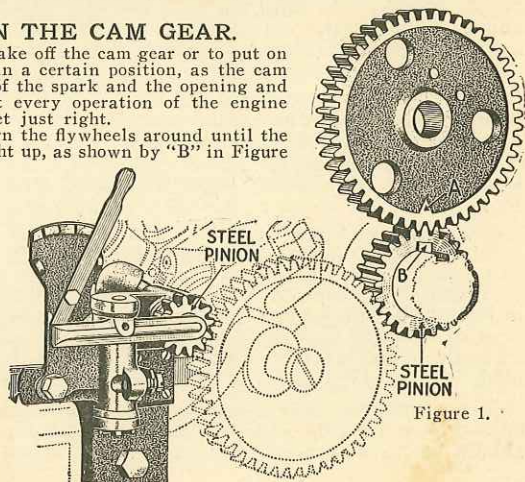
Take off the fuel pipe which connects the tank to the mixing valve, tip the engine over on one side, remove the rods which hold tank in the base and the tank will come out.

## HOW TO PUT ON THE CAM GEAR.

If it is ever necessary to take off the cam gear or to put on a new one it must be put on in a certain position, as the cam on the gear controls the time of the spark and the opening and closing of the valves, in fact every operation of the engine depends on this cam being set just right.

To put on the cam gear turn the flywheels around until the key in the crankshaft is straight up, as shown by "B" in Figure 1; then set the two teeth that are just under the indicator "A" on the cam gear over the one tooth that is just above the key "B"; then roll the cam gear around to the right until it reaches the position as shown by dotted gear, being sure to keep the gear teeth together. Then slip the cam gear pin in place and fasten it with the lock washer and nut.

Be very careful in putting on this gear to see that it is just right. One tooth out of the way makes quite a little difference in the way your engine will run.



## BE SURE YOU ARE USING THE RIGHT PULLEYS ON ENGINE AND MACHINES IT IS DRIVING.

The machines you run with an engine, to give you satisfactory service, must be equipped with the proper size of pulley to correspond with the pulley on the engine.

To be sure that the pulleys you are using are of the right size to give the best results, take the speed of the engine multiplied by the size of the pulley on the engine and divide the result by the speed of the machine that you want to run. The result will give you the size of the pulley you should have on the machine.

**For example:** We will say the speed of the engine is 425 revolutions per minute, the diameter of the pulley on the engine is 12 inches and you want to run a feed grinder 510 revolutions per minute.

$$425 \times 12 = 5100 \div 510 = 10 \text{ inches.}$$

The result, 10 inches, is the size of the pulley you should have on the grinder to run it 510 revolutions per minute.

If there is a pulley on the machine you want to run, to find out what size of pulley to use on the engine, take the speed of the machine multiplied by the diameter of the pulley on the machine and divide by the speed of the engine you are going to use, which will give the size of pulley you should have on the engine to give the best results.

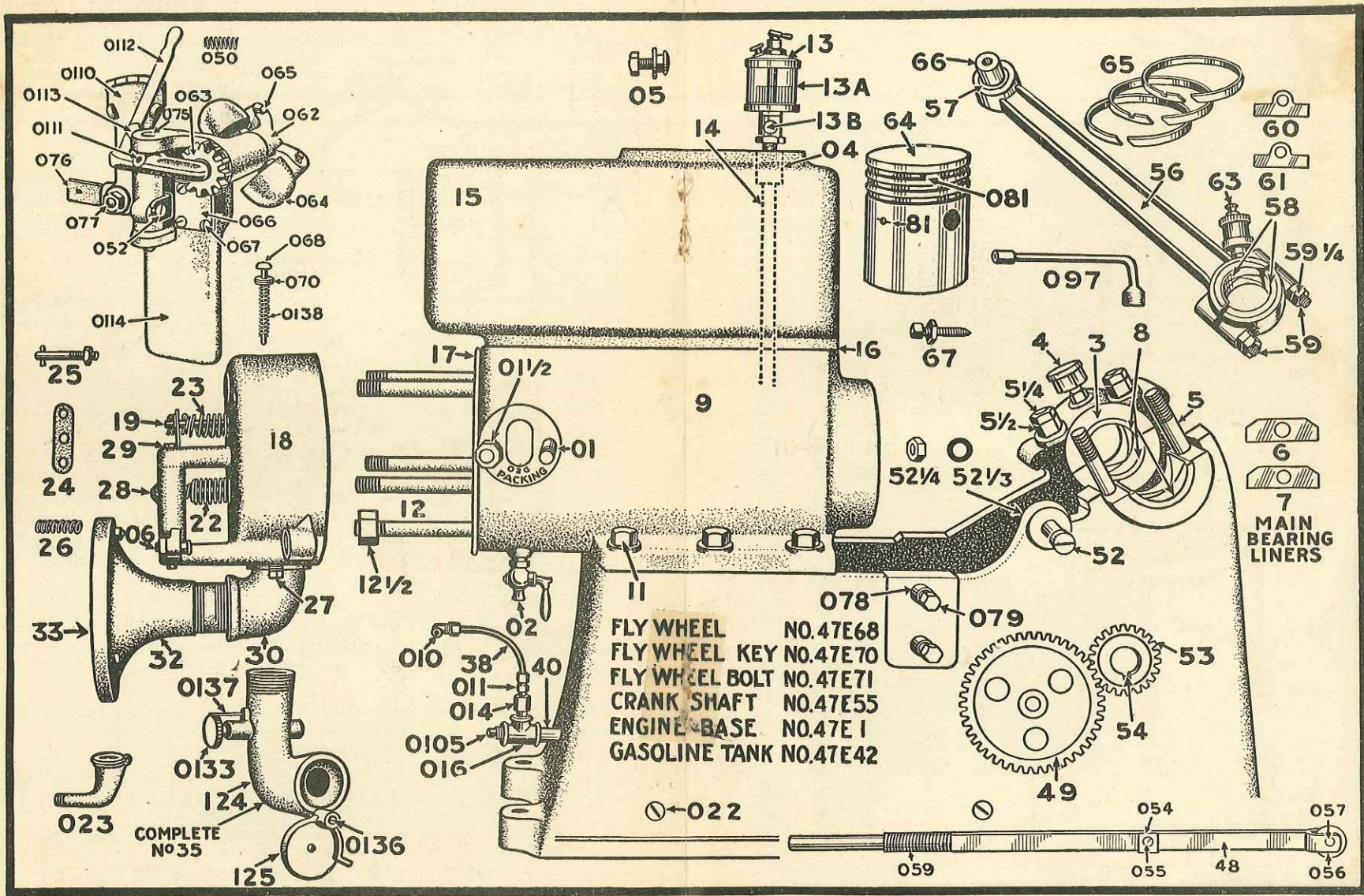
**For example:** Suppose you had a feed grinder that you wanted to run at 425 revolutions per minute. The diameter of the pulley is 12 inches and your engine runs 425 revolutions per minute.

$$425 \times 12 = 5100 \div 425 = 12 \text{ inches.}$$

The result, 12 inches, is the size of the pulley you should have on the engine to run the grinder at 425 revolutions per minute.

If you are not sure as to just what size pulley to get, write and tell us what you want to do and we will tell you just what you need.







Be Sure When Ordering to Give the Number of Your Engine.

Part No.	Description	Horse-Power					
		1½	2½	5	7	9	12
47E01	*Igniter Stud.....	\$0.15	\$0.15	\$ 0.15	\$ 0.15	\$ 0.15	\$ 0.15
47E01½	*Igniter Stud Nut.....	.10	.10	.10	.10	.10	.10
47E02	*Drain Cock.....	.50	.50	.50	.50	.50	.50
47E03	*Priming Cup.....	..	..	.50	.50	.50	.50
47E04	*Oilier Pipe Coupling.....	..	.15	.15	.15	.15	.15
47E05	*Water Reservoir Bolt.....	..	.15	.15	.15	.15	.15
47E06	*Valve Lever Adjusting Screw.....	.15	.15	.15	.15	.15	.15
47E010	*Angle Connection.....	.25	.25	.25	.25	.25	.25
47E011	*Straight Connection.....	..	.30	.30	.30	.30	.30
47E013	*Pipe Union and Coupling.....	..	.30	.30	.30	.30	.30
47E014	*Straight Valve Cage.....	.35	.35	.35	.35	.35	.35
47E015	*Check Valve.....	.15	.15	.15	.15	.15	.15
47E016	*Pipe Tee.....	.20	.20	.20	.20	.20	.20
47E022	*Tank Rod.....	.20	.20	.20	.20	.20	.20
47E023	*Filler Pipe.....	.30	.30	.30	.35	.35	.35
47E026	*Igniter Gasket.....	.15	.15	.15	.15	.15	.15
47E052	xDetent Blade Adjusting Screw.....	.15	.15	.15	.15	.15	.15
47E052K	Trip Blade Adjusting Screw.....	.15	.15	.15	.15	.15	.15
47E053	*Igniter Trip Blade Locknut.....	.10	.10	.10	.10	.10	.10
47E054	*Detent Catch Block.....	.25	.25	.25	.25	.25	.25
47E055	*Catch Block Screw.....	.05	.05	.05	.05	.05	.05
47E056	*Cam Roller.....	.25	.25	.25	.25	.25	.25
47E057	*Cam Roller Pin.....	.15	.15	.15	.15	.15	.15
47E058	*Cam Roller Pin Dowel.....	..	.10	.10	.10	.10	.10
47E059	*Cam Rod Spring.....	.10	.10	.10	.10	.10	.10
47E060	*Governor, complete.....	4.00	5.00	5.00	5.00	5.00	5.00
47E062	*Governor Spindle.....	.75	.75	.75	.75	.75	.75
47E063	*Governor Pinion.....	.50	.50	.50	.50	.50	.50
47E064	*Governor Ball.....	.25	.25	.25	.25	.25	.25
47E065	*Governor Weight Pin With Cotter Pin.....	.10	.10	.10	.10	.10	.10
47E066	*Governor Bracket Plate.....	..	.15	.15	.15	.15	.15
47E067	*Bracket Plate Screw.....	..	.06	.06	.06	.06	.06
47E068	*Governor Spindle Rod.....	.35	.35	.35	.35	.35	.35
47E070	*Speed Changing Washer.....	..	.05	.05	.05	.05	.05
47E075	*Detent Lever Pin.....	.10	.10	.10	.10	.10	.10
47E076	*Detent Blade.....	.15	.15	.15	.15	.15	.15
47E077	*Detent Locknut, complete.....	.15	.15	.15	.15	.15	.15
47E078	*Governor Bracket Dowels.....	.10	.10	.10	.10	.10	.10
47E079	*Cap Screws.....	.08	.08	.08	.08	.08	.08
47E081	*Piston Ring Pin.....	.06	.06	.06	.06	.06	.06
47E097	*Igniter Wrench.....	.35	.35	.35	.35	.35	.35
47E098	*Oil Can.....	.35	.35	.35	.35	.35	.35
47E0105	*¼-Inch Drain Plug.....	.10	.10	.10	.10	.10	.10
47E0110	*Speed Change Body.....	.35	.35	.35	.35	.35	.35
47E0111	*Detent Lever.....	.25	.25	.25	.25	.25	.25
47E0112	*Speed Change Lever.....	.10	.10	.10	.10	.10	.10
47E0113	*Speed Lever Screw.....	.05	.05	.05	.05	.05	.05
47E0114	*Governor Bracket.....	.75	1.00	1.00	1.00	1.00	1.00
47E0133	*Fuel Valve.....	.25	.25	.25	.25	.25	.25
47E0136	*Damper Screw.....	.05	.05	.05	.05	.05	.05
47E0137	*Fuel Valve Spring.....	.10	.10	.10	.10	.10	.10
47E0138	*Governor Spindle Spring.....	.10	.10	.10	.10	.10	.10
47E0142	*Detent Spring.....	.10	.10	.10	.10	.10	.10
47E1	xBase (Stationary).....	9.00	9.00	15.00	25.00	50.00	75.00
47E3	*Base Cap.....	.75	.95	1.25	1.50	1.75	2.00
47E4	*Main Bearing Grease Cup.....	.35	.40	.45	.50	.65	.65
47E5	*Base Cap Stud.....	.20	.25	.25	.35	.35	.35
47E5¼	*Main Bearing Locknut.....	.10	.10	.10	.10	.10	.10
47E5½	*Main Bearing Stud Nut.....	.10	.10	.10	.10	.10	.10
47E6	*Bearing Liners, thick, per set.....	.20	.20	.20	.20	.20	.20
47E7	*Bearing Liners, thin, per set.....	..	.20	.20	.20	.20	.20

NOTE—All items marked (\*) will be shipped by parcel post, postage paid. All items marked (x) will be shipped by express or freight collect.

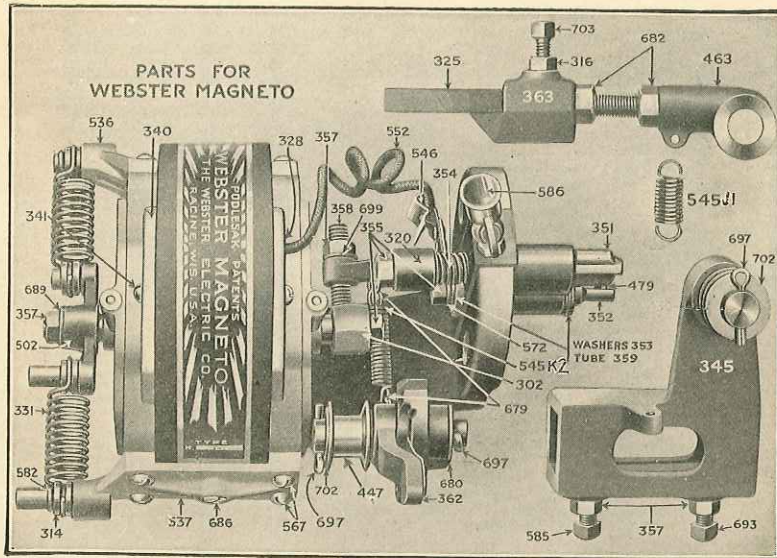
Be Sure When Ordering to Give the Number of Your Engine.

Part No.	Description	Horse-Power					
		1½	2½	5	7	9	12
47E8	*Main Bearings (2 halves).....	\$1.00	\$1.25	\$ 1.75	\$ 3.25	\$ 3.75	\$ 4.50
47E9	xCylinder.....	6.00	8.25	11.25	16.50	23.00	23.00
47E11	*Cylinder Cap Screw.....	..	.15	.15	.15	.15	.15
47E12	*Cylinder Head Stud.....	.25	.30	.30	.35	.45	.45
47E12½	*Cylinder Head Stud Nut.....	.10	.10	.15	.15	.15	.15
47E13	*Sight Feed Oilier, complete.....	1.00	1.25	1.25	1.50	1.75	1.75
47E13A	*Large Glass for Oilier.....	.35	.40	.40	.45	.50	.55
47E13B	*Small Glass for Oilier.....	.25	.25	.25	.25	.25	.25
47E14	*Oilier Pipe.....	..	.25	.25	.35	.35	.35
47E15	xWater Reservoir.....	2.25	3.35	4.50	6.00	8.00	8.00
47E16	*Water Reservoir Gasket.....	..	.85	.90	1.00	1.35	1.65
47E17	*Cylinder Head Gasket.....	.50	.50	.75	.75	1.25	1.50
47E18A	xCylinder Head Complete With Valves, Springs, Etc.....	3.75	5.00	6.50	8.00	10.00	12.50
47E18	xCylinder Head Only.....	1.75	2.50	3.75	4.50	6.25	7.35
47E19	*Exhaust or Inlet Valve.....	.35	.45	.50	.60	.65	.75
47E22	*Exhaust Valve Spring.....	.15	.15	.15	.15	.15	.15
47E23	*Inlet Valve Spring.....	.15	.15	.15	.15	.15	.15
47E24	*Valve Lock Lever.....	..	.15	.15	.15	.15	.15
47E25	*Valve Lock Stud.....	..	.15	.15	.15	.15	.15
47E26	*Valve Lock Spring.....	..	.10	.10	.10	.10	.10
47E27	*Pipe Plug.....	..	.06	.06	.06	.06	.06
47E28	*Valve Lever.....	.40	.45	.50	.55	.60	.75
47E29	*Valve Lever Pin.....	.15	.15	.15	.15	.20	.20
47E30	*Street Elbow.....	.25	.25	.30	.40	.70	1.00
47E32	*Muffler Body With Nipple.....	.80	1.20	1.45	1.65	2.00	2.90
47E33	*Muffler Cap Only.....	.55	.80	.95	1.20	1.45	1.60
47E33A	*Muffler Complete With Nipple and Cap.....	1.35	2.00	2.40	2.85	3.45	4.50
47E35	*Gasoline Mixing Valve Complete.....	1.95	2.10	2.60	2.85	3.40	3.75
47E38	*Supply Pipe and Connectors.....	.50	.50	.50	.50	.50	.50
47E40	*Strainer Nipple.....	.45	.45	.45	.45	.45	.45
47E42	*Gasoline Tank.....	1.60	1.95	2.45	2.60	3.10	3.50
47E48	*Cam Rod.....	.95	1.05	1.20	1.30	1.45	1.85
47E49	*Cam Gear.....	1.10	1.20	1.50	1.75	2.25	2.50
47E52	*Cam Gear Stud.....	.20	.35	.40	.45	.50	.65
47E52¼	*Cam Gear Stud Nut.....	.10	.10	.10	.15	.15	.15
47E52½	*Cam Gear Lock Washer.....	.06	.06	.06	.06	.06	.06
47E53	*Crankshaft Pinion.....	.75	2.00	2.50	2.75	3.25	3.75
47E54	*Crankshaft Pinion Key.....	.10	.15	.15	.15	.15	.15
47E55	xCrankshaft.....	4.00	5.50	7.75	9.75	12.75	18.00
47E56	*Connecting Rod.....	2.00	3.50	x4.00	x5.25	x6.50	x8.25
47E57	*Connecting Rod Bushing.....	.30	.35	.40	.45	.50	.60
47E58	*Connecting Rod Bearing (2 halves).....	.85	.95	1.25	1.75	2.25	3.00
47E59	*Connecting Rod Bolt With Cotter Pin.....	.35	.35	.50	.55	.60	.60
47E59¼	*Connecting Rod Nut.....	.10	.10	.10	.10	.10	.10
47E60	*Connecting Rod Liners, thick, per set.....	.20	.20	.20	.20	.20	.20
47E61	*Connecting Rod Liners, thin, per set.....	..	.20	.20	.20	.20	.20
47E63	*Connecting Rod Grease Cup.....	.35	.40	.45	.50	.55	.60
47E64	*Piston.....	*1.45	*1.90	*2.40	x3.00	x3.75	x4.75
47E65	*Piston Ring.....	.35	.40	.45	.50	.55	.75
47E66	*Piston Pin.....	.45	.50	.55	.65	.95	1.35
47E67	*Piston Pin Set Screw With Locknut.....	.10	.10	.15	.15	.20	.20
47E68	xFlywheel (each).....	3.50	6.75	13.50	18.75	30.00	38.00
47E70	*Flywheel Key.....	.10	.10	.15	.15	.15	.25
47E71	*Flywheel Bolt.....	.25	.25	.30	.30	.30	.30
47E79	*Machine Bolt for Pulley.....	..	.10	.15	.15	.20	.20
47E80	*Pulley Stud With Nut.....	..	.15	.15	.15	.15	.20
47E80	*Pulley Set Screw on ½ H-P.....	.15	..	..	..	..	..
47E81	*Piston Oil Tube.....	.35	.35	.35	.35	.35	.35
47E124	*Mixing Valve Body.....	.75	.75	.75	1.00	1.00	1.00
47E125	*Mixing Valve Damper.....	.15	.15	.15	.20	.20	.20

NOTE—All items marked (\*) will be shipped by parcel post, postage paid. All items marked (x) will be shipped by express or freight collect.



Be sure to give TYPE and NUMBER of magneto when ordering repair parts; also SIZE and NUMBER of engine.

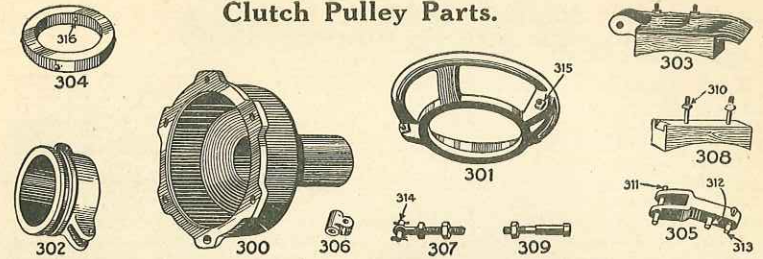


Part No.	Description	Price	Part No.	Description	Price
47E302	Push Finger.....	\$0.55	47E502	Spring Arm.....	\$0.60
47E303	Bracket, Complete.....	5.50	47E536	Magnet Clamp (short pin)....	.30
47E314	Spring Roller.....	.20	47E537	Magnet Clamp (long pin)....	.35
47E316	Nut for Set Screw.....	.05	47E542	Key (Shafts or Electrode)....	.05
47E320	Electrode Arm.....	.30	47E545J1	Journal Spring.....	.15
47E325	Push Rod.....	.35	47E545K2	Electrode Arm Spring.....	.15
47E328	Fiber Bushing.....	.10	47E546	Plug Terminal—Bronze.....	.20
47E331	Inductor Spring.....	.15	47E552	Terminal Wire.....	.10
47E339	Shaft Washer.....	.05	47E567	Clamp Screw.....	.05
47E340	Top Cover.....	.40	47E572	Electrode Washer.....	.05
47E341	Cover Screw.....	.05	47E577	Starting Lever.....	.25
47E345	Valve Rod Clamp.....	.85	47E582	Split Ring.....	.05
47E351	Movable Electrode and Point..	.85	47E585	Set Screw (sharp point).....	.10
47E352	Stationary Electrode and Point.	.75	47E586	Priming Cup.....	.45
47E353	Insulating Washer.....	.10	47E679	Spring Cotter Pin.....	.05
47E354	Electrode Spring.....	.10	47E680	Eccentric Washer.....	.05
47E355	Nut.....	.05	47E682	Push Rod Nut.....	.05
47E357	Nut.....	.05	47E686	Magnet Bar Set Screw.....	.10
47E358	Adjusting Screw.....	.10	47E689	Washer for Spring Arm Nut...	.05
47E359	Mica Tube.....	.25	47E693	Set Screw (cup point).....	.10
47E362	Control Lever.....	.80	47E697	Eccentric Cotter Pin.....	.05
47E363	Wedge.....	.25	47E699	Adjustable Screw Lock Washer.	.05
47E447	Push Rod Roller.....	.25	47E702	Roller Washer.....	.05
47E463	Push Rod Journal.....	.35	47E703	Wedge Set Screw.....	.10
47E479	Spark Point.....	.25	47E708	Wedge Set Screw Nut.....	.05

NOTE—All items shipped by parcel post, postage paid.

Be sure to give TYPE and NUMBER of magneto when ordering repair parts; also SIZE and NUMBER of engine.

## Clutch Pulley Parts.



No.	Be Sure to Give Diameter and Face of Pulley Rim.	SIZE OF PULLEY		
		10x8	12x6 14x8 16x8	20x8 24x8
†47E300	Clutch Spider.....	\$6.00	\$9.25	\$10.00
*47E301	Hand Wheel.....	1.60	2.00	2.15
*47E302	Sliding Sleeve.....	3.00	3.50	4.65
*47E303	Brake Shoe with Block.....	.60	1.00	1.40
*47E304	Set Collar for Spider.....	.90	1.10	1.65
*47E305	Adjusting Arm.....	.85	.85	1.20
*47E306	Knuckle Joint.....	.70	.70	.75
*47E307	Adjusting Bolt.....	.60	.60	.85
*47E308	Friction Block.....	.35	.35	.45
*47E309	Adjusting Bolt.....	.55	.55	.85
*47E310	Bolt and Nut.....	.15	.15	.15
*47E311	Pin.....	.20	.20	.20
*47E312	Pin.....	.20	.20	.20
*47E313	Pin.....	.20	.20	.20
*47E314	Pin.....	.20	.20	.20
*47E315	Bolt and Nut.....	.15	.15	.15
*47E316	Set Screw.....	.10	.10	.10

All items marked (\*) will be shipped by parcel post, postage paid. Item marked (†) will be shipped by express, collect.

## CAST IRON ENGINE PULLEYS.

Belt pulleys for transmitting power from the engine to the machines or line shaft should be of a certain size on each size engine to give the best results. The pulleys furnished on our engines are standard and should not be changed unless absolutely necessary.

### 47E330—Cast Iron Engine Pulleys.

Size, In.	Wt., Lbs.	Price	Size, In.	Wt., Lbs.	Price
4x4	10	\$1.20	20x8	83	\$ 6.15
8x4	16	1.75	24x8	86	8.40
12x6	32	3.00	30x8	132	11.60
16x6	39	4.00			

It is not advisable to use a pulley any larger than 12x6 inches on the 1½ horse-power; 16x6 inches on the 2½ or 5 horse-power; 20x8 inches on the 7 horse-power; 30x8 inches on the 9 and 12 horse-power.

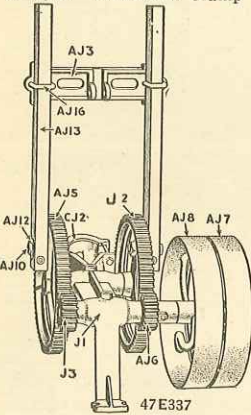
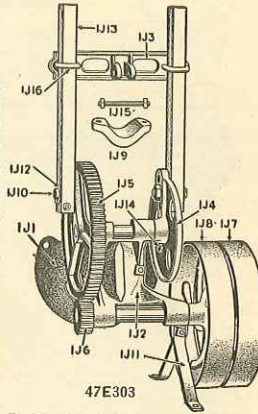


# PUMP JACK PARTS

## Single Gear Belt Driven Pump Jack.

47E303

Part No.	Description	Price
47E1J1	xSub Base .....	\$2.50
47E1J2	xMain Base .....	3.15
47E1J3	*Crosshead .....	1.00
47E1J4	*Crank Disc .....	1.40
47E1J5	*Large Gear and Shaft.....	2.80
47E1J6	*Small Gear and Shaft.....	1.60
47E1J7	*Tight Pulley with Set Screw.....	2.50
47E1J8	*Loose Pulley .....	2.50
47E1J9	*Clamp .....	.60
47E1J10	*Crank Pin and Nut.....	.60
47E1J11	*Brace with Nut.....	.35
47E1J12	*Crank Pin Washer.....	.20
47E1J13	*Pump Arms, each.....	.85
47E1J14	*Set Screw for Crank Disc.....	.25
47E1J15	*Clamp Bolt .....	.35
47E1J16	*Crosshead Clamp .....	.25



## Double Geared Belt Driven Pump Jack.

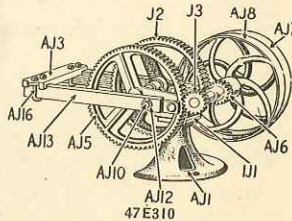
47E337

Part No.	Description	Price
47EJ1	xMain Base .....	\$3.80
47EJ2	*Crank Gear .....	2.55
47EAJ3	*Crosshead .....	1.00
47EAJ5	*Large Gear with Shaft.....	2.80
47EAJ6	*Small Pinion .....	1.25
47EJ3	*Small Gear with Shaft.....	1.60
47EAJ7	*Tight Pulley .....	2.50
47EAJ8	*Loose Pulley .....	2.50
47ECJ2	*Clamp .....	.60
47EAJ10	*Crank Pin with Nut and Cotter Pin.....	.60
47EAJ12	*Crank Pin Washer.....	.20
47EAJ13	*Pump Arms, each.....	.85
47EAJ16	*Crosshead Clamp, each.....	.25
47EB68	*Grease Cup.....	.35
47E14	*Pulley Set Screw.....	.25

## Horizontal Belt Driven Pump Jack.

47E310 and 47E304

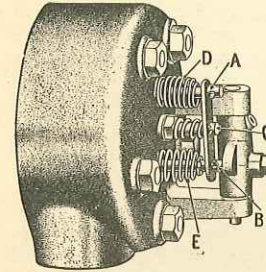
Part No.	Description	Price
47EAJ1	xSub Base .....	\$2.50
47E1J1	xMain Base .....	3.15
47EJ2	*Crank Gear .....	2.55
47EJ3	*Small Gear with Shaft.....	1.60
47EAJ3	*Crosshead .....	1.00
47EAJ5	*Large Gear with Shaft.....	2.80
47EAJ6	*Small Pinion .....	1.25
47EAJ7	*Tight Pulley .....	2.50
47EAJ8	*Loose Pulley .....	2.50
47EAJ10	*Crank Pin with Nut and Cotter Pin.....	.60
47EAJ12	*Crank Pin Washer.....	.20
47EAJ13	*Pump Arms, each.....	.85
47EAJ16	*Crosshead Clamp .....	.25



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## INLET AND EXHAUST VALVES.

The inlet valve "A," as shown in the illustration, is opened by the suction of the piston. For the entire length of the suction stroke gas is being drawn into the cylinder; then when the piston starts to compress the gas this valve closes and is held shut by the valve lock "C," so that no gasoline is wasted.



If there is a loss of gasoline at the mouth of the mixer loosen the locknut on valve lock stud "C" and screw stud out one turn and fasten locknut. If engine does not get enough fuel loosen locknut as above and screw stud in one turn and fasten locknut.

When the gas is at the highest point of compression the spark occurs, an explosion takes place and the piston is forced out on the work stroke. It is then necessary to get rid of the burnt gas so that a new mixture can be drawn into the cylinder for the next explosion.

At the end of the work stroke the piston starts back on an inward stroke, and the cam on the cam gear pushes the cam rod toward the cylinder head. This works the lever on the head of the engine and opens the exhaust valve "B" and the inward moving piston forces the burnt gas out through the muffler.

## HOW TO GRIND THE VALVES.

When an inlet or exhaust valve leaks remove the cylinder head, take off the valve springs, remove the valve you want to grind and wash it and the valve seat in gasoline, then make a paste of fine emery dust and oil. If you cannot get emery dust, use pumice stone with oil. (You can get pumice stone at most any drug store.) Smear this on the valve and valve seat, put the valve in place and put a nail through the hole in valve stem on the outside of the head, grasp the nail with your fingers and turn from left to right for a minute or so, then lift the valve and turn it about half way around and repeat this until the valve and valve seat show an even surface all the way around.

After the valve is ground in, wash off the emery dust with gasoline and do not get any dirt on the valve seat. In replacing the valves be sure to get the heavy spring on the exhaust valve and the light spring on the inlet valve.



## REPACKING THE CYLINDER HEAD.

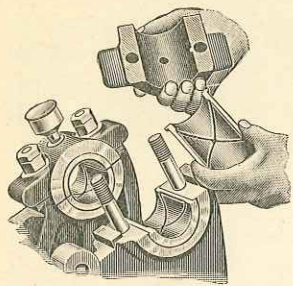
We use a special graphite asbestos packing between the cylinder and cylinder head to prevent the escape of the compressed gas.

To repack the cylinder head in case the packing should blow out or if you should break the packing when removing the cylinder head, you can use ordinary asbestos packing, such as you buy at your hardware store or the kind we furnish under 47E17 on page 15. If you use the ordinary asbestos packing, soak it in linseed oil; if you buy our special graphite asbestos packing, it is ready to be put in.

Before putting on new packing be sure all particles of the old packing are scraped off and that these parts show a smooth, clean surface.

After you have the packing in place push the cylinder head in close to the cylinder and screw on the nuts by hand as far as they will go, then use a wrench and turn each nut, one after the other, about one-half turn at a time. **Do not screw one nut down perfectly tight and then go to the next, as this causes an uneven joint and the packing will not hold.** After the engine has been running for about ten minutes tighten the nuts again and you will have a perfectly tight joint.

If you make a new packing from sheet asbestos you must be sure to cut openings in the packing so the water can circulate from the cylinder, through the cylinder head and around the valves.



The Main Bearings.

### BEARINGS.

The main bearings and crankshaft end of connecting rod have die cast bearings which fit perfectly into the machined bearings. The piston end of the connecting rod has a cast bushing.

All the bearings can easily be replaced; the bearing in the piston end of the connecting rod can be driven out and a new one driven in.

The crankshaft bearings and the bearing in the crankshaft end of the connecting rod are made of a special die cast babbitt. They are fitted with steel liners so you can take

up any wear in the bearings. Remove the bearing cap and take out enough of the strips from both sides of each bearing so they fit snug. Be careful when taking up wear in bearings not to get them too tight.

After you have removed the strips and put the cap back on again, screw down the bolts, but before starting the engine open the exhaust valve by pushing the detent blade in behind the catch block on the cam rod and turn the flywheels around by hand to see that they turn freely.

If they bind you have taken out too many strips and you will have to put enough back until the flywheels turn easily. A bearing should be neither too tight nor too loose; it must fit snug and the engine never be allowed to run when it is loose. Watch the grease cups closely and give them a couple of turns each time you start the engine. See that all bolts are tight and you will have no trouble with the bearings.

## PISTON AND RINGS.

As explained on page 6, what makes the engine run is the combination of air and gas drawn into the cylinder by the suction of the piston, this gas being compressed before it is exploded. To compress this gas it is necessary that the space in the cylinder be gastight. The piston is fitted to the cylinder and makes a fairly tight joint, but on account of the expansion of iron when it gets hot, it is necessary to have some other means of keeping the gas from escaping. Each piston is fitted with three rings that spring out and press against the walls of the cylinder, preventing the gas from escaping.

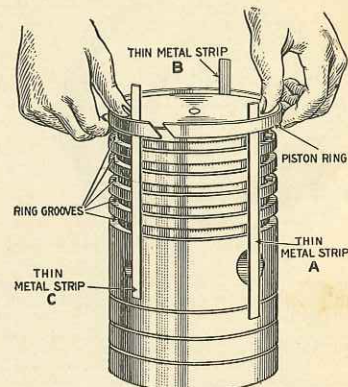


Figure 10.

These piston rings hold the compression and must fit free in the grooves of the piston. Feeding a poor grade of gasoline or lubricating oil, or too much of either, will cause a carbon deposit to form around the rings, which will in time bind them in the grooves, so they cannot spring out against the walls of the cylinder to hold the compression. It is very necessary that you use the proper grade of oil and watch the supply of gasoline, for on this depends the proper running of the engine.

To remove the piston from the cylinder take out the connecting rod bolts at the crankshaft end of the connecting rod. Remove the bearing which loosens the connecting rod from the crankshaft. Next, you will have to take off the governor spindle, as instructed on page 9, which gets the spindle and balls out of the way. This is all of the governor that you will have to take off, as the piston will now slip out of the cylinder.

If you find the piston rings are gummed or held tight in the grooves, they must be thoroughly cleaned. To do this you will have to remove the rings and wash them in kerosene or gasoline and you may have to scrape them with a knife.

To remove the rings take three thin metal strips (pieces of an old hack saw blade are fine for this) and slip under the center ring. Start the first strip under the ring at the joint and force it all the way around until you have it at the position shown by "A," Figure 10, then slip the second strip to "B" and the third to "C," which will raise the ring out of the groove so it can be slipped off. Take the top ring next and repeat the operation; then the bottom ring.

In replacing the rings, put the center ring on first, using the three metal strips as before, then without the three metal strips you can slip the top ring on and then put the bottom ring on, bringing it up from the bottom of the piston. Before putting the piston back in the cylinder oil the rings and surface of the piston thoroughly.



## FRICTION CLUTCH PULLEYS.

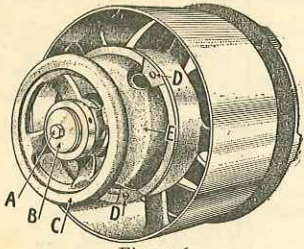


Figure 6.

the set screw "F" (Figure 7) and take off the clutch. This releases pulley "H," so it can be taken off.

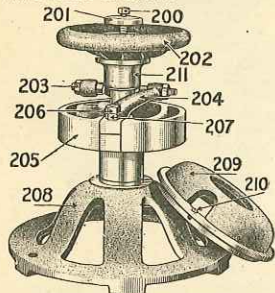
To put on the new pulley you simply reverse the above operations. Be sure the screws "F" and "D" and the cap screw "A" are tight, to prevent them from working loose while the pulley is running.

The pulley will stand still when hand wheel "C" is pulled out. To start pulley, push hand wheel "C" in toward the engine. When engaging, the clutch push the hand wheel "C" in slowly.

**IMPORTANT**—Be sure to oil clutch pulley every time you run the engine. To oil clutch remove iron plug in pulley hub; use regular gasoline engine oil and be sure to replace plug. If pulley is furnished with grease cup, fill grease cup and turn down top one-half turn every time you run the engine.

## CLUTCH PULLEY PARTS.

Be sure when ordering parts for clutch to give size of handwheel, diameter and face of pulley and horse-power of engine.



Part No.	Description.
*47E200	Bolt.....
*47E201	Washer.....
*47E202	Hand Wheel.....
*47E203	Adjusting Screw.....
*47E204	Clutch Dog, each... ..
*47E205	Friction.....
*47E206	Locknut.....
*47E207	Nut.....
x47E208	Pulley Frame.....
*47E209	Clutch Cover.....
*47E210	Set of 3 Screws.....
*47E211	Cam.....
x47E212	Pulley Shaft.....
*47E213	Threaded Clutch Collar.....
*47E214	Shaft Set Screw.....
*47E215	Key for Friction.....

Prices on Pulley Parts for 2½, 5 and 7 Horse-Power	Prices on Pulley Parts for 9 and 12 Horse-Power
\$0.10	\$0.10
.20	.20
1.25	1.50
.15	.15
.60	.75
5.50	8.00
.05	.05
.05	.05
3.50	6.75
1.25	1.50
.15	.15
1.35	1.75
.90	.90
.35	.35
.10	.10
.20	.20

NOTE—All parts marked (\*) will be shipped by parcel post, postage paid, at prices shown. Parts marked (x) will be shipped by express collect.

## 47E329—CLUTCH PULLEY RIMS ONLY.

2½, 5 and 7 Horse-Power.		Price
Size, Inches	Weight	
8x4 Rim	15 pounds	\$3.30
12x6 Rim	23 pounds	5.25
16x8 Rim	45 pounds	7.75
9 and 12 Horse-Power.		Price
Size, Inches	Weight	
16x8 Rim	55 pounds	\$9.25
20x8 Rim	65 pounds	11.90
24x8 Rim	90 pounds	14.35
30x8 Rim	150 pounds	19.30

Shipped by freight from factory in Ohio.

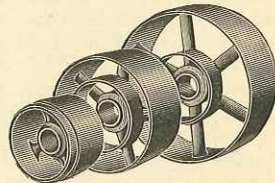
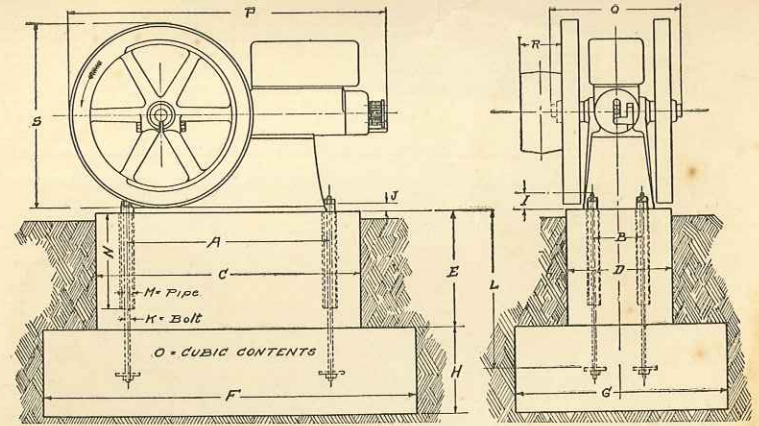


Figure 7.



ENG.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1HP	20"	5½"	29"	14"	12"	41"	26"	12"	1½"	¾"	¾"	18"	1"	10"	10½"	30½"	22½"	4"	18"
2½HP	25"	6½"	36"	18"	18"	48"	30"	12"	2½"	1¾"	¾"	24"	1"	15"	16½"	39½"	21½"	4"	22"
5HP	30"	8"	42"	20"	18"	56"	34"	12"	2"	1½"	¾"	24"	1½"	15"	22"	46½"	24½"	4"	28"
7HP	36"	9"	48"	20"	18"	66"	38"	18"	2½"	1½"	¾"	27"	1½"	15"	36"	56½"	26½"	6"	34"
9HP	41"	10"	54"	22"	24"	77"	44"	18"	2½"	1½"	¾"	33"	1½"	20"	52"	64½"	28½"	8"	38"
12HP	47"	12"	62"	25"	24"	86"	50"	18"	2½"	1½"	¾"	33"	1½"	20"	66½"	70½"	31½"	8"	44"

When an engine is to be located permanently it is best to mount it on a concrete foundation as shown above. In the table each letter shows the distance between the points as indicated in the drawing above.

To make a foundation like this dig a hole as long and wide as indicated by "F" and "G" and as deep as the sum of "E" and "H". If ground is not solid line hole with lumber or sheet metal to prevent caving. Make a box without top or bottom of size as indicated by "C," "D" and "E." Across the top of this box securely attach a couple of strips 2 or 3 inches wide, thickness as indicated by "J" and spaced as indicated by "A," measuring from center to center. These strips should be long enough to reach clear across the hole for foundation and box hung in the center of it. The top edges of box must be perfectly level. In the cross strips bore holes of size as indicated by "K" spaced as indicated by "A" and "B." Foundation bolts of length indicated by "L" fitted with large washers on the bottom should be hung from the cross strips. A piece of pipe or tubing larger than the bolt should be placed on the bolts as indicated by the dotted lines in the diagram. The pipe or tubing should come about ¼ inch below the top of the cross pieces and is put in so bolts can be shifted on account of a variation in the bolt holes in the engine base.

If engine is to be raised from ground the measurement "E" and length of bolts "L" should be increased to correspond with the height of foundation above ground, but measurements below ground must not be changed.

The concrete should be made up of one part good Portland cement, two parts clean sharp sand and four parts clean gravel or crushed stone. Mix thoroughly while dry and then add water, again mixing well till you have a good mixture. Place this in the foundation hole and fill up to within ¾ inch of the top of the box. Then fill the remaining space with a mixture of one part cement and two parts sand mixed thoroughly and moistened sufficiently so it can be spread and troweled smooth. Let the foundation set for two or three days, when the wood forms can be removed and space around foundation filled with earth or cinders. Then mix cement and water about like thick cream and fill the spaces between the pipe and bolts. Mount the engine, put nuts on bolts and screw down tight. It will be best to let foundation harden for at least a week or ten days before using the engine.