INSTRUCTIONS

FOR

STARTING AND GENERAL CARE

OF

"R&V' Triumph"

September 1st, 1916

"R" Line engines

Horizontal Hit – and – Miss Governing Engines

1 H.P. and Larger

Exhibit No. 392

The Object of this Instruction Book is to place at the disposal of every engine owner and operator reliable information concerning internal combustion engine troubles. There are many text books which treat on engine troubles and the remedies, but they, as a rule, contain so much technical information that they are not of practical value to the average engine operator.

This book is so written that he who reads it may understand the contents without deep thought or reference to a scientific dictionary. It tells of ordinary engine troubles which the operator encounters and gives simple remedies for overcoming them; in other words, it helps an engine operator to help himself in time of trouble.

NOTICE !

Since the publication of this instruction book, three different sizes of engines referred to therein, according to the old rating, have now been re-rated as follows:

1 ¾ HP. Changed to 2 HP.
2 ½ HP. Changed to 2 ¾ HP.
6 HP. Changed to 6 ½ HP.

Please bear the above point in mind when reading this instruction book, and oblige

THE ROOT & VANDERVOORT ENGR.CO.
November 1st 1916 EAST MOLINE. ILL.

GUARANTY

We GUARANTEE every "R&V" engine to develop the actual brake horse-power at which it is rated, and to be as economical in fuel consumption as any engine of similar type, **if correctly set up and given ordinary intelligent care and attention.** Each engine is thoroughly tested and all parts carefully examined before leaving our shop. We guarantee it free from imperfections in material and workmanship, and will replace or repair, free of charge, at our shops, any part breaking or wearing unduly, as a result of a hidden defect, for a period of one year from the date of purchase. *Provide,* always, that express or freight are prepaid by the purchaser.

The Root & Van Dervoort Engineering Co.
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The above guaranty does not
apply to repairs or replacements
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NOTE

Further information, not given in this book, will be gladly furnished upon request. Write direct to branch house nearest you.

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DON'T

Don't wire that you cannot start your engine, asking for an expert to help you out, until you have read this instruction book carefully and made sure of the following:

1. THAT THE BATTERIES OR MAGNETO ARE SET UP AND WIRED CORRECTLY (see wiring diagram, pages 11 and 16)
2. THAT A GOOD BRIGHT SPARK IS PRODUCED BY RUBBING THE ENDS OF THE WIRES AT ENGINE TOGETHER (see page 12)
3. THAT IGNITOR POINTS **(WHEN USING DRY CELL BATTERY)** ARE CLEAN AND SET TO SEPARATE **NOT TO EXCEED** 1/16" APART, FIFTEEN DEGREES BEFORE INNER DEAD CENTER ON COMPRESSION STROKE (see pages 9 and 13)
4. THAT IGNITOR POINTS **(WHEN USING OSCILLATING MAGNETO)** ARE CLEAN AND BRIGHT AND **IN CONTACT** WHEN ENGINE IS NOT RUNNING.
   THIS ADJUSTMENT IS DIRECTLY OPPOSITE TO THAT REQUIRED WITH THE USE OF BATTERIES OR ROTATING MAGNETO (see page 16)
5. THAT THERE IS A LIBERAL SUPPLY OF GOOD FUEL IN THE FUEL TANK (see "fuels" and "fuel trouble". pages 18 and 31)
6. THAT YOUR ENGINE HAS GOOD COMPRESSION (see "Compression," etc., page 17)
7. THAT BOTH THE INLET AND EXHAUST VALVES WORK FREELY AND SEAT QUICKLY.
8. THAT ALL MOVABLE WORKING PARTS OF ENGINE, PARTICULARLY THE IGNITOR, WORK FREELY.

THE INTERNAL COMBUSTION ENGINE

An internal combustion engine (commonly known as a gas or gasoline engine) derives its power from heat expansion resulting from the burning of a mixture of gas and air, compressed in its cylinder.

There are tow types of internal combustion engines commonly used – the "two-cycle" and the "four-cycle", or more correctly, *four-stroke cycle type* which requires four strokes of the piston in the cylinder two forward and two back- to produce an explosion, or impulse. Each forward or backward movement of the piston in known as a stroke. (See figs. 2, 3 4 and 5 and description on pages 6 and 7)
All "R&V" engines are of the four cycle type.

GENERAL DESCRIPTION

An internal combustion engine consists of a cylinder in which is fitted a piston coupled to the crank by means of a connecting rod. The cylinder is longer than the stroke of the piston, leaving a space at the head end, called the combustion chamber into which the piston does not enter. (See fig. 1 below)

Add to the above an inlet valve for the fuel, an exhaust valve for the burnt gases, flywheels to maintain the motion between impulses, gears to time the exhaust valve and ignition, a mixer to gasify the fuel, an ignitor to fire the charge in the cylinder and a governor to maintain the speed at a constant point, regardless of load, all of these supported by a suitable base called a crankcase – and you have the essential parts of an internal combustion engine.

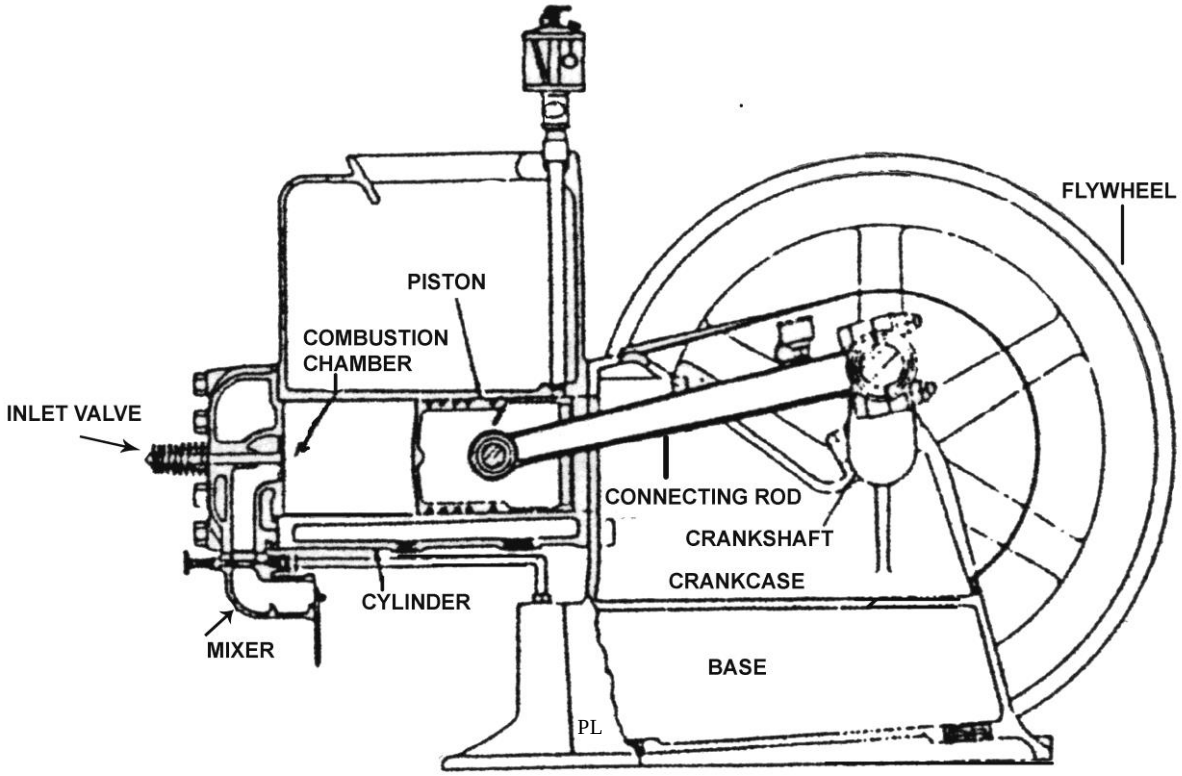


Fig. 1.

PRINCIPLE OF OPERATION

The following cuts give a clear idea of just what takes place when a "four stroke" cycle engine is at work.

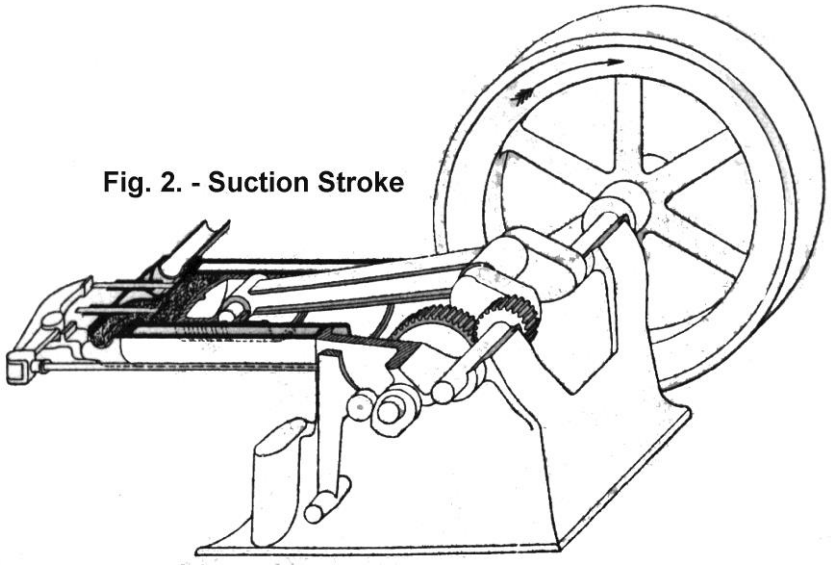


Fig. 2. - Suction Stroke

Suction Stroke – Fig. 2 above shows the engines with both valves closed and with the piston starting away from the engine head. As the piston travels away from the head with the valves closed, a vacuum is formed in the cylinder.

Then the inlet valve is opened automatically by the pressure of the outside atmosphere, because the spring that holds it closed is not strong enough to resist the pressure of the outside atmosphere after the pressure in the cylinder is removed by forming a vacuum.

When the inlet valve is thus forced open, air mixed with gasoline from the needle valve rushes into the cylinder. The vacuum, therefore, may be said to suck in the air and gasoline vapour. **This is called the suction stroke.**

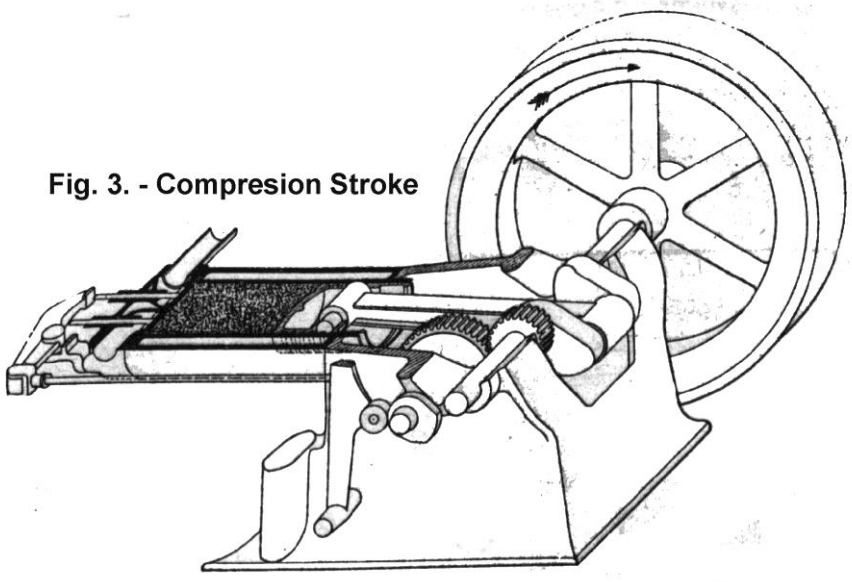


Fig. 3. - Compresion Stroke

Compression Stroke – At the end of the suction stroke, the pressure of the atmosphere on the inlet valve has become equalized by the pressure of the charge drawn into the cylinder. he spring then closes the valve automatically.

The piston now returns towards the cylinder head. The valves are closed and the charge of gas in the cylinder cannot escape, but is compressed in the head of the cylinder by the returning piston. (See Fig. 3, above)

As the piston gets near the end of the compression stroke, an electric contact is formed inside the cylinder. The circuit is broken just before the end of the compression stroke; that is, the contact points of the ignitor break apart. This forms an electric spark between the two points, and the compressed charge of gas is ignited. This causes the explosion, and when the gas suddenly expands as it explodes, the piston is forced way from the engine head with a powerful thrust.

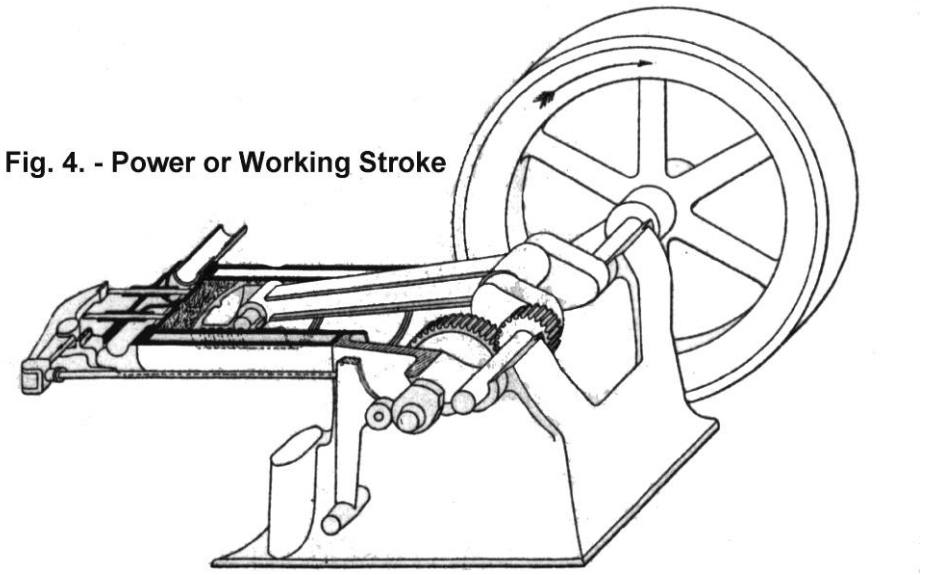


Fig. 4. - Power or Working Stroke

Power or Working Stroke – When the explosion takes place, as described above, the piston is forced outward. This is the power or working stroke. (See Fig. 4 above0

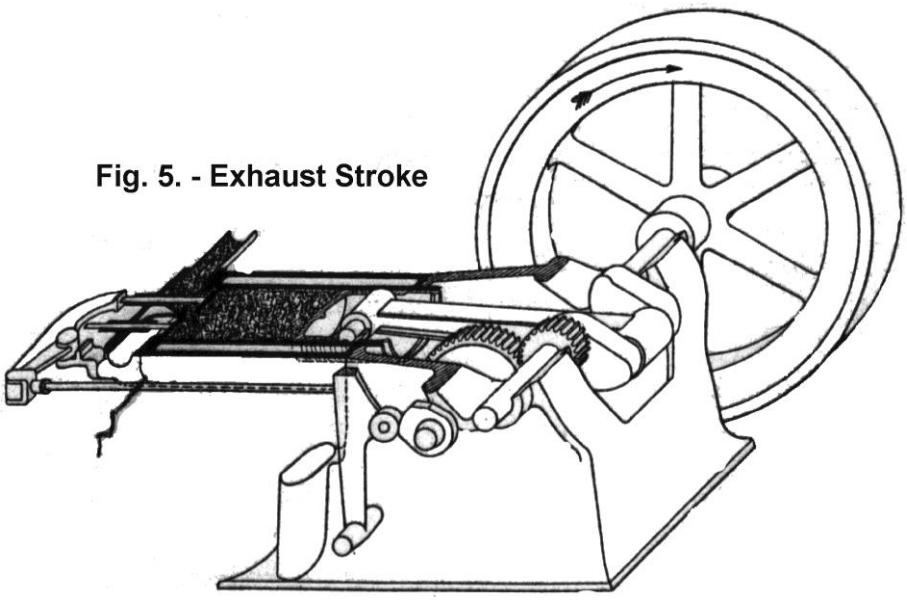


Fig. 5. - Exhaust Stroke

Exhaust Stroke – At the end of the power stroke, the exhaust valve is opened mechanically and the returning piston forces the burned gases out through the exhaust port. (See Fig. 5 above)

At the end of the exhaust stroke, the exhaust valve is closed by its spring and the complete cycle has been finished. The engine is now ready to operate another vacuum in the cylinder, causing another in-rush of gasoline vapour and air, and a rapid repetition of the series of operations just described.

REAL CAUSES OF ENGINE TROUBLE CAN BE GROUPED UNDER FIVE HEADS:

(a) **Ignition** (b) **Fuel** (c) **Compression**
(d) **Incorrect Timing** (e) **Miscellaneous**
and may appear in any of the following forms, due to the reasons which are explained.

Engine Does Not Start	Faulty ignition (See "Ignition Trouble" page 12) Not enough or too much fuel or improper mixture of fuel (See "Fuel Trouble" page 18) Loss of compression (See "Compression Trouble" page 17) Use of poor grade fuel (See "Fuel" page 28 and "Fuel Trouble" page 18) Improper valve timing (See "Incorrect Timing page 19)
Engine Runs Too Slow	Speed regulation lever too low (see diagram of governor, page 23) Not enough tension on governor weight spring (see diagram of governor, "page 23) Weak or late spark (See "Ignition Trouble", page 12) Too much fuel (See page 18) Missing explosions (See second paragraph below). Movable parts of governor not working freely, or governor springs stretched (See "Diagram for adjusting governor" page 23)
Engine Runs Too Fast	Speed regulating lever too high (see diagram of governor, "page 23). Too much tension on governor weight spring (see "Diagram of Governor, " page 23) Detent does not engage catch block (see "Diagram for Adjusting Governor", page 23)
Missing Explosion	Too much fuel (See page 18) Weak spark (See "Ignition Trouble", page 12) Weak battery (See "Ignition Trouble", page 12) Loose wire connections (See ignition Trouble", page 12) Ignitor short-circuited or ignitor points worn down too far (See "Ignition Trouble", page 12)
Loss Of Compression	Lack of lubricating oil or use of poor grade of lubricating oil (See "Oiling Engine", page 26) Leaky valves (See "How to Grind Valves", page 24) Piston rings stuck or badly worn (See second paragraph "Compression Trouble", page 17) Blown-out or defective cylinder head gasket or ignitor gasket (See "How to cut a gasket", page 24)
Loss Of Power	Weak compression (See Compression Trouble", page 17) Faulty ignition (See "Ignition Trouble", page 12) Not enough or to much fuel or improper mixture of fuel (See "Fuel Trouble", page 18 Improper regulation of governor (See diagram page 23 and instructions, page 22) Exhaust valve closing too soon or to late (See "Incorrect Timing", page 19)
Pounding Noise	Connecting rod bearings loose (See page 22) Loose flywheel key (See page 22) Pre-ignition (See "Pre-Ignition", page 21) Too early Ignition (see page 23) Improper length of detent (see diagram and instructions, pages 22 and 23) Badly worn or broken piston rings (See page 22) Badly worn piston (See page 22)

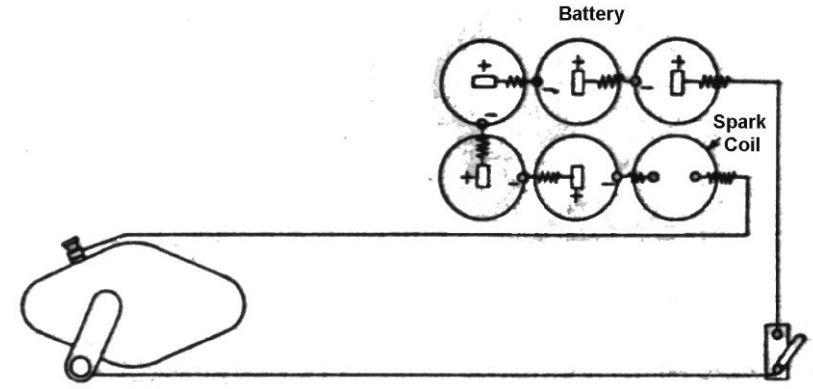
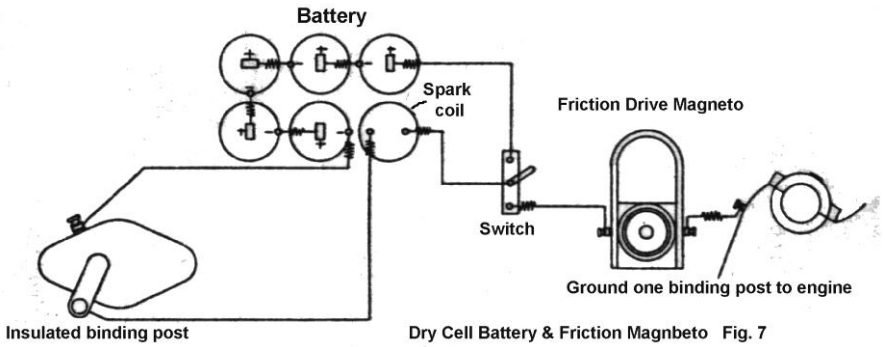
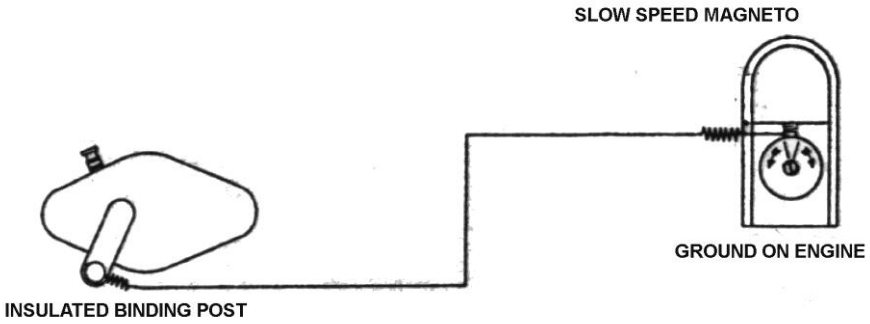


Fig 6





GEAR DRIVEN SLOW SPEED MAGNETO
Fig. 8

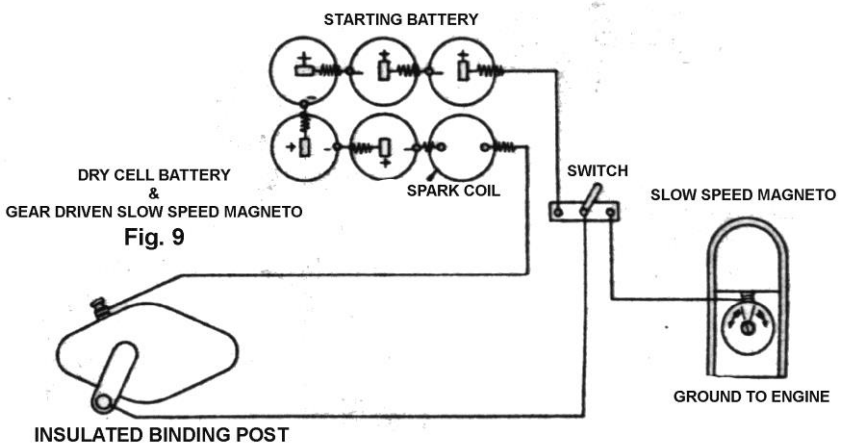


Fig. 9

Wiring Diagrams.

Note: Ignition systems such as diagrammed in Figs 6 -7 and 9 are not furnished with R&V Triumph Engines.

HOW TO LOCATE GASOLENE ENGINE TROUBLES.

There are but a few ways in which a gasoline engines may give trouble, so that if the difficulty is looked into carefully, locating the trouble and fixing it si usually a matter of minutes not hours.

(A) IGNITION TROUBLE

Ninety percent of gasoline engine troubles are due to faulty ignition. Therefore, if an engine will not start, or stops when running, the ignition system should be examined first, unless some other cause for the trouble is immediately apparent.

An engine equipped with "Make and Break" ignition system (used on all "R&V" engines) may cause trouble for any of the following reasons:

1. Switch not closed. Switch must be closed in order to complete the electric circuit so that current will flow when ignitor points are in contact.
2. Loose or broken wires. All wires should be securely fastened to the binding posts.
3. Battey not correctly wired. See Fig. 8. page 11
4. Battery cells exhausted or weak.
5. Short circuit in spark coil or wiring.
6. Short circuit in ignitor.
7. Moveable electrode stuck.
8. Ignitor points rusted or corroded.
9. Ignitor points worn down or set wrong.
10. Ignitor not correctly timed.

The following instructions telling how to remedy the above troubles are given in same order that troubles are listed. Marginal numbers refer to troubles listed.

DRY CELL BATTERY (REMEDIES).

1. To test the battery, disconnect the two wires from the engine binding posts,
2. placing the ends together, then drawing them quickly apart. If there is a fat, hot
3. spark, the battery is in good condition, and the trouble must then be looked for else
4. where. If there is no spark, the switch must be open. One or more wires lose or
5. broken, or short circuited by touching metal parts, battery not wired as shown in the diagrams on page 9, the battery cells exhausted, or the spark coil short-circuited.

4. Each cell can be tested with an ammeter, or by connecting the positive and negative poles with a knife blade, holding the blade against the zinc (-) pole with point against the carbon (+) pole. If the cell is a good one, smoke will rise where the knife point touches the carbon. One exhausted cell spoils a battery of otherwise goods ones.
5. If the cells are in good condition, the spark coil can be tested by cutting it out of the battery, and then testing the battery by rubbing the wires together as indicated above. If a spark is produced with the spark coil cut out, and no spark can be obtained when the coil in connected up, the evidence is that the coil is short circuited, and should be replaced.

   If when the battery is tested as above suggested. There is a weak spark instead of none at all, the evidence is that the cells are nearly exhausted, or that some of the wires are so loose that they do not make good contact.
6. If the trouble is not with battery or magneto, it must be looked for in the ignitor.

TESING IGNITOR – To test the ignitor for short circuit, leave the wire which is attached to the insulated post in place, loosen the other wire and rub it on the engine or ignitor (but not on the binding post to which the other wire is attached). If a spark is produced when the ignitor points are not in contact, it is evidence of a short circuit through the stationary electrode (No35, Fig. 11, below), of the ignitor. In this case the electrode must be taken out and supplied with new mica insulation (see mica washer, Figs. 10 & 11 below), or the old insulation adjusted so that the electrode does not come in contact with the main parts of the ignitor called the ignitor plate (No. 34, Figs 10 & 11 below)

To test the ignitor further, hold the ignitor points (see Fig.11 below) together, rubbing the wire, which has been loosened from the moveable electrode (No. 36, Fig. 10 & 11 below) on any bright part of the engine. *Now,* a spark should be generated wherever the detached wire touched the engine. If *there is no spark,* the ignitor points are dirty, in which case they should be thoroughly cleaned, and scraped with a knife blade.

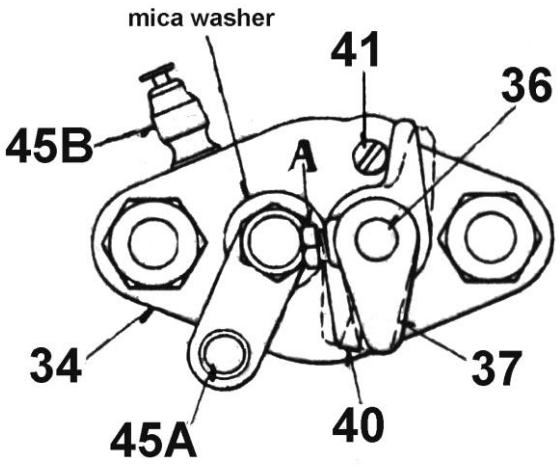


Fig. 10 - Front View

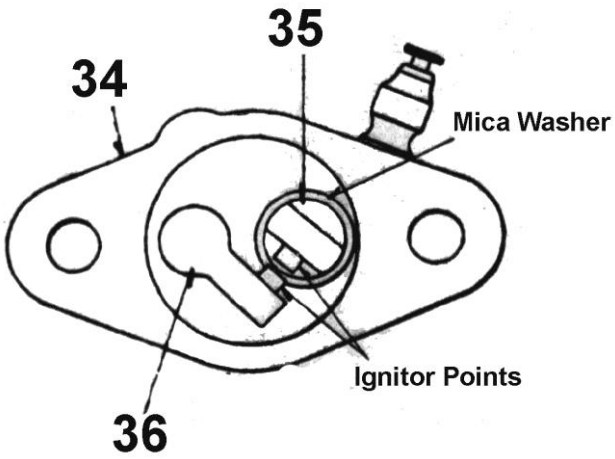


Fig. 11 Rear View

7. Occasionally the movable electrode (No.36, Fig.10 & 11) is dirty or tight, and sticks, so that it does not operate freely, or perhaps not at all. If the points do not snap apart quickly, the spark will not be live one. If the ignitor is stuck so that the points do not operate at all, there will, of course, be no spark. In either case, the movable electrode (No. 36, Figs. 10 & 11) should be taken out and cleaned.
8. A drop of water between the ignitor points may cause the current to flow continuously, or a little corrosion may check it altogether.
9. If the ignitor points are worn off, or set wrong, the engine may fail to operate. As the points wear off, the time of contact is diminished until it is finally necessary to replace them so that they will remain in contact long enough before the circuit is broken to store up energy in the coil for the spark.

   If the ignitor points are set too far apart, they will never come into contact, and there will be not spark. The points should be set about $^{1}/_{32}$" and not over $^{1}/_{16}$" apart.

10. The entire ignition system may be in perfect working order, but the ignitor set so that contact and ignition occur at the wrong point in the cycle. In other words, the ignition is timed wrong (See Fig. 12, page 14)

TIMING THE IGNITOR – The ignitor should be set so that the points come into contact from 60 to 90 degrees before the end of compression stroke, and the ignitor

hammer should trip, breaking the circuit and causing the spark before the crank of the crankshaft reaches dead center at the end of the compression stroke. The exact number of degrees before center at which contact and ignition should occur varies with different engine speeds – the larger, slower speed engines should make contact later, and ignite closer to dead center than the high speed engines. Roughly speaking, the ignition should occur between 15 and 30 degrees before the end of the compression stroke on "R&V" engines up to and including 8-H.P. For engines above 8-H.P., ignition should occur between 5 and 15 degrees below center.

The charge is ignited before the end of the compression stroke to give the gases time to flame up by the beginning on the power stroke.

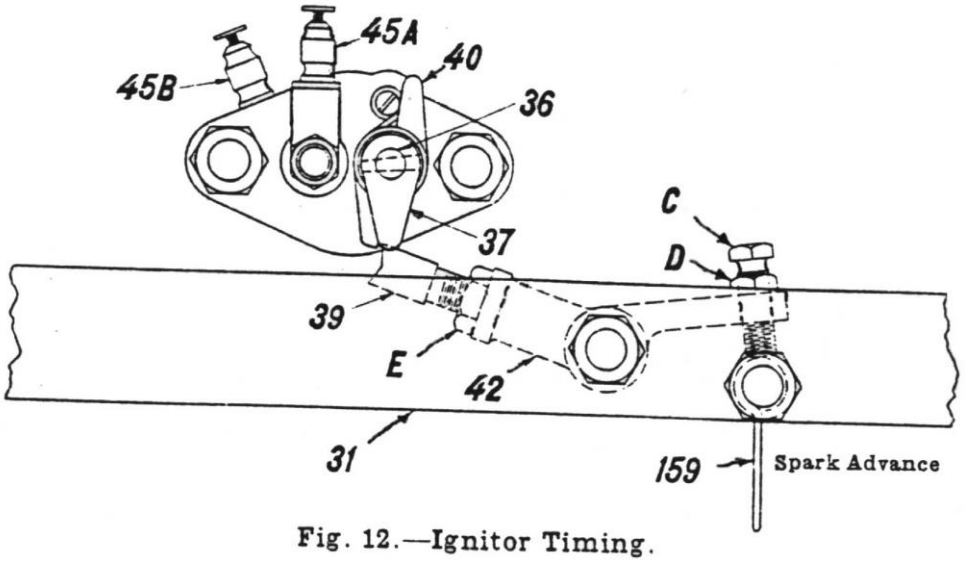


Fig. 12.—Ignitor Timing.

Turn the fly-wheel in the direction that it runs until the ignitor trip (No. 39, Fig. 12 below) reaches its innermost position. In this position it should clear ignitor hammer (No. 40) about one-sixteenth of an inch on the 1, 1¾ and 2½ - HP. and about one-eight of an inch on 4HP and larger engines. This distance is obtained by loosening screw (C). This allows No. 39 to be moved as the ease may require. **When adjusted tighten lock-nut (E).** Now turn wheel until the crank is the proper distance below center (see above) on the compression stroke, where the ignitor should trip. If the ignitor trips later than this, the adjusting screw (C) should be screwed in until the ignitor trips correctly. If the ignitor trips before this point is reached, (C) should be adjusted so that the ignitor trip (No. 39) will release the hammer No.37 at the correct ignition point. After adjusting, tighten lock nut (D).

OSCILLATING MAGNETO (TROUBLES).

1A. Loose or broken wire. Wire should be securely fastened to the binding posts.
2A. Magneto and ignitor not correctly wired.
3A. Short circuit in magneto wire.
4A. Short circuit in ignitor.
5A. Movable electrode stuck.
6A. Ignitor points wet or corroded.
7A. Ignitor points worn down or set wrong.
8A. Ignition not correctly timed.
9A. Magneto and ignitor timed wrong, or magneto out of order.

OSCILLATING MAGNETO (REMEDIES).

2A. Magneto and ignitor should be wired in accordance with instructions and diagrams, page 16.
3A. Insulation on magneto wire might be worn off, causing short circuit by bare wires touching metal parts of the magneto or ignitor. Put on new wire or insulation.

If the oscillating magneto fails to run the engine, remove the magneto and ignitor assembly to determine if the trouble is in magneto or ignitor. To do this see if spark is produced when magneto is tripped. On 1, 1¾ and 2½ H. P. engines where there is no tripping lever provided, the magneto can be tripped by hand or by the use of screw driver or wrench. On large engines the magneto should be cocked by raising trip lever and then tripped by striking the lever quickly with one hand. Be sure to cock magneto sufficient and trip quickly so as to get best possible spark. If a weak spark or no spark at all is produced, see that timing of ignitor and magneto correct. (See "Timing Ignitor and Magneto," pages 15 and 16, and then cock and trip magneto again as described above.

Then if no spark is produced (if timing of ignitor and magneto is correct) the trouble may be in the ignitor, and may be due to any one of the following reasons:

Short circuit in ignitor.
Movable electrode stuck,
Ignitor points met or corroded
Ignitor points worn down or set wrong.
Ignition not correctly timed.

To determine this, operate the engine on dry cell battery. Connect one wire of battery to insulated binding pose on ignitor (without removing either magneto or ignitor from engine), and ground other battery wire by connecting to rocker arm pull back spring, or any convenient, uninsulated point on engine.

4A-5A-6A. See instructions page 12 telling how to locate and remedy short circuit in ignitor - movable electrode stuck and ignitor points wet or corroded.

7A. If ignitor points are worn down or set wrong, see diagram and instructions, on page 13.

. **8A**. If ignition is not correctly timed see "Timings Ignitor and Magneto", page 16.

9A. In case the ignitor operates engine with dry- cell battery it is then evident that the magneto is out of order. If you cannot locate the trouble, after carefully reading instructions on "Operation Care and Adjustment of Oscillating Magneto" page 27, then write to the branch house nearest you.

Comparatively few magnetos give trouble, but when they do, and the trouble cannot be located by following directions. it is best to refer them to expert electricians.

TIMING IGNITOR AND MAGNETO--Ignitor should be adjusted so that **points are always in contact when engine is not running.**

The making of this adjustment depends entirely on the setting of the magneto, which should be placed as described under "Operation and Care of Magneto," page 27.

The charge is ignited before the end of the compression stroke to give the gas time to flame up by the beginning of the power stroke.

To time ignition, **lengthen** or **shorten** the **magneto trip** as necessary until there is about 3/32" or 1/8" space between point of trip and lower leg of magneto oscillator. This adjustment should be made when the exhaust rod is at the farthest point it may move toward the crank shaft. Then move spark advance lever so as to point toward fly- wheel in a horizontal position and turn engine in direction of rotation and note where the magneto trips. If the magneto does not trip at inner dead center, then lengthen or shorten, as necessary, the **magneto trip holder adjusting screw** until it does trip, and then move spark advance back to a vertical position, where the magneto should trip at the correct point or about 20 degrees below inner dead center on the compression stroke.

This point is stamped "Ignition" on governor side fly wheel.

TOO EARLY IGNITION--Care should be taken to time the ignition so that it will not occur too early because if it does, the force of the explosion will cause an outward pressure (see "Power or Working Stroke" Fig. 4, page 9), while the piston is actually travelling inward (see "Compression Stroke," Fig. 3, page 8), so that the engine will be working against itself. While the momentum of the fly-wheels may carry the piston

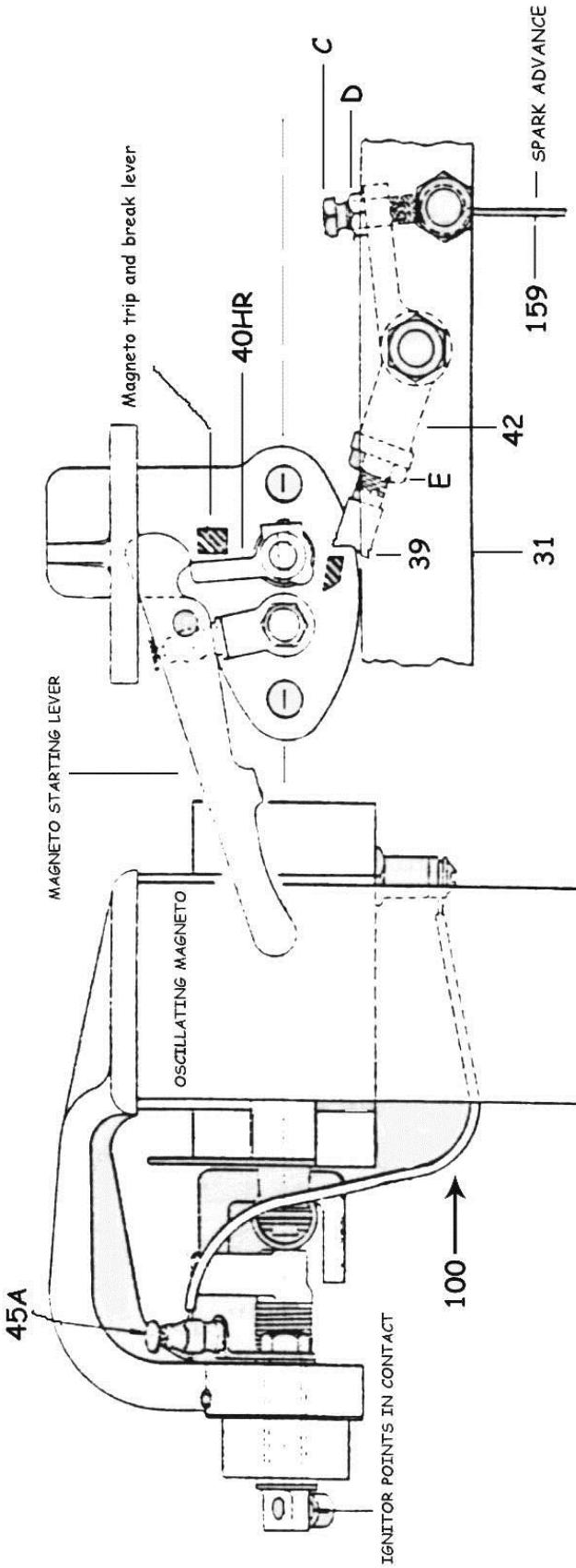


Fig. 13.—Magneto and Ignitor Timing.

against the great outward pressure which the expanding gas exerts against it, this considerably decreases the power because the engine must overcome the tendency to reverse its motion, caused by too early ignition. Too early ignition produces a distinct pounding noise in the cylinder, which is easily detected (see "Pounding Noise, " page 21)

When making any change in timing adjustment of ignitor (when using dry cell battery) be careful that the length of time of contact is not too short to give time for the battery or magneto to establish a god flow of current through the spark coil. This would result in either a very poor spark, poor ignition, or sometimes no ignition at all. The ignitor points should be in contact at least 60 degrees before ignition occurs.

COMPRESSION

The power developed by an engine is largely determined by the compression in the cylinder. If the engine does not start easily or is not developing its power, look for loss of compression. Proper compression is absolutely necessary to get power out of an engine.

The object of compression in an engine cylinder is to insure a rapid, vigorous ignition of the gas to be consumed, resulting in highest degree of heat, the greatest possible expansion of the gases and the most powerful impulse upon the piston. The slower the process of burning in the cylinder, the lighter is the expansion.

Don't forget the importance of watching the compression of the engine carefully. Test it frequently and watch the valves, piston rings, etc., closely to see that there is no leak.

(B) COMPRESSION TROUBLE

To try the engine for compression, turn the flywheel over twice. On one revolution it should turn over easily, but on the other it should turn over hard, because of the compression in the cylinder. Should the fly-wheel turn over easily on both revolutions, it is evident there is not proper compression and the engine will not start easily or pull its load when running.

Bad compression is due to the following reasons:

LEAKY VALVES – The inlet or exhaust valve may be leaking. It is easy to determine which valve is leaking by holding the hand tightly over the air intake and turning the engine fly-wheel. If the inlet valve is leaking, the air will rush out against the hand as the engine turns over on the compression stroke.

To test the exhaust valve, hold the hand over the exhaust pipe and turn the fly-wheel over.

If either of the valves are leaking air, they should be removed and cleaned or ground (see "How to Grind Valve," page 24).

LEAKING PISTON – The rings on the piston may be gummed up with poor or cheap lubricating oil. If so, they will fail to expand properly and the compression will escape past the piston. This trouble can be remedied by removing the piston and thoroughly cleaning the piston rings in kerosene. In case the piston rings are cleaned as above and well oiled, and still the piston leaks, the conclusion would be that the rings are so badly worn they need replacing, or that the cylinder or piston have become badly scored because or improper lubrication.

LOOSE JOINTS – Loss of compression may also be due to loose connections. Make sure that the nuts holding the cylinder head and ignitor to the cylinder are tightened before the engine is started. Repeat this the first few times when the engine becomes cold after running. Attention to this will prevent annoyance from leaks and blowing out of gaskets.

(C) FUEL TROUBLE

NOT ENOUGH FUEL – After being started, the engine should run up to normal speed within a few seconds if it is receiving fuel in the proper proportion. If the engine is not under load, it should take a charge every 7 or 8 revolutions and fire each charge; this indicates that the engine is ready for its load. If there is popping and back-firing (see "Back Firing," page 21) in the mixer, the engine may need more fuel – the inlet valve may not close properly, or the ignitor may be out of adjustment (see "Timing Ignitor," Fig. 12, page 14, also "Timing Ignitor and Magneto," page 16).

See that the tank contains plenty of the proper grade of fuel, and then make sure that the fuel is being delivered at the needle valve. This is readily determined on suction feed engines, such as the smaller Triumphs, by holding the hand tightly over the air intake of the mixer elbow and turning the fly-wheel over on the suction stroke. If there is no obstruction in the pipe that connects with the gasolene tank, the suction in the cylinder will pull up the fuel until it runs out of the mixer elbow.

DIRTY OR LEAKY SUCTION OR SUPPLY PIPES – If the gasolene cannot be drawn up in the way, the check valve in the lower end of the suction pipe should be examined. If trouble is not located there, the suction pipe should be thoroughly cleaned out.

The suction or supply pipe may have a leak. When this pipe is connected with the engine, it should be thoroughly tested to make sure that there are no air leaks in it, for if air works into the pipe, it will cause the priming suction to be lost. In case of a leak in the joints of this pipe, use common laundry soap for packing. **Do not use red or white lead.**

If the gasolene pump (furnished on larger sizes of Triumph engines) does not draw fuel from the tank to the needle valve, the check ball valve in the bottom of the pump should be examined. If the engine has been standing idle for some little time, permitting the gasolene pump to dry out, the check ball may stick to the bottom of the pump, causing failure of the pump to properly draw fuel. In such a case the check balls maybe jarred loose by tapping on the bottom of the gasoline pump.

TOO MUCH FUEL – A dull exhaust report and black smoke issuing from exhaust pipe indicates that the engine is receiving too much fuel, and that the charges that are taken in are nit ignited or else not thoroughly burnt. **It is possible to choke down an engine by feeding too much fuel just as it is to stop engine by not feeding enough fuel.** Do not feed more fuel when more power is wanted. When pulling its load under normal conditions, the engine should make six or eight explosions before the governor acts, "cutting out" the explosions. Should the engine be flooded with fuel, the charge will either not ignite, or will only partially burn. If the engine is flooded with fuel, close the needle valve. The gasolene must be shut off and the fly-wheels then revolved several times to work the over supply of fuel out of the cylinder.

This is easily done by holding the inlet valve open while revolving the fly-wheels. **Failure to start an engine is frequently caused by flooding of the cylinder with too much fuel.**

WATER IN THE GASOLENE – Water in the gasoline is a common source of trouble, yet is often difficult to discover. When pure gasolene is scattered with the finger on a piece of metal, it will spread out smoothly, but if there is water in it, little bubbles very much like quick silver will form. An easy method of removing water from gasolene is to strain it through a chamois skin – all of the water will remain in the chamois skin while the gasolene will run through.

A quantity of water and some dirt may be found in the tank near the end of the gasolene suction pipe leading from fuel tank to the needle valve. This water and dirt is naturally drawn toward the end of gasolene suction pipe because the bottom of the fuel tank slopes in that direction.
To overcome this trouble, the water and dirt should be drained out through the drain hole provided on outside of fuel tank.
It is a good idea to drain the fuel tank often, even though no particular trouble is experienced from that source.

(D) INCORRECT TIMING

The adjustment of the exhaust valve may have gotten out of time, either by a change in the length of the adjusting screw in the exhaust valve rocker arm or by changing the setting of the reducing gears, of which the exhaust cam is a part.

All Triumph engines have a point at which the exhaust valve should open and close stamped on the rim of the fly-wheel on the governor side of engine. This stamping reads:
"Exhaust Open" and "Exhaust Closed."

When the words **"Exhaust Open"** are in line with the side rod, near the end of the power stroke, the exhaust valve should just be starting to open. This point is reached when the crank shaft is about thirty degrees *before* the end of the *power stroke,* or, in other words, about 30 degrees *before outer* dead center. The exhaust valve remains open through the next or exhaust stroke and until the crank shaft has reached a position 5 to 10 degrees *above inner* dead center. At this point the words **"Exhaust Closed"** should be opposite the side rod.

The reducing gears on all Triumph engines are marked so that if they are taken out of mesh, it is possible to replace then in exactly the same position without any difficulty.

If at any time the reducing gears in any unmarked engine are taken out of mesh, they may be properly replaced by following these directions:
1st. Turn the crank shaft until the keyway comes directly on top. (This point is indicated in Fig. 14, page 20)
2nd. Place the cam so that the high point or part marked **"Exhaust part of Cam"** in above mentioned figures comes directly on top in a vertical position, and note which teeth come in mess in the reducing gears. Do not lock the gears in this position.
3rd. Having noted which teeth come together in the second operation, then shift the cam shaft gear back one tooth toward the cylinder and lock both camshaft nuts securely.
4th. Check carefully to see if the above instructions have been followed and observe if the following takes place during two consecutive revolutions of the fly-wheels:
Beginning with the crank shaft about 10 degrees above *inner* dead center, the words "**Exhaust Open"** are opposite the side rod and the exhaust valve just closed.
Turn the engine in the direction of rotation.

The first half revolution of the flywheel corresponds to the suction stroke. Near the end of the second half of the first revolution (this half revolution is the compression stroke) ignition should take place. The ignition should take place. The ignition point is now under the roller. (See Fig, 14. page 20).

Having completed the first revolution and starting the second, the exhaust valve should start to open about 30 degrees *before outer* dead center, or when the words **"Exhaust Open"** are opposite the side rod. The exhaust valve remains open during the rest of the stroke until 5 to 10 degrees *above inner* dead center is reached, which completes the "four stroke" cycle.

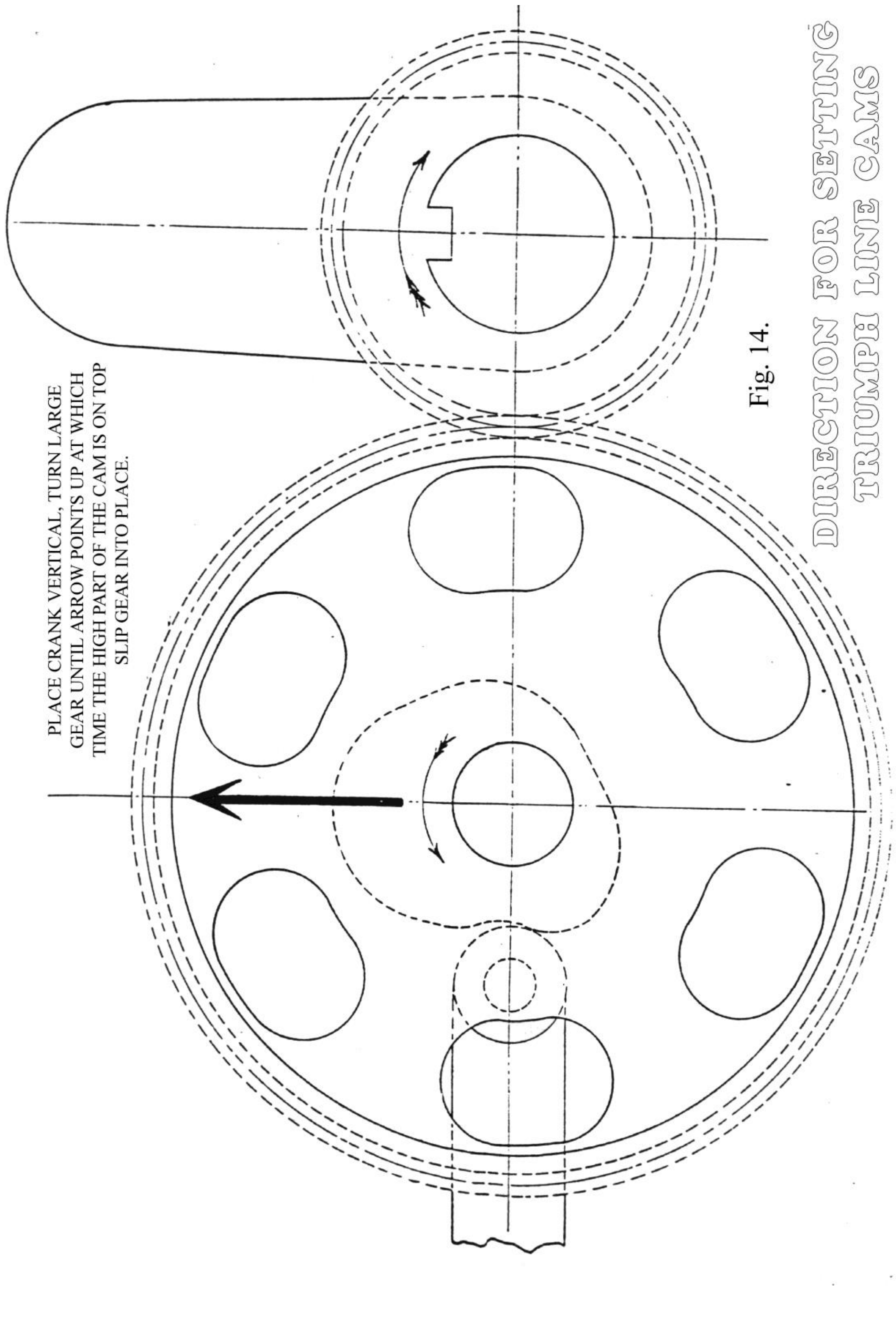


Fig. 14.

DIRECTION FOR SETTING TRIUMPH LINE CAMS

To determine the exact time at which the exhaust valve opens or closes, slip a thin paper between the end of the valve stem and the adjusting screw in rocker arm casting which opens it. The instant the paper is gripped firmly, the valve is starting to open.

Very close adjustment of the valve opening and closing can be obtained by lengthening or shortening the adjusting screw in the exhaust valve rocker arm. After making such adjustment, be sure and tighten the lock nut on the adjusting screw.

(E) MISCELLBNEOUS TROUBLES.

BACK FIRING - When the force of an explosion in the cylinder comes out of the mouth of the mixer or air pipe, it is termed "back-firing" A delayed combustion of the previous charge is the usual cause of back-firing. If the charge of air does not receive a sufficient charge of gas as it enters the cylinder, a slow-burning mixture results.

The remedy for back-firing, if caused by weak or slow-burning mixture, is feeding a little more fuel. If this does not remedy the trouble, the cause is no doubt some foreign substance in the cylinder, as mentioned above. which should be looked after and removed.

SMOKE AT EXHAUST - Black smoke at the end of exhaust pipe or muffler means an over-supply of fuel, and blue smoke indicates too much lubricating oil in the cylinder.

The needle valve should be set to feed less gasolene, and if this does not stop the smoke, the cylinder lubricator should be adjusted so as to feed less lubricating oil into the cylinder. About 8 to 13 drops per minute is the proper feed for the cylinder lubricator, a new engine or heavy load requiring the maximum amount.

Smoke at the open end of the cylinder is generally caused by over-heating or by "blowing" of burned gases past the piston. If the lubricating oil is burning, it is an indication that the cylinder is over-heated or that a poor grade of lubrication oil is being used, which requires an increased supply of cooling water. If the smoke continues to come out at the open end of the cylinder, the piston should be taken out, filled with gasolene and tested for a leak. While the piston is out, examine the piston rings, carefully, and if worn, they should be replaced.

OVER-HEATED ENGINE-if the engine heats up unduly and apparently loses power, the ignition setting should be check to see that it is correct, When the spark is, given too late, the charge in the cylinder is ignited when the compression is low so that the mixture burns slowly and causes the engine to labor. Heating up of the engine may also be caused by the use of poor lubricating oil.

An over-heated piston may be caused by poor circulation of the cooling water or by a deposit of lime or mud in the water jacket. Such a deposit may finally bake and become hard and retain enough heat to cause premature ignition.

POUNDING NOISE.

CYLINDER TROUBLES--If there is a pounding noise in the cylinder, look for;

Premature ignition.
Too early ignition.
Badly worn or broken piston rings.
Badly worn piston.

PREMBTURE IGNITION--Premature ignition is indicated by a pounding noise in the cylinder· and is caused by a red-hot deposit in the cylinder, improper mixture, or over-heated cylinder.

A projecting point of iron or a sooty carbon deposit in the cylinder may become red-hot and ignite the charge too early (before the ignitor is tripped).

To overcome premature ignition examine the cylinder, and if a deposit is found, remove it and clean the cylinder thoroughly.

TOO EARLY IGNITION - (See page 15,

BADLY WORN OR BROKEN PISTON RINGS - If there is a barking noise in the cylinder, it indicates the escape of the expanding gas past the piston rings. If the piston rings are worn to this extent, they should he carefully expanded or replaced by new ones well fitted into their grooves so that they bear on the cylinder wall at all points of their circumference.

BADLY WORN PISTON--A badly worn piston will also allow the expanding gas to escape and cause a barking noise as described above. The only remedy in such a case is to have the old piston replaced by a new one. If the engine is old, the cylinder will probably be worn out of` round, and require re-honing, and a piston of special size, or replacement.

PARTS THAT MAY NEED ADJUSTMENT--Not every pounding noise or thumping about an engine in operation indicates that there is trouble in the cylinder. Such a noise may be caused by parts that need adjustment - i.e.

Loose piston pin bushing.
Loose crank pin bearing.
Loose fly-wheel key or pulley on the crank shaft.
Lost motion in any bearing, gear, or in the governor.

Examine all these parts carefully, and tighten all loose nuts.

A loose fly-wheel or fly-wheel key is indicated by a thumping noise, and frequently a sort of metallic or grating sound. To discover which key or wheel is loose, hold one fly-wheel tightly, and then move the other one backward and forward.

To remedy such trouble, drive the flywheel key in tightly. If it will not tighten sufficiently, put a thin piece of tin under the fly-wheel key, the same width as the keyway, and then drive both the key and the piece of tin into place.

HOW TO ADJUST GOVERNOR.

See diagram, Page 23. When the engine is started it continues to ignite until the normal speed is reached, when the governor weight (which is in the flywheel) goes out, forcing the shoe on the weight arm against the detent shoe. This in turn forces the hardened steel detent under the hardened steel catch block on the exhaust rod

As soon as the engine falls slightly below normal speed, the governor weight will be drawn toward the hub of fly wheel by the governor spring, at once releasing the detent, which will go back to its original position by aid of a small compression spring under the detent casting. When this is done, the roller on the exhaust rod comes in contact with the cam on cam gear, and the engine again makes its complete cycle by taking in a charge of air and gasolene, compressing, igniting, exploding and exhausting the burned gases.

This will continue until the speed of the engine is slightly above normal, then the governor again acts as above explained.

The point of the detent should clear the detent catch block 1/32" in both directions.

To make vertical adjustment of detent, loosen lock nuts on bolt (A) passing through detent casting and move detent in direction desired. To make horizontal adjustment of detent, loosen cap screws (B) holding detent and slide detent in direction desired.

After making such adjustment, be sure to tighten the lock nuts and cap screws securely.

When the speed regulating lever is in horizontal position the governor is set at lowest speed, at which time there should, be 1/16" clearance between the governor weight shoe and the detent casting shoe when the governor weight is resting against the hub of the fly wheel.

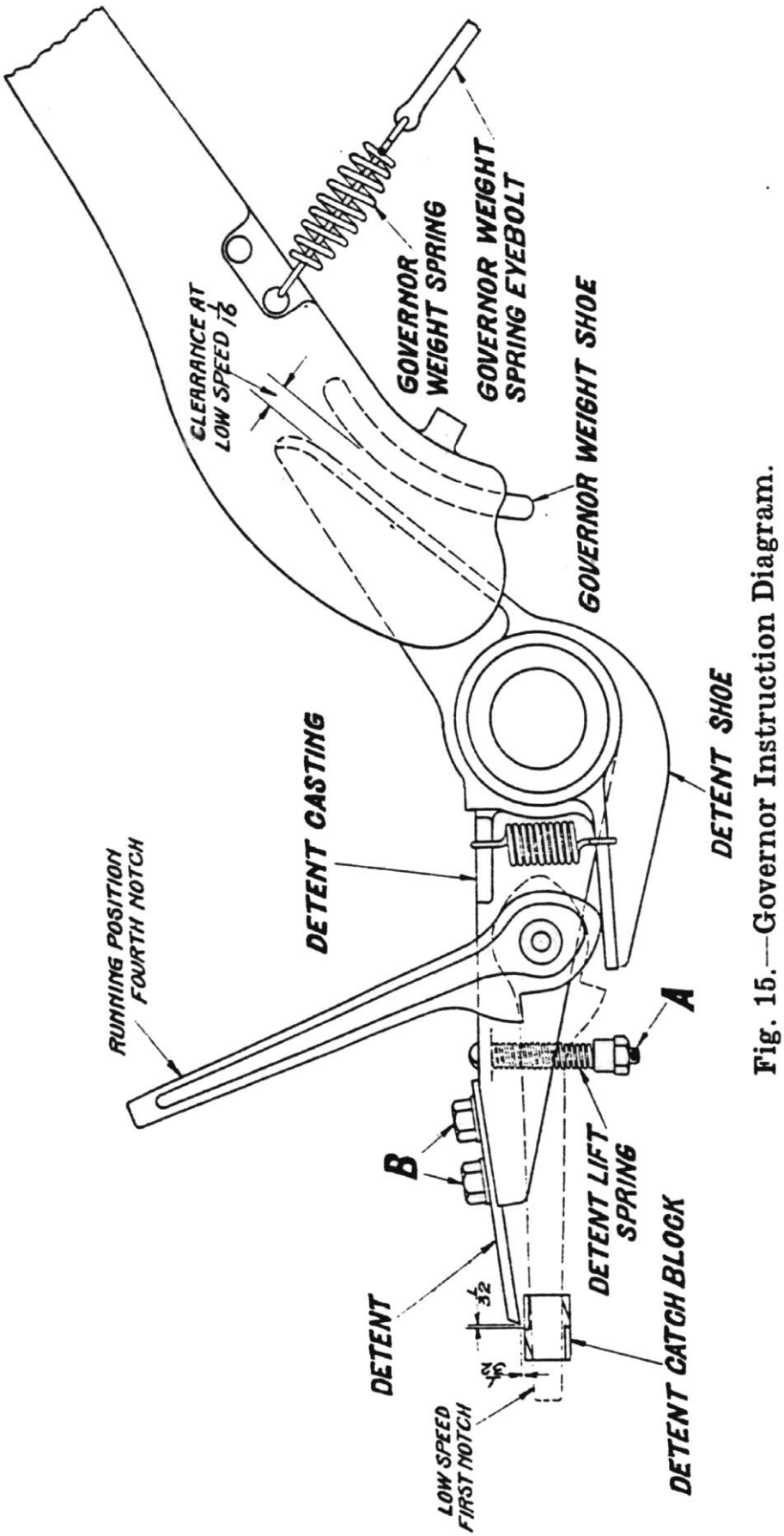


Fig. 15.—Governor Instruction Diagram.

To increase speed of engine, raise speed regulating lever from horizontal to vertical or upright position until proper speed is secured. **The engine will run at normal or rated speed when the speed regulating lever is set at an angle of about 60 degrees above the horizontal position, or in the 4th notch upward.**

Make sure that the governor weight spring eyebolt is adjusted so it is possible for the governor weight shoe to strike the detent shoe when the speed regulating lever is in vertical position; if not so adjusted, the engine will run too fast on high speed. If the governor weight shoe does not touch the detent casting shoe, the tension on the governor weight spring in fly wheel should be relieved until it does. To make this adjustment unscrew lock nut at end of governor weight spring eye holt and be sure to tighten the lock nuts securely after making the adjustment. The governor weight spring should be under initial tension, with governor weight at rest when not running.

HOW TO GRIND A VALVE

A valve needs grinding if it does not show a good bright surface all around. To grind a valve, remove the cylinder head, take the lock nut and spring from the valve stem; lift out the valve and examine the valve seat. Then apply lubricating oil to the valve seat, sprinkle emery dust on the seat, and drop the valve head into the value seat. Insert a brace or screw driver into the slot on the valve head, and turn the valve head back and forth in a quarter circle, occasionally lifting the valve, and giving it a half turn.

It is well to clean off the seat after one application of oil and emery, and then repeat the operation.

After you have secured a good seat, wipe the valve head and stem, as well as the seat and the guide in which the valve stem works, free from emery, oil and grit. Then return the valve head to its seat, and adjust the valve spring.

HOW TO CUT A GASKET

Do not use packing that has been broken by folding. The thickness of packing to use is 1/16" for cylinder heads and ignitors, and 1/32” for mixers and exhaust flanges.
Fibre sheet packing or asbestos is the most economical to use.

Place packing over the piece or casting to receive the gasket and with a machinist’s hammer cut it by striking around the edges of the casting. If there are any holes in the casting, the packing around the edge of the holes should be struck with the ball end of the hammer. Before putting the gasket on, it is well to see that it is oiled, using, preferably, linseed oil.

Every bit of the old gasket should be removed before putting on the new one.

Care should be used in tightening up the nuts on the studs holding the part being gasketed to see that they are tightened uniformly before the engine is started, and again while it is running, an as soon as it has cooled off.

SPARK ADVANCE

All Triumph engines above two horse-power are provided with a spark advance, which consists of an eccentric clip, clamped around the exhaust rod under the rear end of the ignitor trip (see No, 159, Fig.12, page-12),

In starting the engine, the lever of spark advance should point straight outward from the exhaust rod.

When the engine Is running, the lever of the spark advance should hang straight downward.

TO START ENGINE BY CRANKING - Before attempting to start engine, make sure that the nuts holding the cylinder head to cylinder are tightened.

Repeat this the first few times the engine is allowed to become cold. Attention to this will prevent annoyance from leaks and blowing out of gaskets. See that all moving parts work freely. See that the wiring is correct, as shown in diagrams on pages 11 and 16.

Fill oiler on top of cylinder, and regulate to pass about ten drops per minute.

See that the grease cups are full and turned down at least one full turn.

See that lever of spark advance is (see Fig. 12 page 14) points straight toward fly wheel in a horizontal direction. J

Close switch at battery box (No switch used with magnetos).

Close damper in air pipe.

Open needle valve one or two full turns until engine has taken two or three explosions and then close to running mark, as indicated on needle valve dial.

Take hold of the starting handle in fly wheel (furnished on engines 1 to 6 H. P.) and give the engine a quick turn (in the direction of the hands of a clock) until explosion occurs in combustion chamber (which generally requires from two to three revolutions).

The engine should now be on the governor and ready for work.

Be sure that the damper in air pipe is opened-after the engine is running.

TO START ENGINE BY BACKING AGAINST COMPRESSION,

Especially adapted for 4 H. P. and larger engines.

Before attempting to start, see that the wiring is correct, as shown in diagrams on pages 11 and 16.

See that all moving parts work freely.

Fill oiler on top of cylinder and regulate to pass about ten drops per minute. See that grease cups are full and turned down at least one full turn.

See that spark advance lever points toward fly wheel in a horizontal direction.

Let the crank be in any position.

1. Open the lever·-hand2ed starting cup on top of the cylinder head, and turn fly wheels in direction of rotation until magneto and ignitor have tripped. The crank is now at the inner dead center.
2. Close the starting cup.
3. Open needle valve to one-half turn past the running mark indicated on needle valve dial.
4. Fill starting cup about two-thirds full of gasolene when engine is cold, and about one-half full when engine is warm.
5. Now open starting cup and draw the charge into the cylinder by turning the fly wheel over until the crank is nearly to the outer dead center, then close the starting cup.
6. Squirt a little gasolene into the opening of the mixer elbow and close the damper in the air pipe.
7. Raise the starting level on the magneto to its highest point, where it will stay.
   This sets the magneto in the starting position.
8. Now put the right foot on the most convenient spoke in the fly-wheel, take hold of an upper spoke and pull fly wheel back against the compression as far as possible by a quick, hard pull and immediately take foot off from the fly wheel so as not to be caught in the fly wheel when the first ignition occurs. This ignition happens when the crank shaft is about 60 degrees above the inner dead center. At this point the magneto is tripped automatically by the use of the slight depression at the proper point in the cam. When the starting lever on the magneto is raised to its highest position the magneto is in a position to by tripped automatically when the engine is pulled back against compression. The instant the ignitor trip engages the ignitor hammer the magneto starting lever automatically drops out of the way, and remains there until the engine is to be started again. After the engine has

once started, the magneto will operate only at the proper time for igniting the regular charge, as the depression in the cam is not deep enough to cause the ignitor to engage except when the magneto is thrown in the starting position by the use of the starting lever mentioned above.
9. After engine is started, see that the spark advance lever hangs straight down from the exhaust rod to which it is attached. Close the needle valve to the running mark shown on the dial and be sure that the damper in the air pipe is open by having the flat handle parallel to the length of the pipe. A few trials will enable one to start the engine readily in this way.

TO STOP ENGINE

Close needle valve tightly, and open switch at battery box,

Turn off oiler on top of cylinder.

When engine is almost stopped, open starting cup above ignitor so that the last few strokes of the piston through cylinder will drive out burnt gases, and have the cylinder clean for a new charge of fuel when ready to start again

During cold weather it is **very important** that the cooling water be drained from the hopper and around the cylinder after each and every run. Failure to do this is likely to result in a cracked cylinder.

See that the valves are left closed so as to prevent corroding of the valve seats and injury to the inside of the cylinder.

It is advisable to squirt a few teaspoonfuls of kerosene into cylinder at the end of each run, while the engine is still hot, as this loosens the gummy deposits around the piston rings, and helps top keep them tight.

GENERAL CARE OF ENGINE

So far as possible, one man only should be held responsible for the care and running of an engine.

Cleanliness is of great importance. Unless the engine is handled carefully, it cannot be expected to do its work properly.

When an engine is run regularly every day, the piston and valves should be removed from the cylinder, and those parts, as well as the cylinder, should be washed with kerosene or gasolene at least every three months. When kerosene or some other heavy fuel is used, they should be washed even more frequently.

The piston rings should be carefully inspected to make sure that they work freely before replacing the piston in the cylinder. If the valves, particularly the exhaust valve, show even a small amount of wear, they should be ground to a good seat, (See "How to Grind Valves" (page, 20.) The ignitor should be removed about once every week, and the points cleaned with sand paper or a fine file. The ignitor is accurately adjusted and timed before shipment is made from the factory, but this timing should be examined frequently to make sure that it has not changed, (See "Timing Ignitor," page 12.)

When running at short intervals, the conditions under which the engine is to operate will determine the number of times it must be cleaned each season**. To give proper results, an engine should never be allowed to stand more for more than six months without being dismantled and thoroughly cleaned.**

OILING THE ENGINE – **In starting** the engine, see that all the oil holes have been cleaned out before filled with oil.

Use only a good grade of gas engine oil in cylinder lubricator (see sample can of oil furnished with each engine). The use of cheap oil is poor economy as it burns with a heavy carbon residue which collects over the working parts, gumming them up, and often causing the engine to overheat and pre-ignite. (See "Premature Ignition" page 21.)

Use engine oil or any **good** machine oil on all parts, except the cylinder, needing lubrication.

See that the oil pipe leading from the cylinder lubricator to the cylinder is clean so as not to stop the flow of oil.

OPERATION, CARE END ADJUSTMENT OF OSCILLATING MAGNETO.

The ignition current is generated by a magneto in which the armature moves backwards and forward between the pole shoes of the permanent magnets. This movement of the armature is produced by an ignitor trip on the engine which pushes the trip lever end of the combination trip and break lever through an arc of approximately 30 degrees. When the lever end trips over the ignitor trip, the springs pull the armature back to a neutral position so quickly that the break lever recoils and the break lever end strikes abruptly separating the ignitor points at the peak of the current wave? producing a hot spark.

The ignitor points are normally closed, except for the abrupt separation for ignition.
This is exactly opposite of the ordinary battery ignitor where the ignitor points are normally open. Owing to the closed points, batteries cannot be connected to the oscillator ignitor without making some changes.

Do Not Take the Magneto Apart. By this we mean, do not remove the armature or take off the magnets.

Each magneto bearing should receive two or three drops of light machine oil every third day. The movable electrode of the ignitor should be oiled with light machine oil; if it sticks wash it with kerosene. Check up the timing occasionally to see that it is correct.

To adjust magneto:

1. See that there is 3-32" clearance between the movable electrode lever of the ignitor and the upper leg of the oscillator in its neutral position. This distance might vary or change due to sticking of movable electrode of ignitor or wearing of ignitor points; to remedy, loosen movable electrode and drive ignitor points through electrodes the necessary- distance to offset wear.
2. Turn the engine in the direction of rotation until the exhaust rod is at the extreme point of travel toward the crank shaft, at which point the crank until he about 20 degrees below outer dead center on the compression stroke.
3. Unscrew the adjusting screw in the ignitor trip holder, so that the ignitor trip holder will rest against the spark advance lever, which hangs straight down from the exhaust rod.
4. Adjust ignitor trip by screwing it in or out of the ignitor trip holder until there is 1/8” clearance between the ignitor trip and the lower leg of the oscillator, except on 1, 1¾ and 2½ H. P. engines, where this distance should be 1/16".
5. Turn the engine in the direction of rotation until the point of ignition is reached, which is between 15 and 25 degrees below inner dead center on the compression stroke.
6. Then screw down adjusting screw in the ignitor trip holder until the oscillator of the magneto trips.

INSTRUCTIONS FOR OPERATING ON KEROSENE.

1, 1¾ and 2½ HP ENGINES - The kerosene attachment, as provided on 1, 1¾ and 1½ HP engines, consists merely of a cup attached to the cylinder head, for the storage of

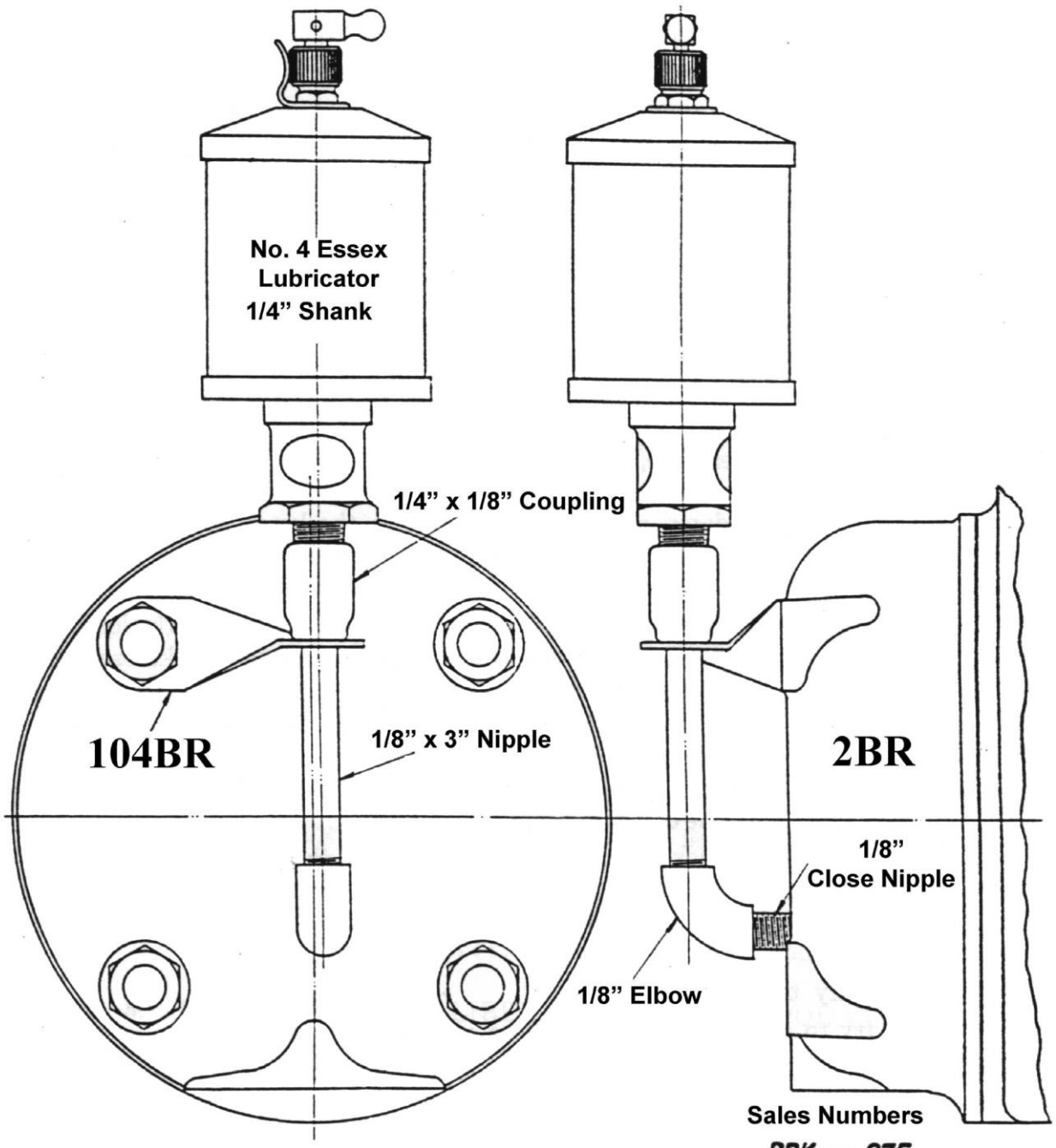


Fig. 16. - 1, 1¾ and 2½ h.p. (BRK) Kerosene Attachment.

Sales Numbers

BRK — 275
BRTK — 284
BRSK — 279
BRSTK — 288
BRMK — 278
BRTMK — 287
BRSMK — 282
BRSTMK — 291

sufficient gasolene for starting and warming up engine. No pre-heater is used or necessary, (See Fig. 16, page 23.)

Fill the cup on cylinder head with gasolene and the regular fuel tank with kerosene.

Close needle valve.

Pour only sufficient water in hopper to cover cylinder so as to heat up cylinder as quickly as possible.

Start engine on gasolene, feeding it by adjusting screw on top of cup, under load until about two-thirds of gasolene is used.

After engine has warmed up open needle valve about two full turns, gradually closing off the gasolene. This will flood the engine with kerosene and show a very black exhaust. Gradually turn off the needle valve until engine is running with a clear exhaust, at which time the needle valve should be open about one-quarter turn.

This whole operation can be performed in from six to eight minutes.

4 H. P. AND LARGER ENGINES -The kerosene attachment as furnished on 4 H. P. and larger Triumph line engines includes a kerosene mixer with gasolene starting tank cast; integral, a pre-heating drum to furnish hot air for light loads, and a water spray needle valve located in the head, which draws water from the cooling jacket and introduces the spray directly into the inlet passage. (See figures following.)

To start the engine on kerosene, fill the gasolene starting chamber with good gasolene, and open gasolene needle valve (G) to the running mark as indicated on the needle valve dial. Close both air pipe dampers, and make sure that the kerosene needle valve (K) and water valve (W) are closed. Proceed to start the engine in accordance with instructions given on page 25.

Having started the engine, open the hot-air damper at once and put on the load. Run the engine on gasolene for ten or fifteen minutes, then gradually open the kerosene needle valve (K) and close the gasolene needle valve (G). If the engine then does not operate smoothly on kerosene, it is not warm enough, and should be run a little longer on gasolene.

As the engine becomes hotter, or as the load increases, it will be necessary to gradually cut off the hot air and open the cold air damper accordingly.

To prevent the heavy knock which always accompanies the explosion of a charge of kerosene gas when engines are under load, open the water valve (W) about one-fourth turn. This valve should be opened the least possible amount to produce a smooth running engine.

Observe Carefully the following:

1st. Don't try to switch to kerosene before engine is hot.

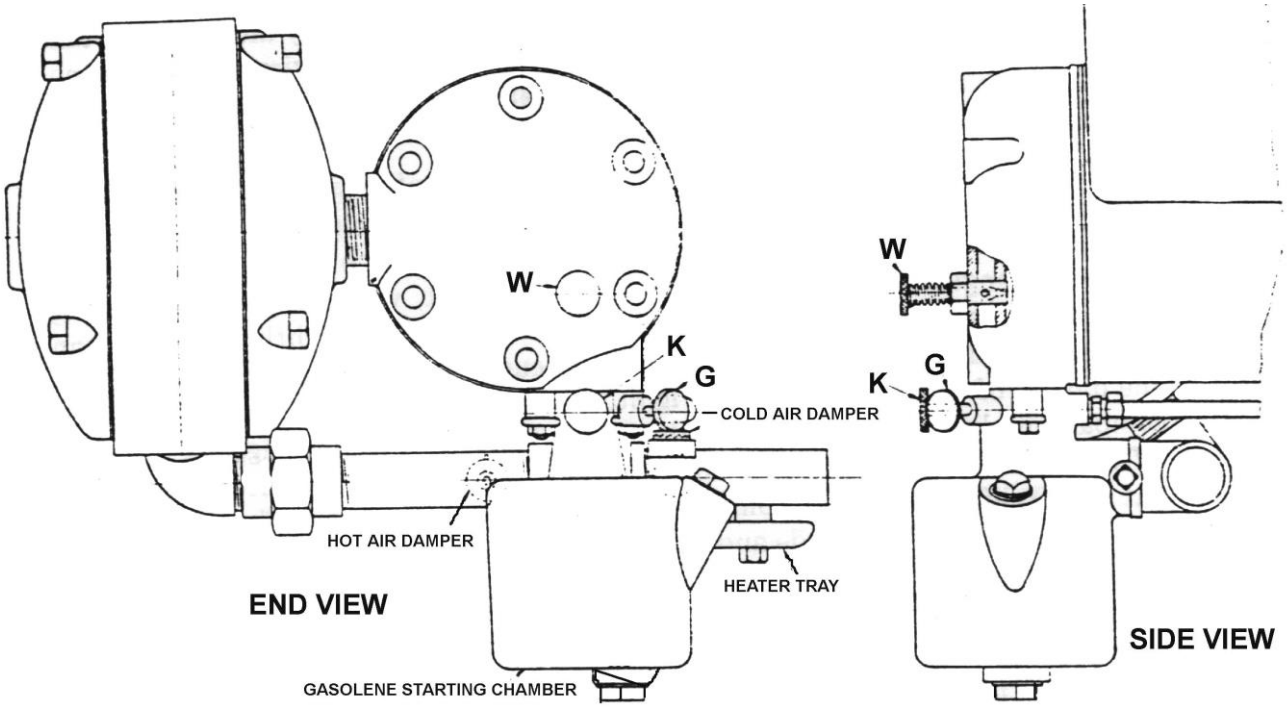
2nd. As load increases or as engine becomes hotter, more cold air and less hot air will be required.

3rd. Use just enough water through water needle valve to produce smooth operation.

When hot air is used on heavy loads more water will be required to deaden the knock than if cod air is used.

4th. In cold weather it may be necessary to burn a little gasolene in the heater tray under the cold air pipe. If the engine is turned over slowly in the direction it runs, with the inlet valve held open, enough hot air will be drawn into the cylinder to insure easy starting, even in the coldest weather.

5th. Always remember to close the water needle valve before stooping the engine.



KEROSENE ATTACHMENT FOR 4 - 6- 8 HORSEP[OWER TRIUMPH ENGINES **Fig. 17.**

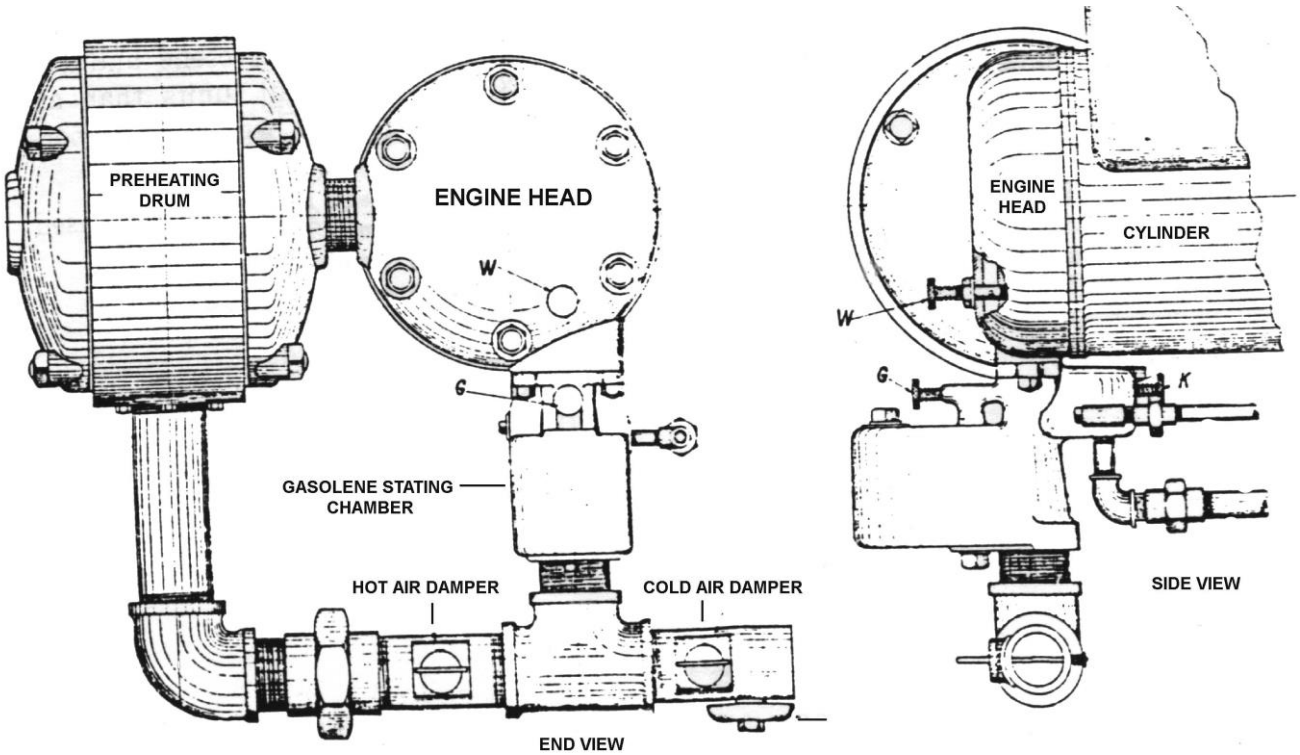


Fig. 18. Kerosene Attachment for 4hp and Larger Engines

FUELS

The names "Gasolene," "Kerosene," "Benzine," "Naphtha," etc., often refer to practically the same product, as the ordinary trade names do not necessarily indic3te a certain fixed product. Naphtha as sold today is usually cheaper and heavier than gasolene.

Gasolene as found in country stores is usually heavier than that found in the cities. The bulk of it is much heavier than the gasolene of ten years ago.

Kerosene remains at about the same weight per gallon year· after year. About one-half of our crude oils are refined into kerosene or distillate, from five to eight gallons being produced for each one of gasolene. The heavy demand on the gasolene supply is causing the poor quality that engine owners are now complaining about, which is rapidly bringing about the use of kerosene as fuel. Distillate from the Southwest is slightly heavier than kerosene, and is used widely as a fuel for traction engines. The heavier the fuel, the greater the danger of causing corrosion on ignitor points, cylinder walls, etc. The usual way to compare qualities is by comparing the weight of fuels with the weight of an equal amount of water, although this test does not always distinguish good fuel from cheap fuel on account of the difference in the composition of crude oils from the different oil fields, and the practice of mixing low-grade and high-grade gasolene.

Owing to the small supply of gasolene produced as compared with tile amount demanded, the tendency is to make it heavier by distilling off some of the heavier oils with it in order to supply the demand. Engine owners, therefore, need to be careful to obtain the proper mixture for, good combustion.

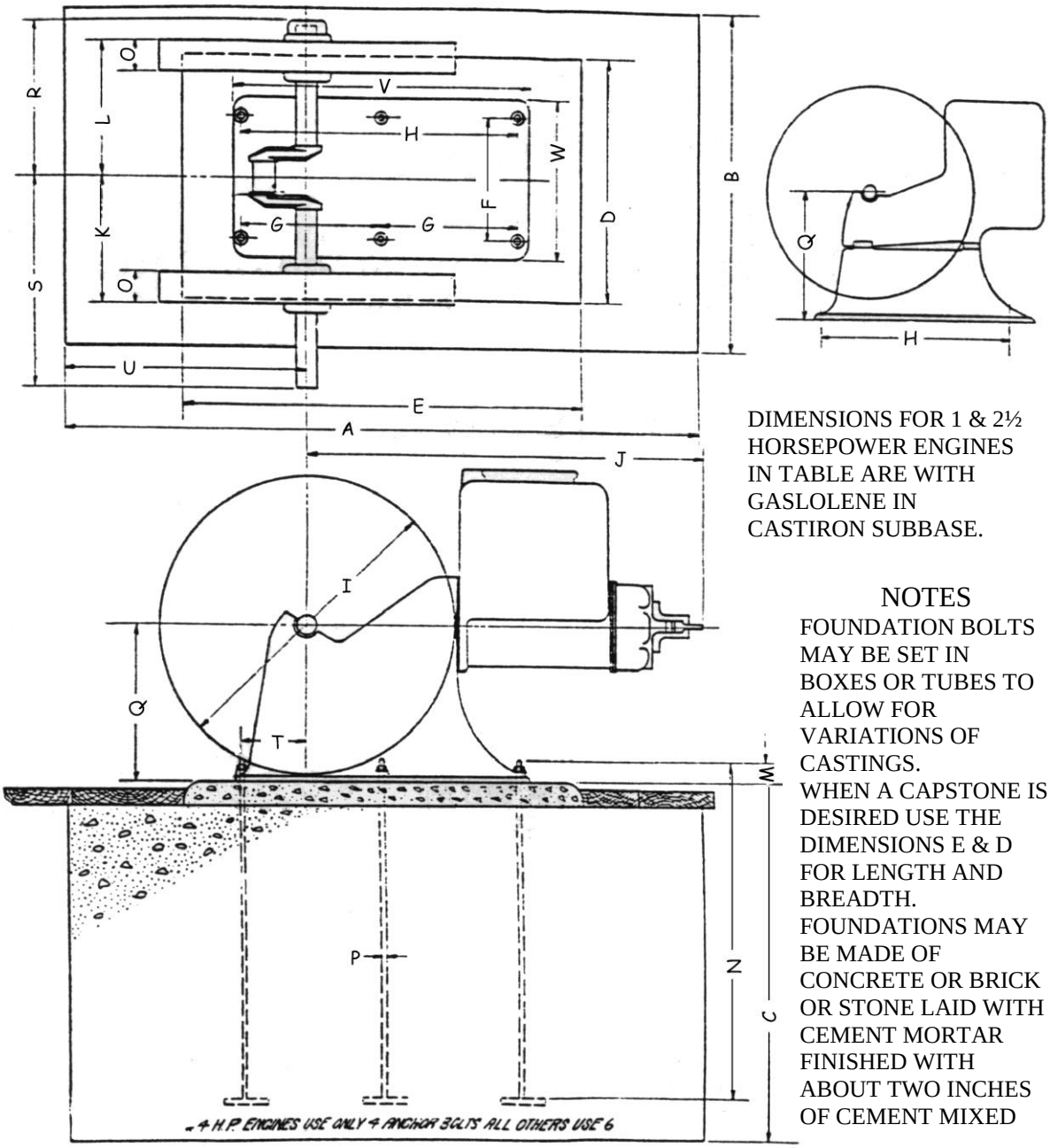
The large oil companies now realize that the heavier fuels: give trouble in starting when used in internal combustion engines, so they are now putting out what is termed a “winter” gasolene and a "summer" gasolene, The winter gasolene, being a little higher grade, contains more of the lighter grades of gasolene which are easily evaporated in cold weather.

It is the common belief that because gasolene is more easily evaporated and ignited than kerosene, it gives more power, but the reverse is true. Kerosene and the lower-grade oils such as distillate, solar oil, etc., contain more heat units than an equal amount of gasolene, and in a properly-designed engine they will give proportionately more power.

"R & V" kerosene attachments should be specified when engines are purchased for use with kerosene and similar distillates.

R & V ENGINES - R TRIUMPH LINE

ROOT & VAN DERVOORT ENGINEERING CO, EAST MOLIONE, ILL.



DIMENSIONS FOR 1 & 2½ HORSEPOWER ENGINES IN TABLE ARE WITH GASLOLENE IN CASTIRON SUBBASE.

NOTES

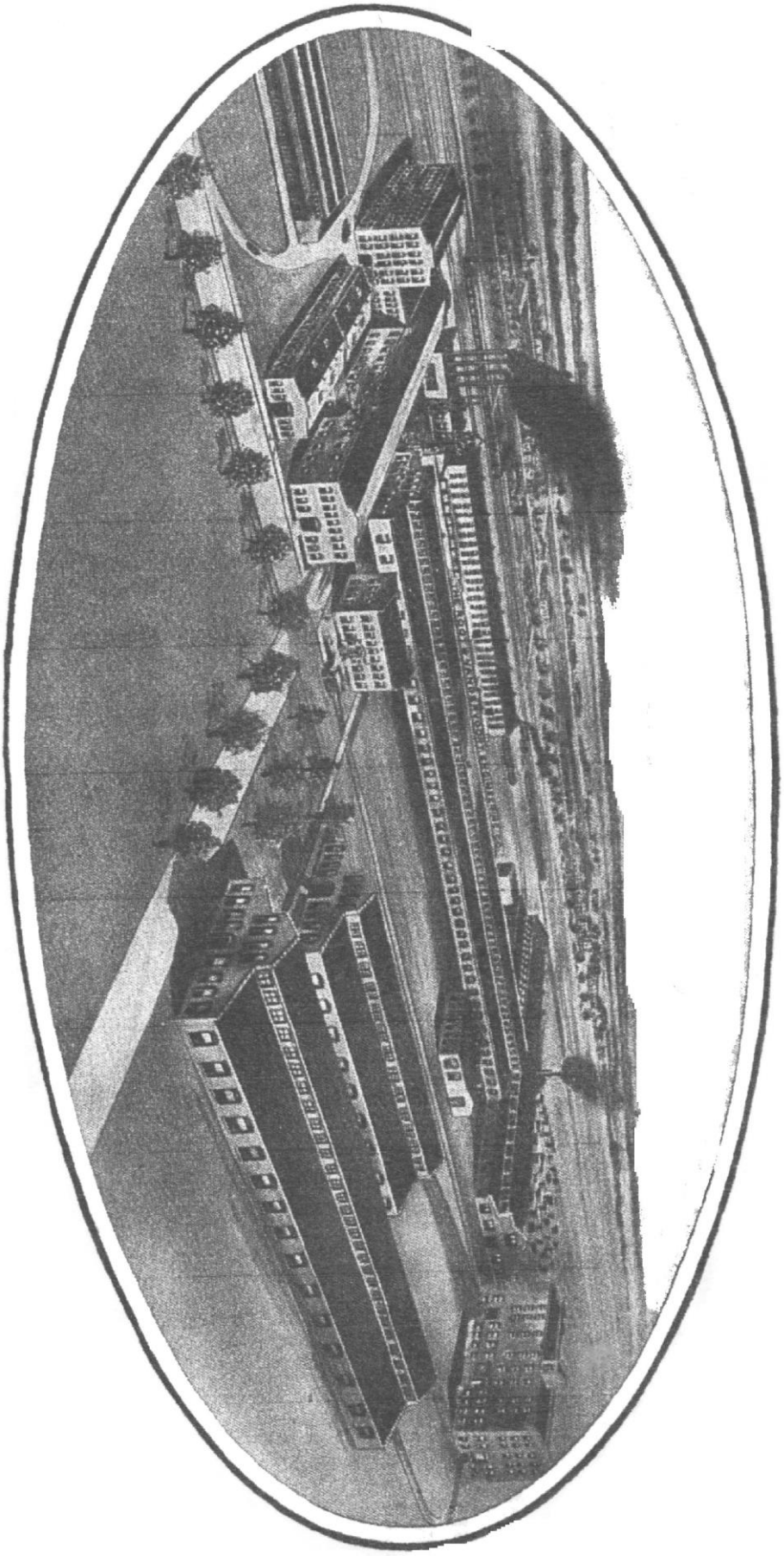
FOUNDATION BOLTS MAY BE SET IN BOXES OR TUBES TO ALLOW FOR VARIATIONS OF CASTINGS.

WHEN A CAPSTONE IS DESIRED USE THE DIMENSIONS E & D FOR LENGTH AND BREADTH.

FOUNDATIONS MAY BE MADE OF CONCRETE OR BRICK OR STONE LAID WITH CEMENT MORTAR FINISHED WITH ABOUT TWO INCHES OF CEMENT MIXED

DIMENSIONS IN INCHES

HP	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1						7¼		16	17½	19¾	6 5/8	8			1⅝	⅜	10½	8 9/16	11¾	4			PJL
1¾						7¼		18	18	22¾	7 7/16	8 5/8			2	⅜	11½	9 11/16	12½	4 5/8			
2½						7¼		19 7/8	20½	23 1/8	7 11/16	8 7/8			2¼	7/16	13	9 11/16	13 1/8	4 7/8			
4	54	28	34	20	36	12		28	29¾	33¼	10 5/16	11 3/16	2	30	2 3/8	½	16¾	13 13/16	17½	7¼	20½	31	15½
6	60	30	40	24	46	18 3/8	16 5/8	33¼	34	40	11 5/8	12 3/8	2	30	3	½	19 7/8	15 1/8	19 13/16	6¾	21½	39¼	18
8	66	32	42	24	50	16½	18½	37	40	43¼	12	13 7/8	2	30	3	½	22¾	16¾	20⅝	7½	25	43¾	18
10	70	36	45	26	54	18	20	40	44	44 5/8	12½	14 3/8	2¼	30	3	½	25	17 3/8	21⅝	8½	26	46½	19½
12	76	38	48	28	60	19¾	23	46	48	49½	13 1/8	15¼	2¼	36	3	⅝	27	18 3/8	22¾	11	28½	52½	21½
16	84	42	50	34	66	20	25	50	51¼	58¼	15	16	2½	44	3 5/16	¾	28¼	19¼	26	12	30	56½	22
20	108	48	60	42	78	28	29	58	59	63	18 7/8	19	2¾	44	4 3/8	¾	32½	22½	28	13	38	65	30



R&V Engine Register

Contact Registrar:

Peter Lowe
16 Church Street
Maclean, 2463
Australia
+61 0449161753
ozengines@gmail.com