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MAGNETIC INDICATOR FOR MULTI-CYLINDER ENGINE VALVE SETTING

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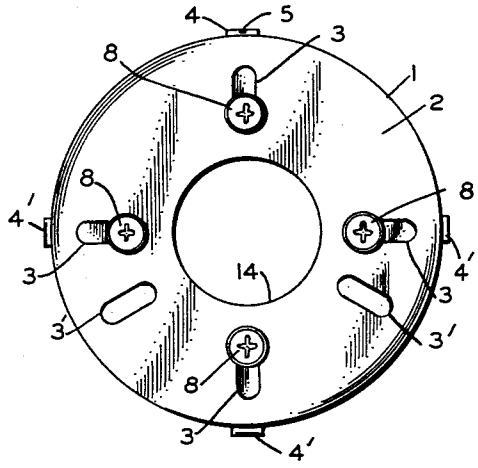


FIG. 1

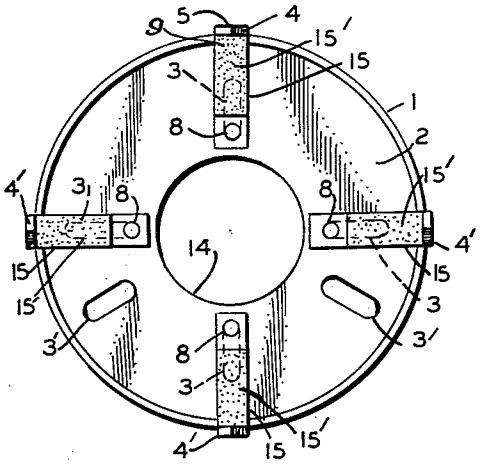


FIG. 3

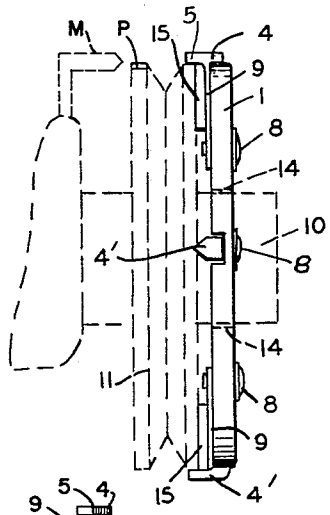


FIG. 2

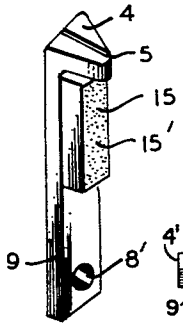


FIG. 4

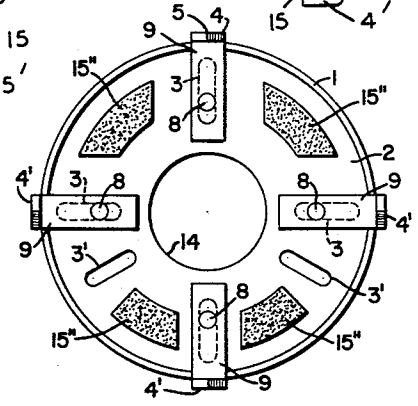


FIG. 5

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MAGNETIC INDICATOR FOR MULTI-CYLINDER ENGINE VALVE SETTING

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This invention relates to multi-cylinder internal combustion engines, and particularly to means for quickly determining the exact dead center at the top of the stroke in each successive cylinder as a prerequisite to accurately setting the valves so that they will open at the precise advance time desired. In high speed engines such as used in automobiles and airplanes it is important that the valves be very precisely adjusted to insure smooth and rhythmic operation, as any irregularity may induce roughness and vibration.

Under modern production and distribution methods for automobiles, the cars are assembled at the factory and shipped without road tests, and are later generally rechecked by the mechanics in the dealer's garages before being sold. Because of its importance to smooth operation, the valve timing is usually verified as part of the rountine dealer's check-up, or later if roughness develops in the engine. For that purpose, each engine block as it comes from the manufacturer is provided with a dead center mark M to match with the corresponding mark P relating to the crankshaft position when the piston of the No. 1 cylinder is at the exact upper dead center of a stroke. Thus without removing the cylinder head a mechanic can set the crank at the zero position from which to adjust the proper lead or advance setting for opening the valve.

In practice it is sometimes difficult to see the factory marks, and it is not easy to make sure that the successive dead center positions for the other cylinders are precisely correct when setting their valves. The principal purpose of the present invention is to provide a device that can be quickly and conveniently applied at more accessible portions of the engine, such as the front side of the fan pulley wheel for example, without the use of tools, so that a mechanic can go quickly to work on the timing and be sure that the successive settings of the crankshaft used are precisely correct. Previous indicators, while capable of giving correct settings, have generally had to be built on the engine or attached by bolts or screws.

The device of the present invention can be readily applied and turned by hand to the exact initial position desired, since it is held on by magnetism; and when once set for the No. 1 cylinder it indicates the proper setting for all the other cylinders also. The settings are clearly visible on a disk easily seen by the mechanic. This results in a considerable saving of time and generally better adjustment. The indicator has no delicate parts and can be manufactured at considerably less cost than some of the more complicated prior devices; furthermore, there are no costs of installation. Since the hole in the center of the indicator disk does not have to fit precisely on the crankshaft, the same indicator is adaptable to quite a variety of sizes. Other practical advantages will become apparent as the description proceeds.

Referring now to the drawings forming part of this specification,

FIG. 1 is a front elevation view of the indicator disk as applied to an internal combustion engine.

FIG. 2 is a side view of the same, showing how it can be magnetically attached to an element on the crankshaft, such as a fan pulley wheel.

FIG. 3 is a rear view of the indicator disk and magnets.

FIG. 4 is a detail perspective view of one of the indicator pointers and its holding magnet.

FIG. 5 is a rear view showing annular ring type magnets instead of radial magnets.

Similar reference numerals refer to similar parts thruout the various views.

Referring now to FIG. 1 and FIG. 2, the indicator device **1** has a main face plate or disk **2** preferably made of thin sheet aluminum or other suitable material, the disk **2** being provided with four slots **3** at 90° intervals from each other and with two other slots **3'** located at 120° from one of the slots **3** at which a principal pointer **4** is located. This spacing permits the device to be used on engines having four, six, eight or twelve cylinders as will be described later.

Besides the principal pointer **4** for the No. 1 cylinder, that pointer having a setting mark **5**, there are three other indicating pointers **4'** which are similar to the pointer **4** though without the mark **5** provided for the No. 1 cylinder. When these pointers are set at 90° intervals in the slots **3** they can be used with four or eight cylinder engines. When the pointers are set in the slots at 120° from each other the device can be used on six cylinder engines. For twelve cylinder engines additional pointers at 60° may be provided.

The pointers **4** and **4'** can be adjusted radially and peripherally by using the screws **8** that hold them in place. Each pointer has a radial extension or arm **9** having a threaded hole **8'** for a screw **8** so that the arm **9** and its pointer can be adjusted radially to fit some part on the crankshaft **10** such as a fan pulley wheel **11** for example. The disk **2** has a central opening or hole **14** which is sufficiently large to permit the device to be used on crankshafts of various diameters, since it does not have to fit them tightly. The pointers **4** and **4'** which extend somewhat axially from the arms **9** are thus easily adjustable for various diameters of pulley yet do not extend so far as to interfere with the pulley belt. They may be similarly adjusted to any other part carrying the dead center marking of the engine.

Previous indicators constructed for this general purpose have usually been attached by some mechanical means such as screws, bolts, nuts, etc., requiring considerable time to apply and often some modification of an engine part. The present indicator requires no such preliminary work, being held in place magnetically, and the mechanic can go to work immediately on the valve timing operation itself.

Referring now more particularly to FIG. 3 which is a rear view of the indicator disk and magnets, the disk can be affixed to any convenient part of the crankshaft **10** such as a fan pulley **11** for example as shown in FIG. 2. The magnets **15** as shown in FIG. 3 are preferably mounted on the arms **9** or other convenient portion of the disk **2** so that they can come directly in contact with the iron pulley **11** or other part of the crankshaft assembly susceptible to magnetism. The magnets **15** are preferably provided with a light coating **15'** of thin rubber cement or other material having a relatively high coefficient of friction to assist in preventing the magnets from slipping on the pulley when the engine is suddenly started up. Such friction material is not of course intended for permanent cement to any one particular position, as the disks must be adjusted. Instead of individual magnets, any other magnetic means such as for example an annular ring type around the hole **14** may be employed. Such an annular arrangement is illustrated in FIG. 5, in which the magnets **15''** that hold the disk **2** in place are arranged in a ring instead of radially. The magnets **15** as shown in FIG. 3, together with the pointer arms **9** are adjustably secured to the indicator disk **2** by the screws **8** as previously described. FIG. 4 shows the general appearance of the magnet and pointer assembly before attachment to the indicator disk.

The manner of using the device will now be apparent to a mechanic skilled in the art of adjusting internal combustion engines. Most such engines are of the 4-cycle type, and when they have four cylinders a piston reaches the top dead center at every half revolution. Accordingly, after the mark 5 on the principal pointer 4 has been lined up with the dead center mark M—P on the engine for the No. 1 cylinder, a half turn of the crankshaft will bring the opposite pointer 4' to that mark, indicating that the piston of the No. 3 cylinder is at exact top dead center position; another such half turn of the engine will bring the pointer 4 to indicate the exact top dead center for the piston of the No. 4 cylinder; and a final half turn will bring the pointer 4' in position for the No. 2 cylinder. From each of these top center positions the mechanic can adjust and set the proper valve timing lead desired.

Eight cylinder engines may require the use of all four pointers 4', since they fire four times a revolution instead of twice as in four cylinder engines. With six cylinder 4-cycle engines a cylinder fires every 120°, instead of 180° as in four cylinder engines, and accordingly with six cylinder engines two of the pointers 4' are removed from the slots 3 to the slots 3', leaving the principal pointer 4 with its mark 5 in place. For twelve cylinder engines slots at 60° may be provided. In engines where all the cylinders are not in line, and the cylinders are not uniformly distributed, as in the case of some V types, for example, corresponding arrangements of the pointers on the disk may be made and the slots cut accordingly. Where the indicators are to be used on one specific type of engine only the number of pointers and slots may be limited to the number and position required for that particular type; but by using additional slots and pointers the same device can be made and sold for a great variety of engines, and be much more useful to the average garage mechanic. The successive operations of determining top dead center for all the cylinders is similar to the steps above described, as will be evident to a mechanic doing such work.

While I have in the foregoing described certain specific forms by way of example, it will be understood that they are merely for the purpose of illustration to make clear the principles of the invention, which is not limited to the particular forms shown but is susceptible to various modifications and adaptations in different installations as will be apparent to those skilled in the art without departing from the scope of the invention as stated in the following claims.

I claim:

1. A dead center indicator applicable to multicylinder internal combustion engines having a top dead center mark for a No. 1 cylinder thereon, comprising in combination an indicator plate, a primary pointer mounted on said plate, said pointer to be placed at a corresponding top dead center mark on the engine for the No. 1 cylinder, supplemental pointers also mounted on said plate to accord with top dead centers of the other cylinders, and magnets carried by the indicator plate to hold it adjustably in proper position relative to the crankshaft of the engine.

2. A dead center indicator applicable to multicylinder internal combustion engines having a top dead center mark for a No. 1 cylinder thereon, comprising in combination an indicator plate having a central opening sufficiently large to go loosely around a variety of engine crankshafts, a primary pointer mounted on said plate, said pointer to be placed at a corresponding top dead center mark on the engine for the No. 1 cylinder, supplemental pointers also mounted on said plate to accord with top dead centers of the other cylinders, and magnetic means carried by the indicator plate to hold it adjustably in proper position relative to the crankshaft of the engine.

3. A dead center indicator applicable to multicylinder internal combustion engines having a top dead center mark for a No. 1 cylinder thereon, comprising in combination an indicator plate having a central opening sufficiently large to go loosely around a variety of engine crankshafts, a primary pointer mounted on said plate, said pointer to be placed at a corresponding top dead center mark on the engine for the No. 1 cylinder, supplemental pointers also mounted on said plate to accord with top dead centers of the other cylinders, and magnetic means carried by the indicator plate to hold it adjustably in proper position relative to the crankshaft of the engine, said magnetic means having a friction coating to assist in holding it in the proper position.

4. A dead center indicator applicable to multicylinder internal combustion engines having a top dead center mark for a No. 1 cylinder thereon, comprising in combination an indicator plate having slots at angular intervals corresponding to the relative top dead center positions of such engines, a primary pointer mounted on said plate and adjustable in one of said slots, said pointer to be placed at a corresponding top dead center mark on the engine for the No. 1 cylinder, supplemental pointers also mounted on said plate to accord with top dead centers of the other cylinders and adjustable in other slots, and magnetic means carried by the indicator plate to hold it adjustably in proper position relative to the crankshaft of the engine.

5. A dead center indicator applicable to multicylinder internal combustion engines having a top dead center mark for a No. 1 cylinder thereon, comprising in combination an indicator disk having a rim and also having a central opening to permit the passage of an end of the engine crankshaft, radially adjustable pointers extending from the rim of said disk and having tips extending axially sufficiently to fit over the edge of a wheel on the engine crankshaft, one of said pointers being a primary pointer corresponding to the top dead center position of the No. 1 cylinder of the engine, the others of said pointers being mounted on said disk to accord with the top dead centers of the other cylinders of said engine, and holding means actuated by magnetism for causing said disk to adhere to any suitable metallic part of the engine that rotates in accord with the crankshaft, whereby the indicator can be readily applied to and removed from said part.

6. A top dead center indicator applicable to multicylinder internal combustion engines, comprising the combination of an indicator disk having a rim, a central opening in said disk sufficiently large so as to accommodate a variety of crankshaft sizes and be applicable to various makes of such engines, radially adjustable pointers attached to said disk and capable of being extended beyond said rim, said pointers being equally spaced circumferentially around said rim according to the top dead center positions in the various cylinders, and holding elements on said disk for securing it so as to rotate with the crankshaft, whereby when the indicator is set for one cylinder the top dead centers of the other cylinders may be readily obtained.

7. A top dead center indicator applicable to multicylinder internal combustion engines, comprising the combination of an indicator disk having a rim, a central opening in said disk sufficiently large so as to accommodate a variety of crankshaft sizes and be applicable to various makes of such engines, radially adjustable pointers attached to said disk and capable of being extended beyond said rim, said pointers being equally spaced circumferentially around said rim according to the top dead center positions in the various cylinders, and magnetic holding elements on said disk for securing it so as to rotate with the crankshaft, whereby when the indicator is set for one cylinder the top dead centers of the other cylinders may be readily obtained.

8. In a top dead center indicator applicable to multicylinder engines, the combination of a disk having a central opening larger than the diameter of the crankshaft on which it is to be placed, permanent magnets

attached to said disk for holding it in place relative to the crankshaft when top dead center settings are being made, radially adjustable pointers attached to said disk and equally spaced circumferentially around said disk according to the top dead center positions in various cylinders, and an additional friction surface between the magnetic holding means and the part rotating with the crankshaft on which it bears.

9. In a top dead center indicator applicable to multi-cylinder internal combustion engines, the combination of a plate having a hole to loosely surround the engine crankshaft, said plate having four slots surrounding said hole and equally spaced 90° apart, two additional slots equally spaced from one of the aforementioned slots and 120° from each other, pointers capable of being adjusted in said slots to extend radially beyond said plate, and holding means comprising magnets for adjustably retaining the plate in place on the crankshaft, whereby

it can be set to indicate top dead centers of the various cylinders of the engine.

10. For use with the fan pulley wheel on a crankshaft of a multi-cylinder internal combustion engine; an indicator disc having a peripheral rim said disc having a central opening, circumferentially arranged magnetic securing means floatingly attached to said disc and index marks equally spaced around the periphery of said disc whereby the top dead center position of an engine cylinder may be determined.

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