Oct. 20, 1925. 1,558,294

A. I. SANDBO

PISTON POSITION INDICATOR

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FIG. 1.

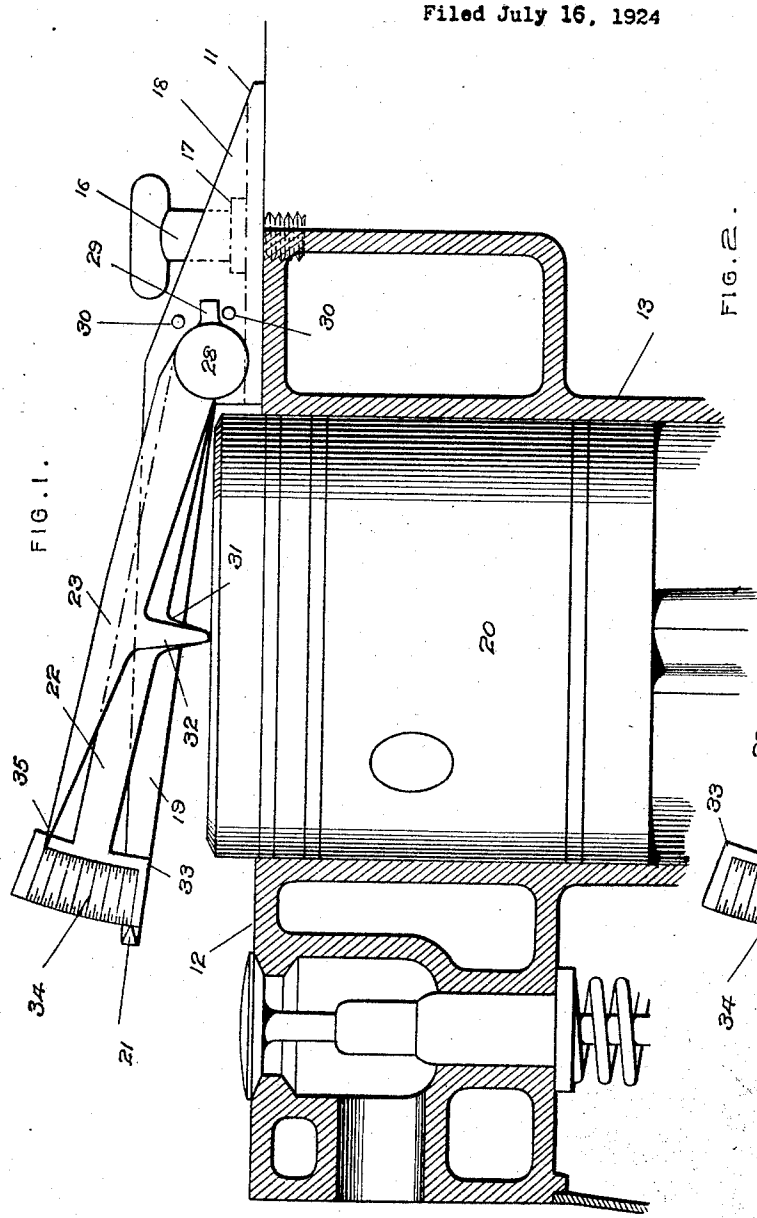


FIG. 2.

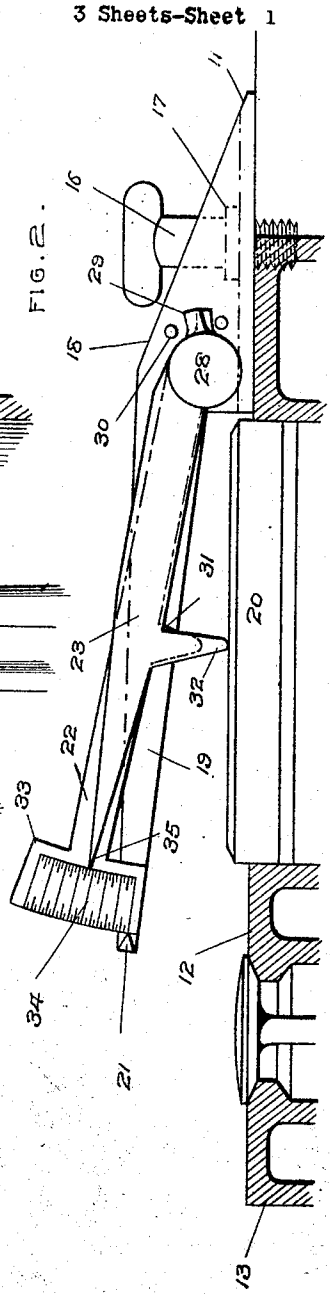
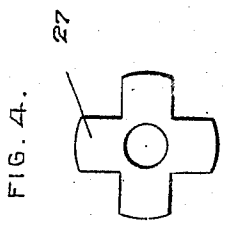


FIG. 4.



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PISTON POSITION INDICATOR

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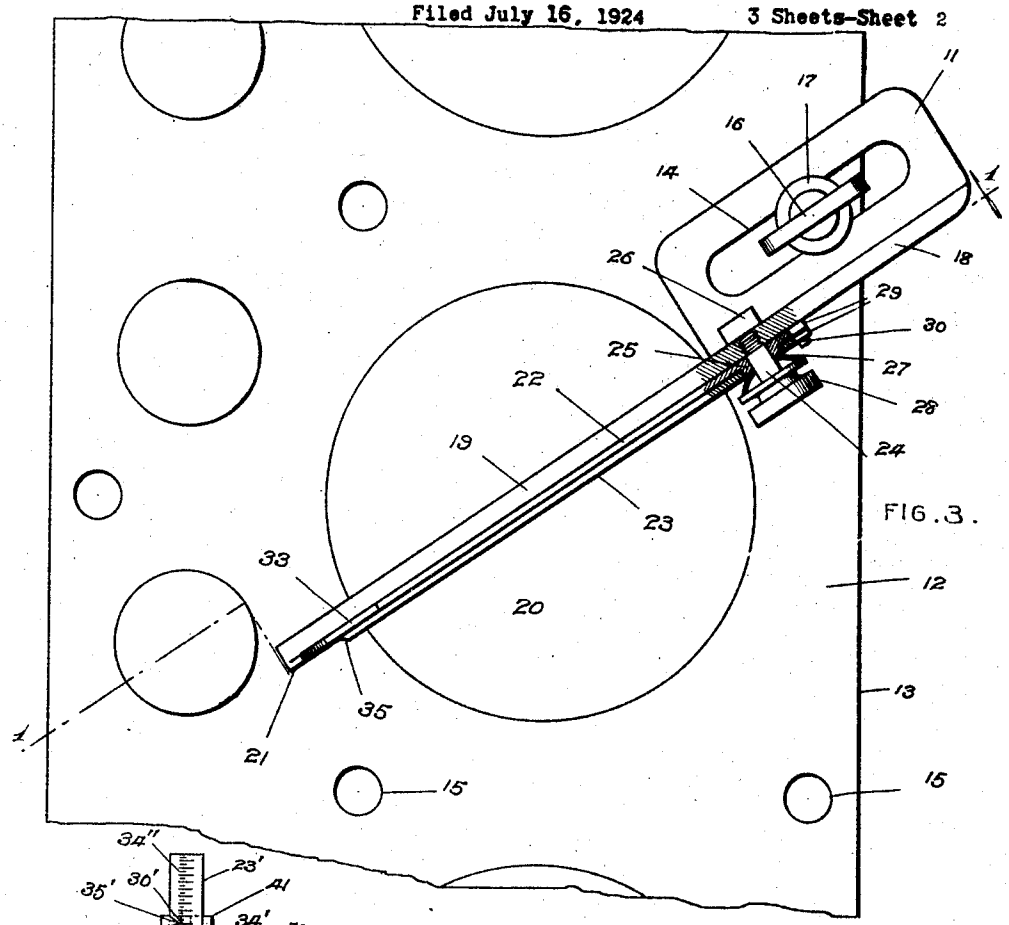


FIG. 3.

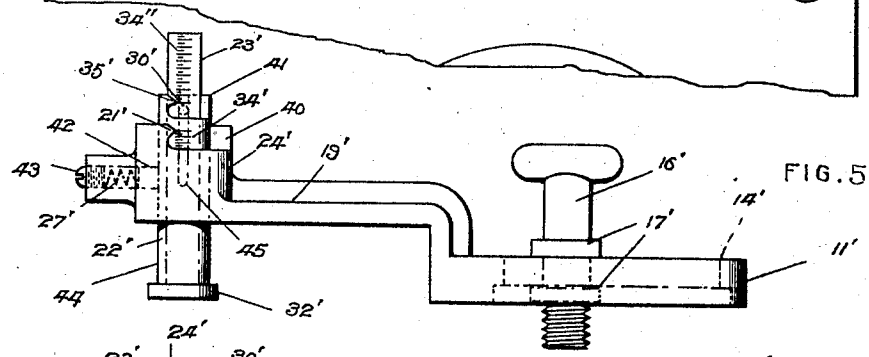


FIG. 5.

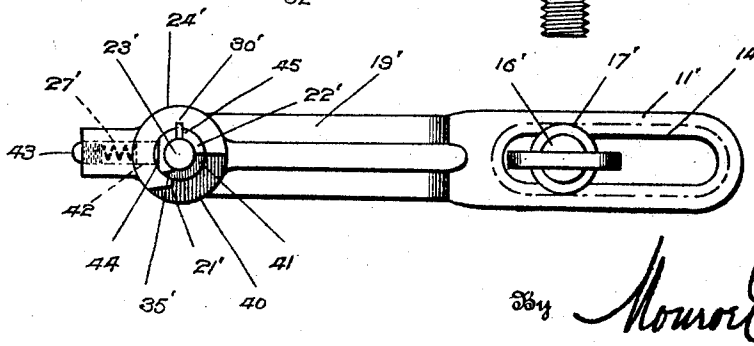


FIG. 6.

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PISTON POSITION INDICATOR

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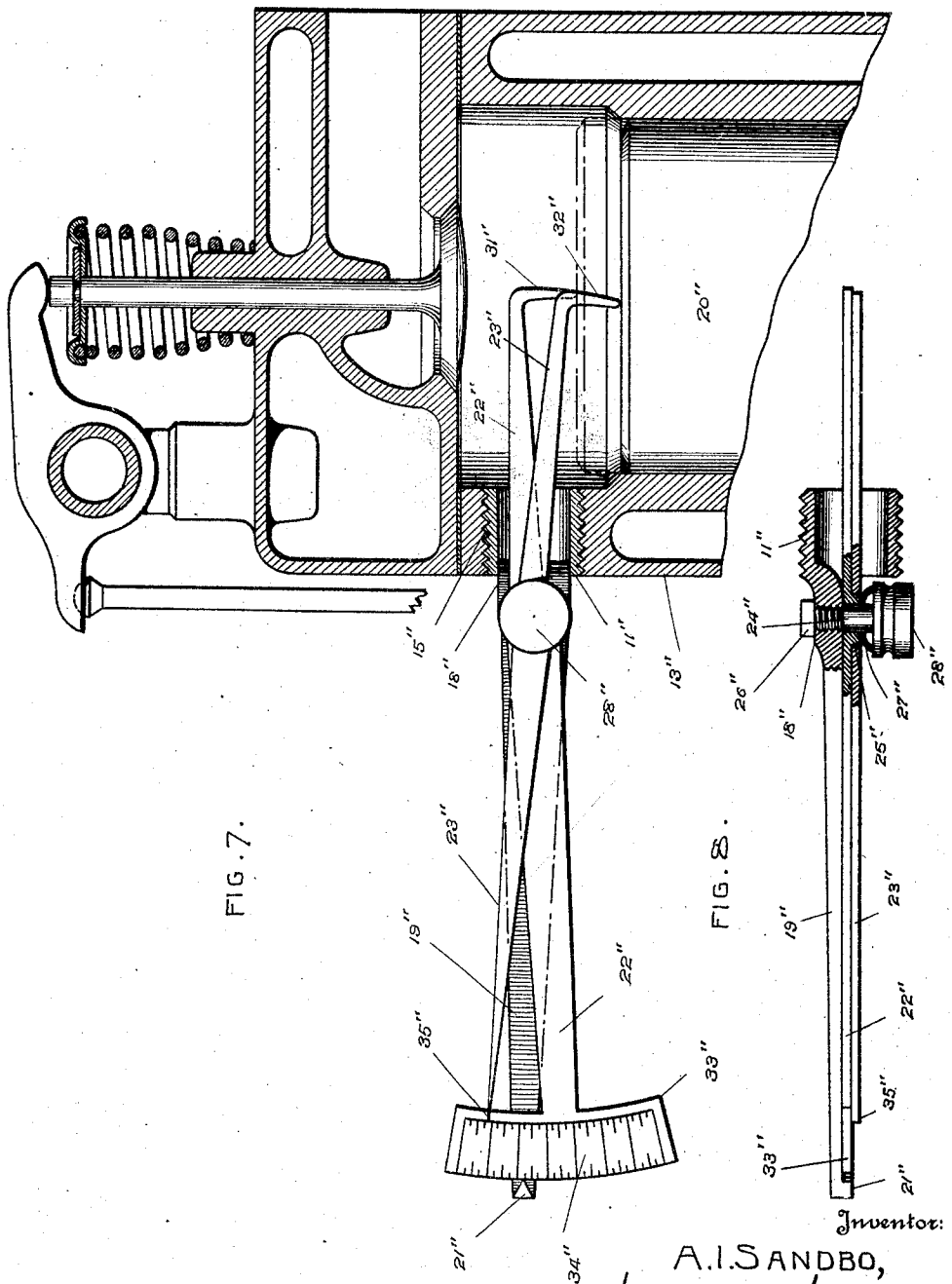


FIG. 7.

FIG. 8.

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UNITED STATES PATENT OFFICE.

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PISTON-POSITION INDICATOR.

Application filed July 16, 1924. Serial No. 726,369.

To all whom it may concern:

Be it known that I, ANTON I. SANDBO, a citizen of the United States, residing at Rock Island, in the county of Rock Island and State of Illinois, have invented certain new and useful Improvements in Piston-Position Indicators, of which the following is a specification, reference being had therein to the accompanying drawing.

The present invention has for its primary object the provision of a device for indicating, in a practical and efficient manner, the position of a piston of an internal combustion engine, to facilitate the adjustment or timing of the valves.

Another object of the invention is the provision of such a device which will indicate the maximum distance that the piston moves above or beyond the head surface of the cylinder or cylinder block, and which will also indicate, within a certain range, the distance that the piston is from its extreme limit of movement at the upper or outer position.

A further object is to provide such a device which can be conveniently secured on the cylinder block or casting for cooperation with the piston, and which has novel cooperating members for indicating the positions of the piston.

It is also an object of the invention to provide such a device which is simple and inexpensive in construction, and which can be used on different engines.

With the foregoing and other objects in view, which will be apparent as the description proceeds, the invention resides in the construction and arrangement of parts, as hereinafter described and claimed, it being understood that changes can be made within the scope of what is claimed, without departing from the spirit of the invention.

The invention is illustrated in the accompanying drawings, wherein—

Fig. 1 is a side elevation of the indicator as in use, with the piston at its extreme limit of movement in the outward or upward stroke, the cylinder block or casting being shown in section on the line 1—1 of Fig. 3, with the valve and piston shown in elevation.

Fig. 2 is a similar view, with portions of the cylinder block and piston broken away, showing the piston moved downwardly slightly.

Fig. 3 is a plan view of the device, portions being shown in section.

Fig. 4 is an enlarged elevation of the friction spring.

Fig. 5 is a side elevation of a modified construction.

Fig. 6 is a plan view of the modified construction.

Fig. 7 is a side elevation of another modified form of indicator as used in a valve-in-head engine.

Fig. 8 is a plan view of the device shown in Fig. 7, portions being shown in section.

In carrying out the invention, there is provided a base 11 to seat on the upper or head surface 12 of the cylinder block or casting 13, and said base is secured on the cylinder block to hold the device in fixed position. The base 11 has an elongated slot 14 to register with one of the bolt holes 15 in the cylinder block, and a clamping screw 16 is adapted to pass down through the slot 14 to screw into the registering bolt hole 15 and has a collar or shoulder 17 to bear on the base 11 for clamping said base on the cylinder block. The bolt holes 15 are left open when the bolts are removed for removing the cylinder head, as is well understood, and the slot 14 not only permits the base 11 to be turned to different angular positions, but also enables the base to be slid longitudinally, so that the indicator can be properly positioned over the piston. In an engine where stud bolts are secured to the cylinder block, the screw 16 is removed, and the base 11 is placed over the corresponding stud bolt, and the nut is threaded on the bolt to clamp the base 11 down on the cylinder block.

The base 11 has an upstanding flange 18 parallel with and located at one side of the slot 14, which is extended at one end to form an arm 19 which extends over the piston 20, and said arm has a lug 21 at its extremity providing a pointer or index.

An arm 22 bears against one side of the arm 19, and a third arm 23 bears against the arm 22, with the arm 22 between the arms 19 and 23. The arms 22 and 23 are pivotally connected with the base for upward and downward swinging movement. Thus, a pivot screw 24 is threaded into the flange 18 at the corresponding end of the arm 19, and the arm 22 is mounted for turning movement on the shank of said

screw. The arm 22 has a boss 25 on which the arm 23 is mounted for turning movement. A lock nut 26 is threaded on the screw 24 and bears against the opposite side of the flange 18 for maintaining the adjustment of the screw, and a bowed friction spring 27 is disposed between the boss 25 and the head 28 of the screw, whereby when the screw is tightened, the pressure of the spring against the boss 25 will hold the arm 22 frictionally against the flange 18 and arm 19, whereas the arm 23 is swingable loosely on the boss 25. The arms 22 and 23 have lugs 29 projecting from their pivoted ends and disposed between stop pins 30 secured to the flange 18, whereby to limit the swinging movement of said arms 22 and 23, thereby keeping the arms in associated relation and preventing them from swinging apart too far.

The arms 22 and 23 have the depending fingers 31 and 32 to bear on the piston 20, whereby the arms 22 and 23 can be raised by the piston when it is at the upper or outward limit of its movement.

The three arms have cooperating indicating means. Thus, the arm 22 has a head 33 with a scale of graduations 34 on the face thereof with which the pointer 21 is cooperable, and the free end of the arm 23 also has a pointer or index 35 cooperable with the graduations 34. The graduations indicate, in fractions of an inch or other unit, the position of the piston with reference to the surface 12 of the cylinder block.

In using the indicator, the base 11 is secured on the cylinder block adjacent to the piston with which the device is to be used, with the piston lowered or retracted. The arms 22 and 23 are swung downwardly, and then, when the piston is raised or projected above the surface 12, it contacts with the fingers 31 and 32 and swings the arms 22 and 23 away from the cylinder block, the arm 19 being stationary. The piston is moved to its limit with the corresponding crank of the engine crank shaft (not shown) turned "on center" or at its extreme upper position. The arms 22 and 23 are therefore moved as far as possible from the cylinder block, depending on the amount that the piston is projected from the cylinder block, which varies with different engines. The head 33 is moved upwardly relatively to the pointer 21, and the pointer 21 will therefore indicate on the graduations 34, the distance that the piston projects beyond the surface 12. Furthermore, the friction spring 27 will hold the arm 22 frictionally against the arm 19, so that the arm 22 will remain in raised position when the piston is lowered, so that the pointer 21 will continue to indicate on the graduations 34 the altitude or height of the piston above the surface 12 in the uppermost position of the piston. However, when the piston is lowered, the arm 23 being loose, will move downwardly with the piston, and the opinter 35 of said arm will indicate on the graduations 34, as seen in Fig. 2, the distance that the piston is moved downwardly below its extreme upper position as seen in Fig. 1.

The indicator can therefore be conveniently used for adjusting and timing the opening of the valves of the corresponding cylinder, it being well known that the valves are timed to open at a certain position of the piston at or near its uppermost position. The adjustments differ with different engines, and, after the arm 22 has been raised by the piston to the extreme limit, the pointer 35 will indicate on the scale of graduations 34 the distance that the piston has moved down from its extreme upper position. The valves should open when the pointer 35 is at predetermined positions on the scale of graduations, and it is thus possible to make adjustments so as to time the valves properly, as will be understood by those skilled in the art. The device thus automatically indicates the position of the piston between its highest point and the position of the piston with its upper surface flush with the surface 12.

When applying the base 11 to the surface 12 of the cylinder block, care should be taken that the base seats snugly on said surface, and said surface should be cleaned off if necessary.

In using the indicator on the engine of a Ford automobile, for example, with the base 11 secured to the cylinder block, the engine crank shaft is turned slowly and stopped when the piston has reached its highest point (known as "on center" position) and the arm 22 is raised so that the pointer 21 indicates on the graduations 34 the highest altitude of the piston. When the piston reaches this position the exhaust valve should be closed. Now, the crank shaft is again turned until the piston has moved down one-sixteenth of an inch, which is indicated by the pointer 35 on the graduations 34. At this position of the piston the intake valve should start to open. If the valves do not open at the proper positions of the piston, then adjustments in the valve gear are made to properly time the valves with reference to the movement of the piston. The same tests can be made for the valves of each cylinder by positioning the device over the different pistons.

Figs. 5 and 6 show a modified construction in which the three main parts may be castings, whereas the arms 22 and 23 and base 11 and arm 19 may be formed from sheet metal. Thus, the base 11′ and arm 19′ comprise a casting of suitable metal, the arm 19′ being offset upwardly similar to the arm 19, and the base 11′ being provided

with a slot 14′ to receive the screw 16′ for securing the base on the cylinder block, the screw having the collars 17′ for holding it in position on the base 11′. The arm 19′ has a vertical guide portion 24′ with an opening therein in which a vertical tube 22′ is slidable, and a rod 23′ is slidable vertically in said tube, said rod having a head or enlargement 32′ at its lower end to seat on the piston and to contact with the lower end of the tube 22′. The guide portion 24′ has a recess 40 in its upper end formed at one end with a pointer 21′ to register with graduations 34′ on the tube 22′. The tube has a similar recess 41 in its upper end formed with a pointer 35′ at one end to register with graduations 34″ on the rod 23′. The tube 22′ is held frictionally in raised position by means of a coiled spring 27′ disposed within an opening in the portion 24′ between a friction member 42 and a plug 43 screw-threaded into said portion 24′. The friction member 42 bears against the flat side 44 of the tube 23′ to prevent said tube from turning and to also hold the tube in raised position, while the rod 23′ is slidable loosely in the tube. The rod 23′ carries a pin 30′ working in a slot 45 in the tube 22′ to prevent the rod 23′ from turning relatively to the tube 22′ and to also prevent the tube from being accidentally lost. Thus, the pin 30′ contacting with the upper end of the portion 24′ will limit the downward movement of the rod 23′, and the downward movement of the tube 22′ is limited by the head 32′. The head 32′ also limits the upward movement of the rod 23′ in the portion 24′, and the pin 30′ limits the upward movement of the tube 22′ relatively to the rod 23′, to hold the parts assembled.

The modified form of device is used in substantially the same way as the first form. Thus, when the base 11′ has been secured on the cylinder block, and the piston is raised, the piston contacts with the head 32′ and raises the rod 23′ thereby raising the tube 22′ with said rod. The pointer 21′ will therefore indicate on the graduations 34′, the highest position of the piston, and the tube 22′ is held in its raised position by the spring 27′ and friction member 42, although the tube can be readily slid downwardly manually. As the piston is moved downwardly, the rod 23′ moves downwardly with the piston, said rod being loose within the tube 22′, and the pointer 35′ will therefore indicate on the graduations 34″ the distance that the top of the piston is below its highest point.

Figs. 7 and 8 depict still another variation in the construction of the device, for use especially with valve-in-head engines, the movable members being mounted in much the same manner as in the device shown in Figs. 1, 2 and 3. The base or support comprises a plug 11″ which is screw-threaded into the spark plug hole 15″ of the cylinder 13″ from which the spark plug has been removed. The plug 11″ has an outstanding flange or portion 18″ from which the arm 19″ projects, said arm having the lug or pointer 21″ at its extremity. The lever 22″ is mounted for oscillation on the screw 24″ which is screw-threaded through the portion 18″, and the lever 22″ has the boss 25″ on which the lever 23″ is mounted for turning motion. A lock nut 26″ is threaded on the screw 24″, and a spring 27″ is disposed between the boss 25″ and the head 28″ of the screw, the same as in the first form of device. The levers 22″ and 23″ have arms to project into the cylinder, and said inner arms of the levers have the respective depending fingers 31″ and 32″ to bear on the piston 20″. The outer arm of the lever 22″ has the head 32″ with the scale of graduations 34″ thereon, and the free end of the outer arm of the lever 23″ has the pointer or index 35″.

The device shown in Figs. 7 and 8 is used in substantially the same manner as the device shown in Figs. 1, 2 and 3, excepting that the plug 11″ is engaged in the spark plug hole of the cylinder to position the device with reference to the piston, without removing the cylinder head with which the valves are assembled. However, the members 22″ and 23″ are levers of the first order, while the members 22 and 23 are levers of the third order. Also, levers 22″ and 23″ move in directions opposite to the movement of the arms or levers 22 and 23, the head 33 being raised while the head 32″ is moved downwardly The inner arm of the lever 23″ must also be of greater weight than the outer arm of said lever, so that the lever 23″ will move with the piston 20″.

Having thus described the invention, what is claimed as new is:—

1. A piston position indicator comprising three members assembled with one another, one member having means for mounting it on a cylinder block, a second member being movable relatively to the first named member in one direction only with the piston, and the third member being movable relatively to the second member in both directions with the piston, the first-named and second members having cooperable pointer and graduations for indicating the position of the second member relatively to the first-named member, and the second and third members having cooperable pointer and graduations for indicating the position of the third member relatively to the second member.

2. A piston position indicator comprising three members assembled with one another, one member having means for mounting it on a cylinder block, a second member being

movable relatively to the first named member and frictionally held in its different positions, and the third member being movable loosely relatively to the second member, both the second and third members being adapted to be moved in one direction by the piston and the third member being movable in the other direction also with the piston, the first named and second members having cooperable pointer and graduations for indicating the position of the second member relatively to the first named member, and the second and third members having cooperable pointer and graduations for indicating the position of the third member relatively to the second member.

3. A piston position indicator comprising three members being assembled with one another, one member having means for mounting it on a cylinder block, a second member being movable relatively to the first named member, friction means for holding the second member in different positions, and the third member being movable loosely relatively to the second member, both the second and third members being adapted to be moved in one direction by the piston, and the third member being movable in the opposite direction also with the piston, said members having cooperating pointers and graduations whereby the position of the second member relatively to the first named member will indicate the extreme movement of the piston and the relative position of the second and third members will indicate the distance of the piston from said extreme position.

4. A piston position indicator comprising three members assembled with one another, one member having a base to be mounted on a cylinder block and having an offset arm to extend across the piston, a second member being movable relatively to said arm and frictionally held in different postions relatively to said arm, and the third member being movable loosely relatively to the second named member, both of said second and third members being arranged to be moved by the piston in one direction and the third member being movable in the opposite direction also with the piston, said arm and second and third members having cooperable pointers and graduations for indicating the position of the piston.

In testimony whereof I hereunto affix my signature.

ANTON I. SANDBO.