

May 3, 1932.

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1,857,005

VALVE MECHANISM FOR INTERNAL COMBUSTION ENGINES

Filed Aug. 1, 1931

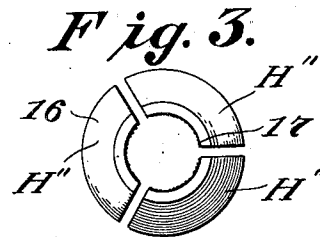
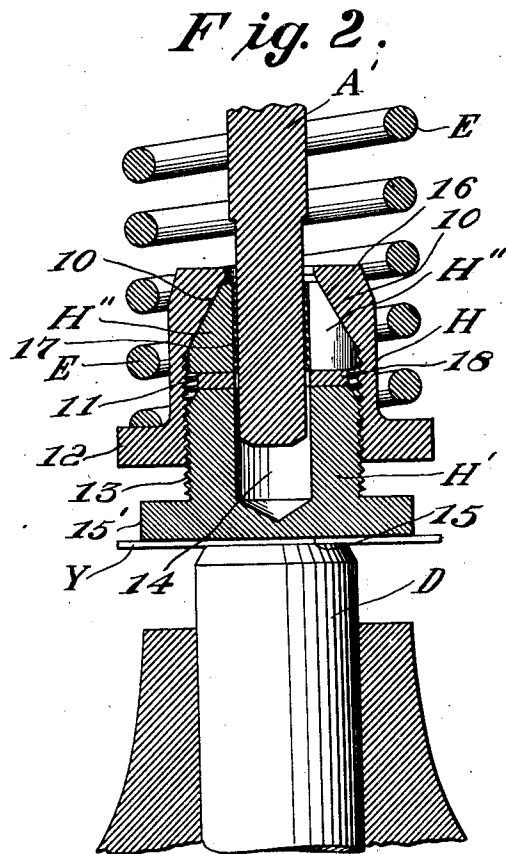
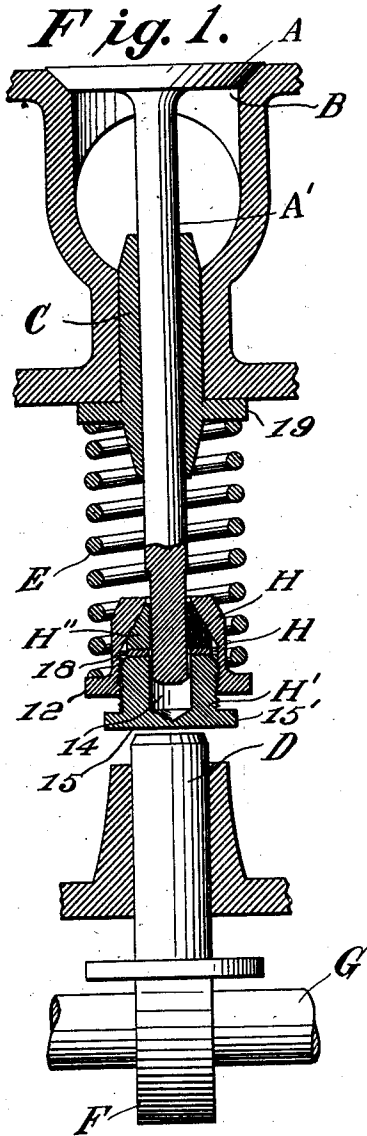


Fig. 4.

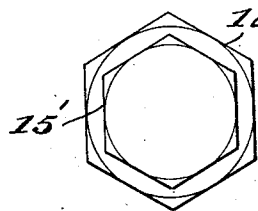
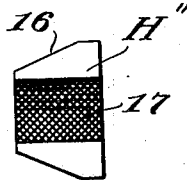


Fig. 5. J. G. Schotthoefer

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VALVE MECHANISM FOR INTERNAL COMBUSTION ENGINES

Application filed August 1, 1931. Serial No. 554,576.

The valve mechanism to which this invention relates includes a reciprocating valve stem provided at one end with a port closing member or valve proper, hereinafter termed "valve", and at its opposite end with a head of special construction and utility, to which it is releasably connected and which is adapted to be engaged by the cam actuated valve tappet, and a spring operated to hold the valve yieldably to its seat about the port controlled by said valve and to put tension on said head to hold the latter yieldably in operative relationship with said valve tappet. The "head" at the end of the stem opposite the valve and accordingly interposed between the valve stem and the valve tappet is characterized in that it comprises a plurality of relatively adjustable members and an inner clamping means so correlated with each other and with the end of the valve stem that by merely turning one of said members in one direction relatively to the other and to the clamping means the head and stem will be tightly locked together, and by turning said member in the opposite direction, the stem will be freed from the head and when thus freed, may be rotated within the head without changing its longitudinal position relatively to the head, since it has no threaded engagement with any element of the head and when locked to the head is held entirely by frictional engagement between it and the clamping means.

It is well understood that internal combustion engines include a number of port controlling valves and their appurtenant springs, tappets, etc., together with a shaft by which the cams are carried, and that certain of the valves open and close ports through which the fuel is admitted to the combustion chamber of the engine while others open and close ports through which the spent gases are expelled. It is also well understood that the valves are opened and closed in a timed relation predetermined by the setting of the relative positions of the cams which operate the valve tappets, respectively.

It is further well understood that in all these engines a certain "clearance" is pro-

vided between each tappet and the part of the corresponding valve stem which in the operation of the engine is engaged by said tappet, whether said "part" of the valve stem be integral with said stem, as in a well known make of a popularly priced car, or adjustably fixed thereto as in the instant invention. This "clearance" is necessary to compensate for the expansion of the valve and its stem caused by the terrific heat to which they are subjected in the operation of the engine. The extent of the clearance required in certain makes of engines differs from that in other makes and the clearance which has been found to be best by the manufacturer and which he therefore has provided should be retained throughout the entire period of usefulness of the engine. In all these engines, regrinding of the valves to their seats is necessary at more or less frequent intervals and more or less difficulty—increasing the time required and adding to the expense of the work—has been experienced in providing the exact pre-existing clearance found to give the best results, which has been destroyed in the regrinding operation. Moreover, the removal of the valves in prior proposals, which is a necessary preliminary to the regrinding operation—and also to the replacement of a badly worn or warped valve—calls for skill and has been attended with difficulties which has made such work slow and troublesome.

One important purpose of this invention, therefore, is to provide a valve mechanism for internal combustion engines, in which the labor of freeing the valve for removal or regrinding to its seat is reduced to a minimum and calls for no particular skill; and another of its important purposes is to produce a valve mechanism in which the relative adjustment to bring about the particular clearance between the valve operating tappet or pusher and the part of the valve engaged therewith, predetermined to give the best results, may be readily maintained.

To these ends I have provided the free end of the valve stem with a means which substantially forms a head at said end of the stem, to be engaged by the end of the corresponding valve tappet, and which head is pro-

vided internally with means which as hereinbefore stated by the mere turning of a member of the head effects the locking of the stem to the head or release of the stem from the head, as the case may be, and have so correlated said head with the stem and with the valve spring that when the stem has been so released from the stem, the valve is free to be entirely removed and to be turned as in grinding without disturbing the position of any other part of the valve mechanism.

A structural embodiment of the invention of very advantageous nature, is shown in the accompanying drawings and will be herein-
after described in detail without, however, thereby intending to restrict the invention to details of said embodiment, since changes in the details may be made without departing from the spirit of the invention defined by appended claims.

In said drawings, wherein like characters of reference denote corresponding parts in the several views:

Fig. 1 is a view, mainly in section, showing one of the valve mechanisms ready for operation, this view illustrating the valve in seated position and the clearance between the valve tappet and the part of the valve which in operation is engaged by said tappet;

Fig. 2 is a similar view on a larger scale, of certain of the parts shown in Fig. 1, illustrating the relative positions of the parts when the valve is ready for removal or is being applied, or reground, its stem having been freed from the head;

Fig. 3 is a detail plan view of the complementary locking elements employed in said head, showing the same in partially separated condition;

Fig. 4 is a detail view of one of said elements, viewed from its inner side; and

Fig. 5 is an inverted plan view particularly intended to illustrate the shape of the members of the head provided between the valve stem and valve tappet.

A designates a reciprocating valve, proper, and A' its stem. This valve, proper, automatically controls a port B which in practice may be for either the inlet of the fuel to the combustion chamber of the engine or for the exhaust of the spent gases from said chamber. The stem A' is guided in its reciprocations in any way, a guide sleeve C stationarily mounted in the engine block being illustrated as one suitable means for this purpose.

Reciprocation of the valve and its stem are effected under control of a cam operated valve lifting tappet D, the valve and stem being under tension of a spring E which acts in opposition to the tappet. F designates the cam which moves the valve from its seat to thereby open the port controlled by said valve. This cam is mounted on a cam shaft G, as usual.

The end of the valve stem A' opposite the

valve A and presented toward the valve tappet is provided with a separately formed head which projects therefrom into operative relationship with the end of said tappet. This head is composed of two relatively adjustable members H, H' and a plurality of internal elements H'' operative under control of one of said elements to releasably clamp the head to the valve stem, the correlation of the parts being such that when the said elements are not in clamping engagement with the valve stem the latter, and consequently the valve, may be freely removed from and rotated or oscillated within the head; thereby permitting the valve to be ground to its seat, or replaced by another valve, with no labor other than that involved in the movement of the clamping elements out of clamping engagement with the valve stem. It will be noticed that the member H is in the form of a hollow nut one of whose end portions is beveled internally, as shown at 10, and the other of whose end portions is formed with internal screw threads 11 and with an external flange 12. The other member, H' of the head is formed with external screw threads, as shown at 13, to engage the threads 11 of the member H, and is also formed with an internal chamber 14 which is open at one end to permit the end of the valve stem to project thereinto, the opposite end of this member being closed and providing a plane surface 15 to be engaged by the end of the tappet throughout the entire area of said tappet end. This end of the member H' is also provided with a flange 15'. The flanges 12 and 15' are suitably formed to be engaged by appropriate tools for convenience in adjusting them relatively to each other. As here shown, the flanges are of hexagonal shape to receive wrenches of corresponding form, for the foregoing purposes.

Each clamping element H'' includes a beveled outer wall 16 arranged to engage the beveled wall 10 of the member H and with a roughened inner wall 17 to engage the surface of the valve stem. It will be noticed that these clamping elements complementarily form a sleeve through which the end of the valve stem extends and which sleeve is adapted to be contracted tightly about the end of said stem, thereby to clamp the stem to the head, by partially rotating the member H in one direction, and to be expanded to thereby release the stem from the head, by partially rotating said member H in the opposite direction. A washer 18 preferably is interposed between the confronting ends of the member H' and clamping elements H'' to provide a bearing for the latter.

The spring E is mounted about the valve stem A' between the flange 12 of the member H and an appropriate part of the engine, as a flange 19 projecting from the guide sleeve for example.

It will be noticed that the lower end of the valve stem passes loosely through the opening at the mouth of the member H and also loosely through the washer 18 and into the chamber 14. In other words, it will be noticed that the only parts of the head which tightly engage the valve stem when the stem is locked to said head are the clamping elements H'', there being sufficient clearance provided between the stem mouth of the member H, washer 18 and wall of the chamber 14 to overcome tendency of the stem to bind against these parts at any time in the operation of the engine. This clearance is preferably provided in part at least, by reducing the diameter of the end of the stem as shown.

Upon reference to Fig. 1, it will be noticed that when the parts are assembled for operation the member H has been screwed down upon the member H' and relatively to the clamping elements H'' into the position in which it has contracted and holds the sleeve formed by said elements tightly against the stem. In this position of the parts the outer end of member H' is separated from the end of the valve tappet D only by the space indicated as being necessary to provide the clearance which produces the best results in the operation of the engine, and the tight engagement of the roughened inner surfaces of the clamping elements with the circumferential surface of the valve stem prevents any accidental separation of the valve stem and head and causes said stem and head to reciprocate unitarily. To destroy this clamped relation between said head and stem it is necessary only to partially rotate the member H in a direction which slackens it relatively to the member H'. This operation may be conveniently effected by applying a wrench to the flange 12 and turning said wrench, and hence the member H, in the proper direction, while the member H' is held stationary. As the result of this operation the clamping sections H'' are freed from the pressure which was exerted thereon by the beveled wall of the member H (see Fig. 2) sufficiently to release the valve stem and thereby permit said stem to be freely lifted from said head and to be rotated or oscillated within the same as required in the regrinding of the valve or in the operation of replacing a warped or badly worn valve by another.

When the operation of regrinding has been completed, or when a new valve and its stem has been applied in lieu of one which has been discarded, the head is clamped to the stem thereof by turning the member H relatively to the member H' in the direction which forces the elements H'' into tight engagement with the valve stem.

Attention is called to the fact that the correlation of the parts is such that the original clearance between the tappet and the part of the valve stem to be engaged by said tappet

may be maintained with absolute assurance if a "feeler" or thickness gauge of the proper size, (indicated at Y, Fig. 2) be interposed between the end of the valve tappet and the member H' and retained there throughout the period between and including the freeing of the valve stem from the head at the beginning of the intended operation and the clamping of the head to the stem at the end of the operation. It may be here mentioned that in another application for Letters Patent of the United States of America, executed by me of even date herewith I have shown, described, and claimed a combined wrench and gauge specially well adapted for use in holding the member H' while the member H is being screwed or unscrewed relatively thereto and at the same time maintaining the predetermined clearance between said member and the valve tappet.

Mention should be made of the fact that each of the clamping elements H'' which conjointly form a sleeve by which the head is locked to the stem by friction is formed of hardened steel and accordingly the roughness or knurled surface is produced in these elements instead of upon the valve stem, which is usually of a much softer material. If the stem, however, were of a material as hard or harder than that of the said elements H'', it would be a matter of indifference as to which of the surfaces were roughened or knurled since the purpose of this is to increase the frictional grip of said elements upon the stem. It will clearly be understood that if these elements have a screw-threaded engagement with the stem, the beneficial results which are the result of the particular combination and correlation of the parts shown in this application would not be gained, or at any rate, would be materially lessened.

Having now described the preferred embodiment of the invention, what I believe to be new and desire to secure by Letters Patent, is:—

1. A valve mechanism for an internal combustion engine, including a reciprocatory valve stem provided at one end with a valve and having its other end of non-threaded construction, and a tappet engaging head having a locking means movable into tight engagement with said non-threaded end of the stem and when so engaged frictionally attaching the stem and head together for unitary reciprocatory movement, said means being also movable relatively to said stem to release the latter from the head, the stem when thus released being free to be moved longitudinally bodily, and also rotatively without corresponding longitudinal movement, of the head; the head also having a member operative to attach said locking means to and detach the same from, said stem.

2. A valve mechanism for an internal combustion engine, including a reciprocatory valve stem provided at one end with a valve and whose other end is provided with a head including relatively adjustable members one of which is arranged to be engaged by a valve tappet and the other having an internal non-threaded opening to receive the non-threaded end of the valve stem, and a locking means mounted in said opening about the stem, said locking means and the latter member having correspondingly beveled surfaces in contact with each other to cause the locking means to be pressed into frictional locking engagement with the non-threaded end of said stem by movement of said member.

3. A valve mechanism for an internal combustion engine, including a reciprocatory valve stem provided at one end with a valve and at its other end with a head, said head including a pair of members one of which is arranged to be engaged by a valve tappet and is formed with an internal chamber to receive the end of the stem, the other of said members having an opening through which the stem extends, said members having screw threaded engagement with each other, and a separately formed locking means mounted in one of said members about the portion of the stem therein, said locking means and the member in which it is mounted having correspondingly beveled surfaces in contact with each other to cause said locking means to be pressed into locking frictional engagement with the valve stem by screwing the member in one direction and to remove said pressure by screwing said member in the other direction.

4. A valve mechanism according to claim 2, in which the locking means mounted in one of said members is formed of a plurality of members arranged conjointly to form a sleeve and whose inner surfaces are roughened or knurled to increase their grip upon the valve stem when adjusted into their locking relation therewith.

5. A valve mechanism for an internal combustion engine, including a reciprocatory valve stem provided at one end with a valve and at its other end with a head, said head including a pair of members one of which is arranged to be engaged by a valve tappet, said members having screw threaded engagement with each other and provided with sections shaped to be engaged by wrenches, a locking means mounted in one of said members about the valve stem, said locking means and member having contacting beveled surfaces to cause the locking means to be pressed into frictional locking engagement with the said stem by longitudinal movement of the member relatively to said means, and a tensioning spring engaging the head.

6. A valve mechanism according to claim 5 in which the locking means is formed of

a plurality of members arranged conjointly to form a sleeve and whose inner surfaces are roughened or knurled to increase their grip upon the valve stem when adjusted into their locking relation therewith.

7. A valve mechanism for an internal combustion engine, including a valve tappet, a spring tensioned tappet-engaging head and a valve stem provided with a valve at one end and having its other end extending loosely into said head, the head comprising two complementary members having a screw threaded engagement one with the other and each provided with an external section to be engaged by a wrench, one of said members being arranged to be engaged by the tappet and the other provided internally with a means to lock the head and valve stem together by friction, the last named member and locking means having beveled surfaces in frictional contact with each other.

8. A valve mechanism according to claim 7 in which the locking means is composed of a plurality of longitudinally separated sections which conjointly form a sleeve through which the valve stem extends and said sleeve is internally roughened or knurled to increase its frictional grip on the stem when adjusted into a locking relation with the stem.

In testimony whereof I have hereunto signed my name.

JOSEPH G. SCHOTTHOEFER.