July 24, 1923. 1,463,130

J. B. MORRIS

TOOL FOR REMOVING VALVES

Filed July 3, 1922

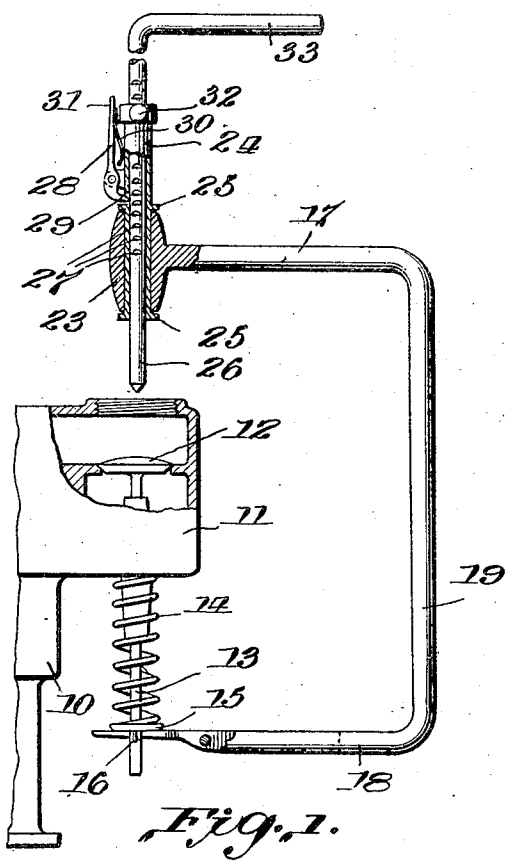


Fig. 1.

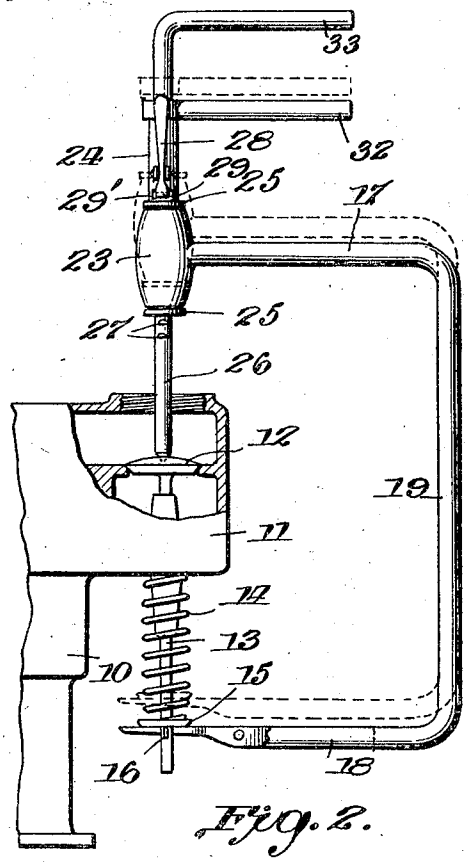


Fig. 2.

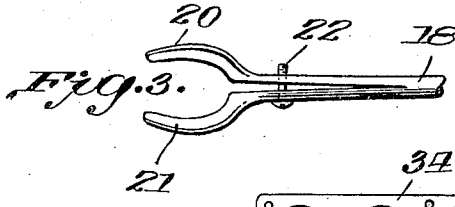


Fig. 3.

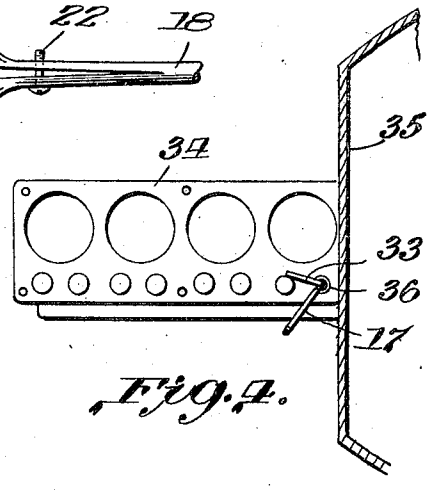


Fig. 4.

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Patented July 24, 1923. 1,463,130

UNITED STATES PATENT OFFICE.

JAMES B. MORRIS, OF NASHVILLE, TENNESSEE.

TOOL FOR REMOVING VALVES.

Application filed July 3, 1922. Serial No. 572,646.

To all whom it may concern:

Be it known that I, JAMES B. MORRIS, a citizen of the United States, residing at Nashville, county of Davidson, and State of Tennessee, have invented certain new and useful Improvements in Tools for Removing Valves; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in tools for removing valves which are retained on their seats by springs, and more particularly such valves in internal combustion engines.

The ordinary poppet valve employed in internal combustion engines has, as is well known, a stem extending through and beyond the valve casing, a spring cup loosely mounted on the outwardly extended stem and adapted to bear against a retaining element on the end of the stem such as a nut screwed thereon or a pin or key extending therethrough, and a spring surrounding the stem and compressed between the spring cup and the valve casing to resiliently retain the valve upon its seat. To remove the valve, the nut, key or other retaining element must first be removed or withdrawn, after which the valve with its extending stem, freed from the spring, is lifted from the casing. This, however, is ordinarily a difficult operation, due to the fact that the spring on the valve stem is in strong compression against the nut, key or other retaining element through the bearing of the spring cup thereon, and there is no support on the structure of the engine or associated parts handy as a fulcrum for the application of a lever to compress the spring toward the valve casing and away from the retaining element.

The difficulty of the operation is moreover often greatly increased due to mechanisms or structures with which the engine is associated preventing ready access to the valve parts. This is particularly so in the case of internal combustion engines installed in motor vehicles, some structural part of the vehicle or associated mechanism in many instances being positioned so close to the valve parts of the engine as to allow insufficient room for the manipulation of the customary type of spring compressing tool having a lever or other hand operating part extending in fixed position from the frame of the tool and requiring an invariable path of movement.

An object of the present invention is to provide a tool or device for readily and rapidly performing the operation referred to of compressing the valve spring so as to permit the easy removal of the retaining element from the stem of the valve and the removal of the valve from its casing.

Another object of the invention is the provision of a tool of this character which is hand operated in compressing the spring but is automatic in action to sustain the spring in any desired degree of compression.

Still another object of the invention is the provision of such a tool having hand-operated parts adjustable in position and path of movement relative to the body or frame of the tool so as to enable the operator to accommodate the tool to the working space about the valve parts and to the angle of approach necessary to gain working access thereto.

A further object of the invention is the provision of a tool adapted for use upon valves of all sizes and of all lengths and diameters of valve stems.

The novel tool or apparatus for removing the valve comprises, broadly stated, a frame-like structure of suitable conformation to encompass the valve casing and valve parts and having two movable-engaging parts, one movable, in adjusting the tool to its working position, into engagement with the head of the valve and the other engaging the valve spring and movable toward the valve head in compressing the spring. Handles for the manual movement of these parts are provided, adjustable to varying angular positions relative to the frame of the tool, so as to enable the operator to accommodate himself to the working space about the valve parts. These handles are, desirably, cooperatively arranged in such manner as to adapt them in the various angular positions referred to to be gripped together by the hand of the operator to move the spring-engaging element of the tool in a direction compressing the spring. These features provide not only a more ready working access to the tool in places otherwise difficult to reach but greater speed of operation since they enable a sufficient force to be applied by the hand of the op-

erator to move the valve engaging parts without the employment of levers, screws and like devices which not only increase the power applied at the expense of speed of operation, but also make for increased complexity of structure, and which in addition require substantial space for their operative movements.

My invention also contemplates the employment of means for releasably maintaining the parts of the tool in spring-compressing position, without manual exertion for this purpose.

The principles of my invention will appear from the detailed description hereafter given of a preferred form of apparatus or tool. It is to be understood, however, that such preferred embodiment is merely illustrative of my invention, and that within the broad scope of the invention are included other specific constructions capable of functioning in accordance with its principles.

In the accompanying drawings, which illustrate a preferred embodiment of the invention,

Fig. 1 is a view partly in side elevation and partly in section of the tool with the parts in the position of adjustment required to initially apply the tool to the valve of an internal combustion engine, a portion of the engine with the valve to which the tool is to be applied, being also shown;

Fig 2 is a view similar to Fig. 1 with the tool in working position upon the valve parts;

Fig. 3 is a plan view of the spring-engaging part of the tool;

Fig. 4 is a partial plan view, diagrammatic in character, showing an internal combustion engine mounted upon a motor vehicle, and showing in section the dashboard of the vehicle in close proximity to one of the engine-valves.

The internal combustion engine is indicated generally by the numeral 10, having a valve casing 11 with the usual type of poppet valve 12 seated therein, the valve having a stem 13 protruding below the valve casing. The valve is resiliently retained upon its seat in the customary manner by a coiled spring 14 surrounding the valve stem, and under compression between a spring cup 15 and a wall of the valve casing 11, spring cup 15 being mounted loosely upon the valve stem and bearing against a retaining key or pin 16.

In the illustrative embodiment of my invention, a generally U-shaped bar is employed providing two arms 17 and 18 extending at substantially right angles from a connecting portion 19, the whole forming a frame which may be positioned to encompass the valve casing and the valve and with the arms extending in parallel alignment in the same plane, in the position of the parts as shown in Fig. 1, above the valve head and below the valve stem.

The arm 18 is bifurcated, as shown particularly in Fig. 3, to provide two resilient prongs 20 and 21, adjustably spaced by means of the screw 22, to adapt the tool to valve stems of varying diameters. As shown in side elevation in Figs. 1 and 2, the lower faces of the prongs are curved or inclined upwardly from the lower line of the arm 18 to the ends of the prongs, thus providing sharpened terminals and an inclined face for the insertion of the prongs between the valve key 16 and spring cup 15.

The upper arm 17 terminates in a hub 23 in which a sleeve 24 is rotatably journaled, said sleeve having upper and lower flanges 25 cooperating with the opposite flat faces of said hub to provide a swivel-mounting of said sleeve in said hub. A cylindrical bar or rod 26 is freely mounted in said sleeve 24 for longitudinal and rotary movement with respect thereto. Said rod is adapted in its downward longitudinal movement to engage the head of the valve, as shown in Fig. 2, the lower end of the rod being preferably pointed as shown to be centered in the conical cavity usually present in the valve head. A series of notches 27 are cut in the cylindrical surface of the rod 26, to form a series of ratchet teeth extending longitudinally of the rod throughout the major portion of its length and with each tooth extending but a short distance measured circumferentially of the rod. A pawl 28 is pivotally mounted upon the sleeve 24, as shown in Figs. 1 and 2, having a tooth 29 movable through a slot 29′ in the sleeve into lateral engagement with the rod 26. A spring 30 attached to the underside of the handle 31 of the pawl and bearing against the sleeve 24 tends to maintain said tooth in contact with said rod, the tooth being withdrawn from said contact by pressure exerted upon the handle 31, as will be obvious.

The sleeve 24 is provided at its upper extremity with a handle 32, affixed to said sleeve and extending substantially at right angles thereto, and the rod 26 is likewise provided with a handle 33, the rod being preferably bent, as shown, to form the handle referred to.

With the arrangement of parts referred to, it is to be observed that the sleeve 24 and rod 26 are rotatable each independently of the other and both relative to the bar or frame 17—18—19; also that the rod 26 and the bar 17—18—19 are each reciprocable relative to the other. It is further to be observed that the relative rotative movements of the sleeve and rod may be made use of to engage and disengage the pawl on the sleeve from the ratchet on the rod, the tooth on the pawl traveling circumferentially of the

rod in such relative rotational movements. Fig. 1 shows a relative angular position of the rod and sleeve engaging the tooth of the pawl upon the smooth surface of the rod and out of engagement with the ratchet portion. Fig. 2 shows a relative angular position of the rod and sleeve engaging the pawl with the ratchet. The handles 32 and 33 are so positioned on the sleeve and rod respectively as to extend in the same direction in alignment when the pawl on the sleeve is in engagement with the ratchet on the rod. A swing of the handles to alignment in opposite directions disengages the pawl from the ratchet, and the ratchet teeth may obviously be made of such width extending circumferentially of the rod as to cause such disengagement by a less angular movement of the parts. In the illustrative embodiment the ratchet teeth are made of such circumferential extent as to cause disengagement of the pawl therewith by a ninety-degree turn of these handles relative to one another, as indicated in Fig. 1.

As clearly shown in Fig. 1, the ratchet teeth and the tooth of the pawl are so cut, each with one straight and one beveled face, as to permit, with the pawl in engagement with the ratchet, unrestrained movement of the rod toward the lower arm 18 of the U-shaped bar and hence toward the valve head, the pawl in such movement of the rod riding over the beveled face of each tooth. As the bar 17—18—19 is also bodily movable longitudinally of the rod 26, the arrangement of ratchet and pawl referred to likewise permits unrestrained movement of the bar upwardly of the rod, as the parts are viewed in Figs. 1 and 2, and hence a movement of the spring engaging forks 20—21 toward the valve head in spring compressing direction. Movement of these parts in the opposite direction, that is of the rod 26 upwardly away from the valve head and of the spring-compressing forks 20—21 downwardly in compression-relieving direction, is restrained by engagement of the pawl and ratchet, with their straight faces cooperating, until the pawl is released either by manipulatiton of the pawl handle 31 or by relative rotation of the sleeve and rod handles 32 and 33.

In the use of the tool, valve-engaging rod 26 is drawn outwardly of the frame 17—18—19 to a sufficient extent to present the tool with an opening between the arm 18 and the inner end of the rod 26 wide enough to encompass the valve casing and the valve parts. The arm 18 is then positioned to advance the forks 20—21 between the valve key and the spring cup, and the arm 17 is positioned to present the valve engaging rod in alignment with the valve head. The handles 32 and 33 are then rotated to present that angular position with respect to the engine or its associated structures permitting the most ready manipulation of the tool. With the handles in alignment in the desired angular position, the rod 26 may by means of the handle 33 be pushed into engagement with the valve head, the pawl riding over the ratchet teeth in this movement of the rod, as already stated. Or, the sleeve handle 32 and the rod handle 33 may be angularly positioned relative to each other to entirely free the pawl from the ratchet and the rod pushed in smooth sliding contact with the tooth of the pawl into engagement with the valve head.

The position of the parts in thus applying the tool is shown in Fig. 1. Fig. 2, shows in full lines the position of the tool in working position, with the rod 26 in engagement with the valve head and the forks 20, 21 inserted between the valve key and the spring cup, and the handles 32, 33 in alignment. It is particularly to be observed that when the tool is thus applied in working position, the handles 32, 33 not only extend in alignment in the same direction but are so juxtaposed that they can be gripped together by the hand of the operator for relative movement bodily in approaching direction. In such relative movement obviously the handle 32 moves toward the handle 33, since the valve rod 26 is restrained from movement by its abutment upon the valve head. Such movement of the handle 32 also obviously carries along the bar 17—18—19 and with the spring-engaging part 20—21 moving in a spring-compressing direction. With the parts positioned as viewed in Fig. 2, the bar or frame bearing the spring engaging parts is lifted along the valve engaging rod, the pawl and ratchet cooperating to prevent a return movement or drop in spring-releasing direction, and permitting a step by step lift which enables the spring compressing operation to be performed with a minimum of effort and at the same time with greater speed than is possible by levers or lifting screws. Fig. 2 shows in dotted line the position of the tool and its parts with the spring compressed away from the valve key.

After the spring has thus been lifted away from the valve key by the lifting bar 17—18—19 and that key removed, the lifting bar may be gradually and easily lowered by gripping the handles 32, 33 with one hand and pressing the pawl handle 31 with the other in such a manner as to produce a step by step release of the pawl and ratchet. The spring compression having been entirely released, the tool is easily removed by a sidewise movement thereof.

My novel apparatus or tool, as will now be obvious, possesses the advantage of capability of operation in a small space about the valve parts to be engaged and by manual operation from various angles of approach. These features are of practical im-

portance in many situations of use of valve-lifting tools. For example, in a large number of motor vehicles, the dash-board or some other structural part of the vehicle or associated mechanism is so closely positioned with respect to one or more of the engine valves as to prevent the use of valve-lifting tools having operating handles in position fixed upon the tool and requiring an invariable path of movement. Fig. 4 diagrammatically illustrates such a close association of parts in a motor vehicle, the numeral 34 indicating generally the internal combustion engine mounted on the vehicle and 35 the dash-board of the vehicle positioned so closely adjacent the valve 36 as to prevent the use of valve-lifting tools having operating handles, for example, extending toward or requiring a path of movement toward the dash-board referred to. In the use of my novel tool, however, as there illustrated, not only may the tool be applied to the valve with the main bar or frame 17—18—19 directed away from the dashboard, but the operating handles may be rotated about that bar or frame to positions presenting more ready access thereto and a free path of movement.

In the foregoing description, reference has been made to the use of the tool in removing valves from internal combustion engines of the L-head type in which the valve casing is disposed laterally of the cylinder, and the drawings show such an engine. As hereinbefore stated, however, the concrete embodiment and example of use of the novel tool are merely illustrative and not restrictive of the invention.

What I claim is:

1. In a valve-releasing tool, a bar, a spring-engaging member mounted thereon, mechanism cooperating with said bar to move said spring-engaging member longitudinally of the stem of said valve, said mechanism having handle-parts for its manual operation adjustable to varying angles with respect to said bar and adapted for complete operation of said mechanism in any of said positions of angular adjustment.

2. In a valve-releasing tool, a bar, having a part adapted to engage the spring of the valve for compressing the same, mechanism cooperating with said bar to move the same in a direction compressing said spring, said mechanism having handle-parts for its manual operation adjustable to varying angles with respect to said bar and capable of complete operation of said mechanism in any of said positions of angular adjustment.

3. In a valve-releasing tool, a bar having a part adapted to engage under the spring of the valve for compressing the same, lifting mechanism cooperating with said bar to move the same in a direction compressing said spring, said lifting mechanism having a handle for its manual operation adjustable to varying angles with respect to said bar, said lifting mechanism being designed for complete operation by movement of said handle in any of said positions of angular adjustment.

4. In a valve-releasing tool, a bar, a spring engaging member mounted thereon, mechanism cooperating with said bar to move said spring-engaging member in a direction compressing said spring, said mechanism having two handle-parts movable in approaching direction and adapted to be gripped by the hand of the operator for manual operation of said mechanism, said handle parts being mounted for adjustment to varying angles with respect to said bar.

5. In a valve-releasing tool, a frame adapted to encompass the valve, members mounted on said frame and each movable relative to the other in opposite directions, one to engage a valve head and the other to engage and compress the spring of said valve, and handles operatively associated with said members, adjustable to varying angular positions with respect to said frame and adapted to be moved into positions enabling the operator to grip both handles together to move one of said members in a direction compressing said spring.

6. In a valve-releasing tool, a rigid frame adapted to encompass the valve, a bar mounted on said frame for movement of said bar and frame each relative to the other, said bar adapted to engage the head of said valve, said frame having a part adapted to engage under the spring of said valve, and handles upon said bar and said frame adapted to be gripped for relative movement to move said frame in a direction compressing said spring.

7. In a valve-releasing tool, a frame adapted to encompass said valve, a bar mounted on said frame for movement of said bar and frame each relative to the other, said bar adapted to engage the head of said valve, a member mounted on said frame adapted to engage under the spring of said valve, a handle mounted upon said bar and upon said frame respectively extending in parallel planes and each rotatable in said planes to varying angular positions relative to said frame and said valve parts, said handles being adapted to be gripped for relative movement in approaching direction to move said frame in a direction compressing said spring.

8. In a valve-releasing tool, a frame U-shaped to provide arms encompassing the valve when the tool is applied in working position, a rod slidably mounted in one of said arms and adapted to extend into engagement with the head of said valve, the other of said arms having a part adapted to engage under the spring of said valve,

and handles mounted upon said rod and said first-mentioned arm respectively and adapted to be gripped for relative movement to move said frame in a direction compressing said spring.

9. In a valve-releasing tool, a frame having two arms encompassing the valve when the tool is applied in working position, a cylindrical bar slidably and rotatably mounted through one of said arms and adapted to extend by sliding movement through said arm into engagement with the head of said valve, said bar having a ratchet extending longitudinally thereof but of less extent circumferentially than the surface of said bar, a spring-pressed pawl on said arm adapted to engage said ratchet, a handle on said bar adapted to rotate said bar to engage or disengage said pawl from said ratchet and to move said bar longitudinally into engagement with said valve head, the other of said arms having a part adapted to engage under the spring of said valve, and a handle on said frame operable to move said frame along said bar.

10. In a valve-releasing tool, a frame U-shaped to provide arms encompassing the valve when the tool is applied in working position, a sleeve swivel-mounted in one of said arms, a cylindrical bar slidably and rotatably mounted through said sleeve and adapted to extend into engagement with the head of said valve, said bar having a ratchet face extending longitudinally thereof but of less extent circumferentially than the surface of said bar, a spring-pressed pawl mounted on said sleeve and adapted in one angular position of said sleeve and bar to engage said ratchet, the other of said arms having a part adapted to engage under the spring of said valve to compress said spring by movement of said arm toward the head of said valve, and handles rigidly mounted upon said sleeve and said bar, said pawl and ratchet being cooperatively arranged to permit movement of said frame in a direction compressing said spring and to prevent movement of said frame in a direction releasing said compression.

11. In a valve-releasing tool, a frame having two arms encompassing the valve when the tool is applied in working position, a sleeve swivel-mounted in one of said arms, a cylindrical bar slidably and rotatably mounted through said sleeve and adapted to be moved longitudinally into engagement with the head of said valve, said bar having a ratchet extending longitudinally thereof but of less extent circumferentially than the surface of said bar, a spring-pressed pawl mounted on said sleeve and adapted in one angular position of said sleeve and bar to engage said ratchet, handles one on said bar and one on said sleeve relatively arranged to be moved into and out of alignment in relatively rotating said bar and sleeve to bring said ratchet and pawl into and out of engaging relation, the other of said arms having a part adapted to engage under the spring of said valve to compress said spring by movement of said frame relative to said bar, said handles being adapted in said positions of alignment to be gripped together by the hand of the operator to impart movement to said frame compressing said spring.

In testimony whereof I hereunto affix my signature.

JAMES B. MORRIS.