

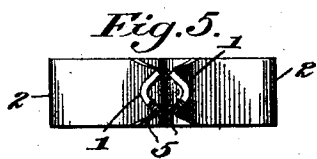
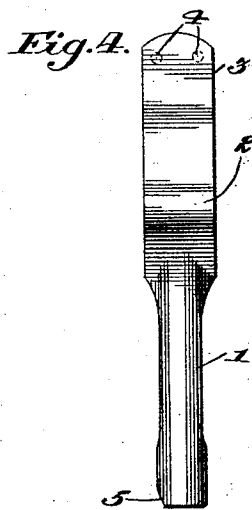
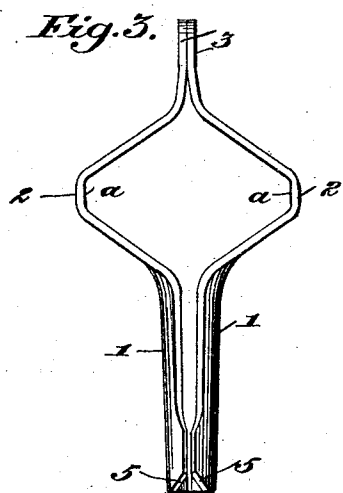
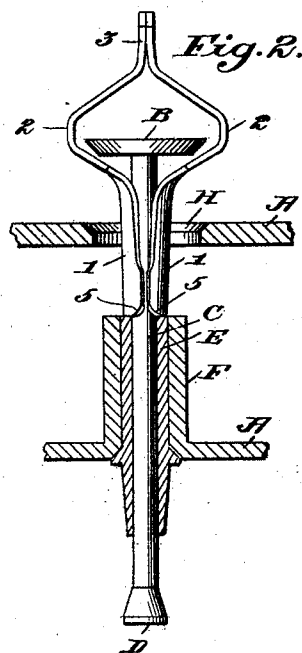
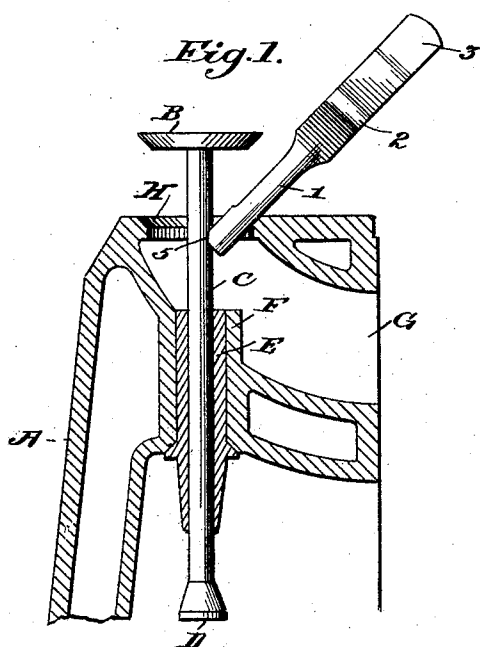
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BUSHING REMOVER

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UNITED STATES PATENT OFFICE

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BUSHING REMOVER

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This invention relates to bushing removers and is primarily intended for use in removing the valve-stem bushings of a recent popular make of automobile that has gone into practically universal use in this country recently.

In said make of automobile the valve stems have an enlarged lower end and said stems are centered in their usual guides by longitudinally split cylindrical bushings inserted in the guides from the bottom after the valve stems have been inserted in position, said bushings being normally held in place by the upper ends of the usual valve springs.

Because of the foregoing construction, in order to remove the valves for replacement or for grinding etc., it is not only necessary to free them from their respective springs, but it is also necessary to remove the bushings in order to permit the upward withdrawal of the lower ends of the respective valve-stems. Necessarily the springs will be bodily removed, but even when freed of the action of their cooperating springs the bushings will remain in normal position in an engine that has been in use, due to the action of heat and the formation of carbon and accumulation of gummy oil or oil residue and the like, so that said bushings must be positively thrust or pulled out of the valve guides while the valve-stems are interposed between each respective pair of semi-cylindrical bushings.

The primary objects of the present invention are, to provide a simple tool for insertion through the usual engine block intake or exhaust port and fitting about and guided by the valve stem for removing or driving out said bushings; to provide a tool of this character formed to straddle the valve whereby the thrust on the tool will be exerted in a direction substantially parallel to the axis of said valve-stem and said bushing against the upper end of said bushing; to facilitate the application of the tool to the valve-stem; and to obtain a very simple construction economical of manufacture and adapted to large quantity production.

In this application we show and describe only the preferred embodiment of our invention simply by way of illustration of the practice of our invention as by law required.

However, we realize that our invention is capable of other and different embodiments and that the details thereof may be modified in various ways, all without departing from our said invention. Therefore, the drawing and description herein are to be considered as merely illustrative and not as exclusive.

In the accompanying drawing:

Figure 1 represents a fragmentary sectional view of an engine block of the make of automobile referred to, with the valve and its stem raised and a bushing removing tool embodying our invention being shown in elevation in course of being applied thereto, the valve spring and lower valve-spring cup being removed;

Figure 2, a view at right angles to Fig. 1, the tool being applied to the valve-stem and straddling the valve and resting on the upper end of the bushing in operative position to drive the bushing out of the valve guide;

Figure 3, an elevation of the tool, on an enlarged scale;

Figure 4, an elevation of the tool taken at right angles to Fig. 3; and

Figure 5, a bottom elevation of the tool.

Referring now in detail to the drawing, A indicates the engine block having the usual intake and exhaust ports, such as port G opened and closed by cooperating puppet-valves, such as valve B adapted to close said port G by contact with its seat H and having a valve-stem C extending through valve-stem guide F and centered therein by longitudinally split cylindrical bushing E comprised of two cooperating semi-cylindrical members, the said valve-stem having an enlarged lower end D to receive and support the usual lower spring cup, not shown, without need for the employment of a retaining pin or key.

All of the foregoing construction mentioned in the immediately above paragraph is old and forms no part of the present invention, being illustrated generally and described briefly merely to afford the proper background to promote a quick understanding of the present invention.

The tool of the present invention is composed of two preferably heavy stiff resilient members having each a long arm portion 1

and an upper short flat portion 3 and between said portions being bent into an approximately flattened bottom V-shape. Said members are associated together with their V-shaped portions 2 opposed to each other and their upper and lower ends in registry, as well illustrated in Fig. 3 and as thus associated are spot welded together as at 4 in their upper flat portions 3, as shown in Fig. 4, and thus are free to be forced apart for almost their entire length to permit the spreading of the long arms 1 with relation to each other during application to a valve stem C. Because of the foregoing construction the material employed for the two members making up the tool may be quite heavy and stiff.

The V-shaped portions 2 will of course be of such size that the distance between their opposed flattened portions or inner faces *a* thereof will appreciably exceed the greatest diameter of the valve B so that when the tool is applied in operative position to a valve-stem the portions 2 of the tool will straddle the valve B, as illustrated in Figure 2.

The arms 1 will lie together and will preferably converge downward from the portions 2 to their tips on a very slight angle to aid in bracing the tool as a whole when subjected to a blow or downward pressure incident to driving out the bushing E. Also, said arms 1 will preferably be curved or bent in cross-section with their concave faces presented toward each other to approximately conform to, receive between them, and fit about, the valve stem C and to have a composite external face of such size and shape as to pass downward into the valve-stem guide F during the driving out of the bushing E. In other words, as applied to the valve-stem C, all portions of the lower parts of the arms 1 will lie nearer to the valve-stem C than the inner face of the guide F, thus guarding against all possibility of injurious contact therewith, avoiding damage both to said guide F and to the tool.

To facilitate the spreading of the arms 1 during the application thereof to the valve stem the adjacent lower end corners or portions of said arms will preferably be beveled as at 5, the tool being inserted at an angle through the port with said beveled portions 5 adjacent the valve-stem C, when a slight shove will cause said beveled portions to spread apart in riding about the cylindrical face of said stem until the lower portions of the arms 1 straddle said stem, when a swinging of the tool as a whole to vertical position causes the arms 1 to move into parallel relation with said stem C, when they spring toward each other, embracing said stem with their opposed concave faces.

The concave or cross-sectional curved construction of the arms not only serves to correctly position the tool on the valve stem and with relation to the bushing E and the guide

F, but also serves to aid in bracing the tool as a whole against longitudinal deformation and to this end the said arms will preferably be of such cross-sectional form throughout, their upper ends or portions where they merge with their respective V-shaped portions 2 being of such concave shape and materially bracing the lower portion of the expanded straddling portion of the tool as a whole against deformation under pressure or hammer blows.

The operation is briefly as follows: The tool is inserted in a slanting position through the port hole and its beveled edges 5 are forced against the valve stem until the arms 1 spread and straddle the valve stem, when the tool is swung to vertical position, as illustrated in Fig. 2 with the lower ends of arms 1 engaging the upper end of the bushing E, when a sudden downward pressure, or a light tap with a hammer, will force out the bushing E. The tool may then be withdrawn together with the valve and its stem and thereafter separated in obvious manner from the valve stem, or it may be pulled from the valve stem while the valve and its stem are held against removal, according as may be desired.

Any suitable material may be used and of course any usual suitable securing means, other than spot welding, may be employed for securing the two members of the tool together. Further, although preferable, it is not essential that they be permanently or rigidly secured together so long as there is some provision for holding them relatively immovable or substantially so during the actual operation of removing the bushing, though of course under the influence of pressure or a blow one member may move endwise more than the other, it being borne in mind that the article is not a highly technical or exact precision instrument, but a rough usage tool constructed largely by sheet metal stamping operations from the general run of sheet metal stock and subject to variations in the thickness or weight of metal, in the degree of resiliency, in contour or form as the press and stamping dies may become worn etc. and also in relative positions during the assembly operations, all being matters incident to large quantity production operations.

Also, while the lower ends of the portions 1 of the tool are shown and described as lying in the same horizontal plane, this is not essential, although most natural, usual and preferred.

Also, while thrust on the bushings in a direction as nearly exactly parallel to the axis of the valve stem as is obtainable is desirable, this is not an essential, such thrust need not be exactly parallel to such axis, nor need it closely approach parallelism to such axis, but it will be sufficient simply if the tool applies a pressure, thrust or blow to the

upper ends of the bushing members resulting in their being displaced downward from their normal position in their cooperating guides F.

5 Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A bushing removing tool comprising two members having their upper end portions secured together, free arms adapted to cooperate in fitting about an interposed part and adapted to engage the opposed end face of a bushing while said interposed part extends in said bushing, and formed intermediate said upper end portions and said arms with portions outwardly bent away from each other whereby said members may straddle an element of greater diameter than, and carried by, said interposed part and exert pressure on said opposed end face of said bushing.

2. A poppet-valve bushing remover comprising two members having opposed upper portions, opposed arms and oppositely outwardly bent intermediate portions, said upper portions being maintained in operative relation, said intermediate portions being adapted to straddle the valve on the upper end of a valve stem, and said arms being adapted to embrace the valve stem and engage the upper end of said bushing.

3. A poppet-valve bushing remover comprising two members having opposed upper portions, opposed arms and oppositely outwardly bent intermediate portions, said upper portions being secured together, said intermediate portions being adapted to straddle the valve on the upper end of a valve stem, and said arms being adapted to embrace the valve stem and engage the upper end of said bushing.

4. A poppet-valve bushing remover comprising two members having opposed upper portions, opposed arms and oppositely outwardly bent intermediate portions, said upper portions being rigidly secured together against relative movement, said intermediate portions being adapted to straddle the valve on the upper end of a valve stem, said arms being adapted to embrace the valve stem and engage the upper end of said bushing, and each of said members as a whole being stiff and slightly resilient, said resiliency normally forcing said arms into contact with each other and permitting their spreading movement to receive the valve-stem between them.

5. A poppet-valve bushing remover comprising two members having opposed upper portions, opposed arms curved in cross-section with their concave faces opposed to each other, and oppositely outwardly bent intermediate portions, said upper portions being connected together, said intermediate portions being adapted to straddle the valve on the upper end of a valve stem, and said arms

being adapted to embrace the valve stem and engage the upper end of said bushing.

6. A poppet-valve bushing remover tool having arms connected at their upper portions, said arms being formed with oppositely outwardly bent portions adapted to straddle the valve on the upper end of a valve stem and having portions depending from said outwardly bent portions respectively and adapted to receive between them the valve stem and to engage the upper end of the bushing.

7. A poppet-valve bushing remover tool having arms connected at their upper portions, said arms being formed with oppositely outwardly bent portions adapted to straddle the valve on the upper end of a valve stem and having portions depending from said outwardly bent portions respectively and adapted to receive between them the valve stem and to engage the upper end of the bushing, the adjacent side edges of said depending portions being beveled downward away from each other to the extreme lower ends of said portions.

8. A poppet-valve bushing remover tool having arms connected at their upper portions, said arms being formed with oppositely outward bent portions adapted to straddle the valve on the upper end of a valve stem and having portions depending from said outwardly bent portions respectively and adapted to receive between them the valve stem and to engage the upper end of the bushing, the adjacent side edges of said depending portions being beveled downward away from each other to the extreme lower ends of said portions, and the lower parts of said depending portions being formed with opposed inner concave faces to cooperate with each other in embracing and centering the valve stem between them.

9. A bushing remover comprising a single member including a driving portion, a valve hood, and a valve stem shank having a long channel for receiving the valve shank to permit the driving of a bushing out of an engine block with the valve protected in said hood.

10. Means for removing valve guides comprising a longitudinally grooved stem adapted to embrace a valve stem and provided with a valve receiving recess.

11. Means for removing valve guides comprising a longitudinally grooved stem adapted to embrace a valve stem and provided with a valve hood, said grooved stem being slightly less in diameter than the valve guide to be removed.

In testimony whereof we have signed our names to this specification at Lancaster, Pennsylvania, this 20th day of November, 1928.

HARRY W. KULP.
MARTIN C. DELLINGER.