

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: **85105663.0**

(51) Int. Cl.⁴: **F 01 L 1/46**

(22) Date of filing: **08.05.85**

(30) Priority: **08.05.84 US 608068**

(43) Date of publication of application:
13.11.85 Bulletin 85/46

(84) Designated Contracting States:
DE FR GB

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(54) **Hand-operated valve refacer.**

(57) A valve refacing tool having a sleeve-like housing, and a substantially cylindrical support disposed within and removably fixed to the housing. This cylindrical support has a small-diameter cylindrical opening which extends axially from the inner end thereof, and which communicates with the small-diameter end of a truncated conical recess which opens outwardly through the other axial end thereof. This conical recess accommodates the head of a poppet valve. A plurality of cutting blades are secured in angularly spaced relationship around the conical recess. The cylindrical support is split into a plurality of separable arcuate sectors, and each is individually fixedly but releasably secured to the housing.

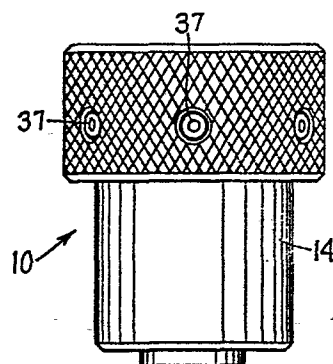


FIG. 1

HAND-OPERATED VALVE REFACER

BACKGROUND OF THE INVENTION

This invention relates to a tool for resurfacing the annular seating surface on poppet valves as used in internal combustion engines.

The resurfacing of the seating surface on poppet valves has typically required utilization of machinery which effects a grinding of the seating surface by means of a grinding wheel. Such machinery is expensive to purchase and maintain, and is complex to operate. Small
10 repair shops generally can not afford such machinery, and hence will often replace the valve due to an inability to reface the seating surface on the old valve.

There has been suggested a valve refacing device employing a cylindrical housing having a conical recess formed in one or both ends thereof. This device, as disclosed by Australian Application No. 91999/82, employs one or more carbide cutting blades which are positioned within elongated bores formed in the housing and thence project forwardly through elongated slots so
20 that the cutting blades project outwardly from the conical surface. With this device, the poppet valve is positioned so that the stem projects coaxially through the housing, whereupon the truncated conical seating surface is positioned within the recess for engagement with the cutting blades. Relative rotation between the

device and the poppet effects a cutting, and hence a refacing, of the seating surface.

While the valve refacing device of Australian Application No. 91999/82 does perform a desirable valve refacing operation, nevertheless this device does possess disadvantages. For example, the manner in which the blades are mounted on or within the housing, using either the grooved housing or a separate conical shell, increases the complexity of the overall device. These arrangements also make it difficult to provide a conical recess having a minimal diameter opening at the apex end of the recess, and hence make it difficult to position the cutting blades close to the small-diameter end of the recess, whereby refacing of very small-diameter poppet valves is difficult, if not impossible.

Another valve refacing device has also been suggested by German Gebrauchsmuster No. G 82 30 294.4 which illustrates a device having a one-piece sleevelike housing provided with a conical recess in one end thereof, which recess has grooves extending radially along the wall thereof, and carbide cutting blades are positionable within these grooves. With this arrangement, the machining of the housing and the forming of the conical recess and blade grooves prevents the recess from being of small diameter at the apex end, and hence prevents the blades from being positioned close to the apex, whereby this device is unable to accommodate small-diameter poppet valves.

In the valve refacing tool of this invention, there is provided a sleevelike housing having an enlarged cylindrical opening which terminates at its inner end in a shoulder. A sleevelike cylindrical support is removably positionable within the cylindrical opening and is

securable to the housing, as by screws. This cylindrical support has a conical recess formed in the outer axial end thereof, which conical recess at its apex end communicates with a small-diameter opening which extends axially through the support and communicates with the opening which extends coaxially of the housing. This conical recess is bounded by a conical surface having a plurality of grooves formed therein and projecting radially outwardly thereof. These grooves permit
10 carbide cutting blades to be locked in position therein. The cylindrical support is axially split so as to be defined by a plurality, preferably at least three, of arcuate sectors. This enables the central opening of the cylindrical support to be of minimal diameter, which diameter is sized (i.e., about 0.5 inch in diameter) so as to normally be only slightly larger than the typical valve stem and is hence a small fraction of the diameter of the conical surface at its outer or large-diameter end, whereby this permits the conical surface to be
20 properly machined so that the apex end communicates with said opening of minimal diameter. This enables the blade-receiving grooves to project radially to the apex end of the conical recess, and the blades themselves can be positioned close to the apex so as to readily accommodate poppet valves of small diameter. The cylindrical support can be readily interchanged to permit the valve refacing unit to be utilized with poppet valves of different angles.

BRIEF DESCRIPTION OF THE DRAWINGS

30 Figure 1 is an elevational view of the improved valve refacing tool of this invention.

Figure 2 is a top view of the device shown in Figure 1.

Figure 3 is a central sectional view taken substantially along line III-III in Figure 2.

Figure 4 is an enlarged, fragmentary sectional view taken substantially along line IV-IV in Figure 2.

Figure 5 is as view similar to Figure 3 but illustrating the tool having a different support therein for accommodating a valve of a different angle.

DETAILED DESCRIPTION

Referring to the drawings, the inventive valve
10 refinishing tool 10 is specifically for use with a
poppet-type valve 11. Such poppet valve has a truncated
conical valve surface 12 formed on the head thereof,
which head is secured to one end of an elongated stem
13. This valve surface 12 conventionally extends at an
angle of either 30° or 45° relative to a plane which is
perpendicular to the longitudinal axis of the valve
stem, although other angles are also utilized.

The tool 10 includes a housing 14 formed substan-
tially as a cylindrical sleeve having an externally
stepped configuration. This housing 14 has a stepped
20 bore 16 extending coaxially therethrough. This bore 16
includes a lower bore 17 which is of smallest diameter,
an intermediate bore 18 of intermediate diameter, and an
upper bore 19 of largest diameter.

The lower end of housing 14 has a liner sleeve 21
fixedly positioned within the lower bore 17, such as by
being press fit therein. This liner sleeve 21 in turn
has a sleevelike bushing 22 snugly but removably posi-
tioned therein. The bushing 22 defines therethrough a
30 bore 23 which is coaxially aligned with the bore 16 so
as to snugly accommodate the valve stem 13. The sleeve-
like bushing 22 has a shouldered flange 24 which abuts
against the lower axial end of the housing, which

shoulder flange enables the bushing 22 to be removed and replaced by a like bushing having a different diameter opening 23 therethrough, whereupon the bushing 23 is selected according to the diameter of the stem 13.

10 Tool 10 also includes a removable cylindrical support 26 which is positionable within the upper end of the housing 14. This cylindrical support 26 includes an inner cylindrical portion 27 which is snugly but removably positioned within the intermediate bore 18, and an outer cylindrical portion 28 which is snugly positioned within the upper bore 19. The cylindrical support 26 abuts against a shoulder 29 defined at the interface between the lower and intermediate bores.

20 The cylindrical support 26 has a conical bore 31 formed in and opening outwardly through the outer or upper end thereof, which conical bore at its apex or small-diameter end coaxially communicates with a small-diameter cylindrical bore 32 which extends axially downwardly through the cylindrical support 26. This bore 31 and its cylindrical opening 32 extends coaxially through the cylindrical support 26 and coaxially communicates with the lower bore portion 17.

The cylindrical support 26 is axially split so as to define a plurality of arcuate sectors or segments, there being three such segments 33, 33' and 33" in the preferred embodiment. These segments are formed by radial cuts 34 which project inwardly from the periphery of the cylindrical support to the longitudinal axis.

30 Each of the segments 33, 33', 33" is individually fixedly secured to the housing 14. For this purpose, each segment is secured by a pair of screws 37 which are spaced circumferentially and extend through appropriately shouldered openings 36 formed in the housing 14

for threaded engagement with aligned threaded openings formed in the appropriate segment.

The conical wall 31 has a plurality, here three, of elongated slots or grooves 41 formed therein, there being one said groove 41 formed in each of the segments in the illustrated embodiment. These grooves 41 have their inner ends in communication with the opening 32, from which the grooves project radially outwardly along the conical wall 31 so that the outer ends project through the outer or upper axial end of the respective segment. An elongated cutting element 42, such as an elongated cutting bar of carbide material having cutting teeth 43 extending in angled relationship across the upper surface thereof, is releasably positioned within each of the grooves 41. This cutting element 42, in the illustrated embodiment, has a trapezoidal cross section so that the base width exceeds the top width, and the groove 41 has a similar trapezoidal cross section so that the cutting element 42 hence has to be slidably inserted into the groove from the outer end thereof. A small counterbore 44 is formed in the conical surface 31 directly adjacent each of the grooves 41, and an annular wedge 46 is positionable within each counterbore and has an appropriate side surface which wedgingly contacts one of the tapered side surfaces on the respective cutting element 42. A screw 47 secures the wedge 46 downwardly to hold the cutting element 42 within its groove. As so positioned, the cutting element 41 projects upwardly above the conical surface 31 so as to expose the teeth 43 to permit performance of a refacing operation.

The three cutting blades 42 are preferably disposed in a nonuniform angularly spaced relationship such that the angles between adjacent blades are not all equal.

The conical surface 31 associated with the embodiment illustrated by Figure 3 is designed for accommodating a poppet valve having a 45° angle valve seat. This 45° angle is measured relative to a plane which extends perpendicular with respect to the longitudinal axis of the valve stem. However, the support 26 of Figure 3 can be replaced by the modified cylindrical support 126 of Figure 5, which support has a conical surface 131 designed for accommodating a valve seat having an angle of 30°. This modified cylindrical support 126 is otherwise identical to the support 26.

Hence, in the valve refacing tool 10 according to the present invention, the tool includes not only the housing 14, but also includes at least two removable cylindrical supports 26 and 126, each of which is preferably defined by three arcuate sectors, with one of the supports being suitable for a 30° valve seat and the other suitable for a 45° valve seat. Further cylindrical supports having different angles thereon can also be provided if desired. The cylindrical supports 26 and 126 can hence be readily interchanged depending upon the angle of the valve seat which is to be refaced.

The segmented construction of the cylindrical support 26 or 126 enables the opening 32 to be of minimal diameter (i.e., about 0.5 inch) and permits the conical surface 31 and grooves 41 to be properly machined so as to extend all the way up to this opening 32. This opening 32 is hence only slightly larger than the diameter of the bushing bore 23. The blades 42 can thus be positioned so as to readily accommodate valve seats of small diameter.

To utilize the tool, a poppet valve is positioned within the tool substantially as illustrated by Figure

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5, following which relative rotation effects refinishing of the valve seat 12 due to the latter being rotated across the cutting teeth 43. This refacing operation is preferably accomplished manually, such as by securing the free end of the valve stem 13 within a vise so as to stationarily support the valve 11, following which the tool 10 can be manually gripped and axially pulled toward the valve head to control the contact pressure between the cutting blades and the valve seat. Manual rotation of the tool then effects the desired refacing of the valve seat.

CLAIMS

1. A tool for refacing the valve seat of a poppet-type valve having a stem, characterized by:

a sleevelike housing (14) having a bore (16) extending axially therethrough, said housing defining thereon an annular shoulder;

a substantially cylindrical sleevelike support (26 or 126) removably positioned within said bore (16), said cylindrical support having an axial surface which substantially abuts said shoulder;

10 said cylindrical support (26 or 126) having opening means extending coaxially therethrough in alignment and communication with said bore, said opening means including a truncated conical recess (31) which opens inwardly from an outer axial end of said cylindrical support and converges as it projects axially therefrom for communication with a small-diameter opening (32) which projects axially of said cylindrical support from an inner axial end thereof, and said conical recess being defined by a substantially truncated conical surface
20 which opens outwardly of said outer axial end;

at least one elongated cutting blade (42) removably mounted on said cylindrical support (26 or 126), said elongated cutting blade extending substantially radially outwardly along said conical surface and having a cutting surface thereon which is spaced outwardly from said conical surface;

 said cylindrical support (26 or 126) being axially split so as to define a plurality of separable arcuate sectors (33, 33', 33'') which together effectively define
30 a complete sleevelike cylinder; and

 securing means (37) coacting between said housing and each said sector for permitting each said sector to

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be positioned within said bore and fixedly but releasably secured to said housing.

2. A tool according to Claim 1, characterized in that said cylindrical support is defined by at least three arcuate sectors (33, 33', 33'') each extending through an angle of substantially less than 180°.

3. A tool according to Claim 1 or Claim 2, characterized in that said securing means includes a plurality of screws (37) which extend radially through said housing for threaded connection with the respective sectors, each said sector being fixedly but removably secured to said housing by at least two said screws which are circumferentially spaced apart.

10 4. A tool according to any one of Claims 1-3, characterized in that the cylindrical support has three blade-receiving grooves (41) formed in the conical surface thereof in angularly spaced relationship, each of said grooves accommodating one of said blades (42) therein, each said groove having a trapezoidal-shaped cross section and opening outwardly at the opposite ends thereof as defined at the large- and small-diameter ends of the truncated conical surface, said blade having a trapezoidal cross section provided with a base having a width which is greater than the width of the surface having the cutting teeth thereon, said blade being slidably insertable into the groove from one of the ends thereof.

5. A tool according to any one of Claims 1-4, characterized in that the bore (16) is stepped and includes a large-diameter bore portion (18) in which

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said cylindrical support (26 or 126) is positioned, the stepped bore also including a small-diameter bore portion (17) which opens outwardly through the other end of said housing, and a sleeve-like bushing (22) snugly but removably positioned within said small-diameter bore portion.

6. A tool according to any one of Claims 1-5, characterized in that a second cylindrical support (126) which is removably positionable within said bore and is substantially identical to said first-mentioned cylindrical support except that the second cylindrical support has a conical recess therein which is of a different angle from the conical recess of the first-mentioned cylindrical support.

7. A tool according to any one of Claims 1-6, characterized in that said small-diameter opening (32) has a diameter which only slightly exceeds the diameter of the typical valve stem.

8. A tool for refacing the annular valve seat formed on the head of a poppet-type valve having an elongated stem projecting from the valve head, comprising:

a sleeve-like and substantially cylindrical housing (14) having a stepped bore (16) extending axially therethrough, said stepped bore including a large-diameter bore portion (18) which opens outwardly through one axial end of said housing, said large-diameter bore portion defining an inner annular shoulder on said housing;

a substantially cylindrical sleevelike support (26) removably positioned within and substantially wholly occupying said large-diameter bore portion, said cylindrical support having an inner axial surface which substantially abuts said shoulder;

20 said cylindrical support (26) having opening means (31, 32) extending coaxially therethrough in alignment and communication with said bore, said opening means including a truncated conical recess (31) which opens inwardly from an outer axial end of said cylindrical support and converges as it projects axially therefrom for communication with a small-diameter opening (32) which projects axially of said cylindrical support from an inner axial end thereof, said conical recess being defined by substantially truncated conical surface which opens inwardly of said one axial end, and said small-diameter opening (32) having a diameter which is only a
30 small fraction of the diameter of said truncated conical surface at the large diameter end thereof as defined at said outer axial end of said cylindrical support;

said cylindrical support (26) being axially split so as to define at least three separable arcuate sectors (33, 33', 33'') each extending through an angle of substantially less than 180° , said sectors together effectively defining a complete sleevelike cylinder when positioned within the large-diameter bore portion of said housing;

40 movable securing means (37) coacting between said housing and each said sector for permitting each said sector to be positioned within said large-diameter bore portion and fixedly but releasably secured to said housing;

each of said arcuate sectors (33, 33', 33'') having at least one blade-receiving groove (41) formed in the conical surface thereof, said groove extending substantially radially of said conical surface (31) so that the groove opens outwardly at the opposite ends thereof through the large- and small-diameter ends of the truncated conical surface; and

at least one elongated cutting blade (42) fixedly but removably mounted within at least one of said grooves, said elongated blade extending substantially radially outwardly along said conical surface and having a cutting surface thereon which is spaced outwardly from said conical surface.

9. A tool according to Claim 8, wherein the stepped bore (16) formed in said housing includes a small-diameter bore portion (17) which opens through the other end of said housing and coaxially communicates with said large-diameter bore portion (18), the small-diameter opening (32) as formed in said support being of significantly smaller diameter than said small-diameter bore portion (17), and a sleeve-like bushing (22) snugly but removably positioned within said small-diameter bore portion (17), said bushing having a cylindrical opening (23) of small cross-section extending coaxially there-through for guiding the elongated valve stem.

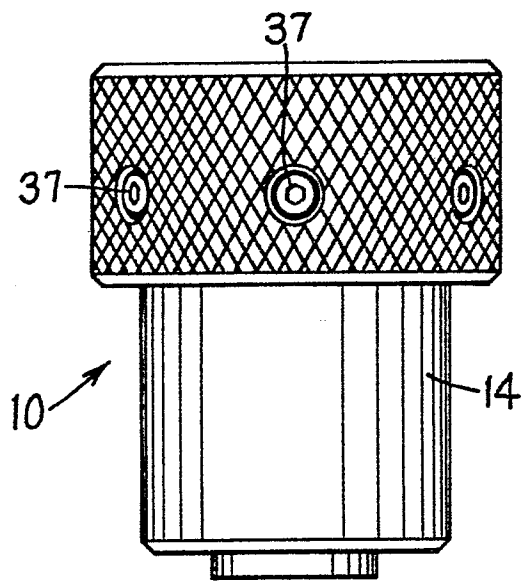


FIG. 1

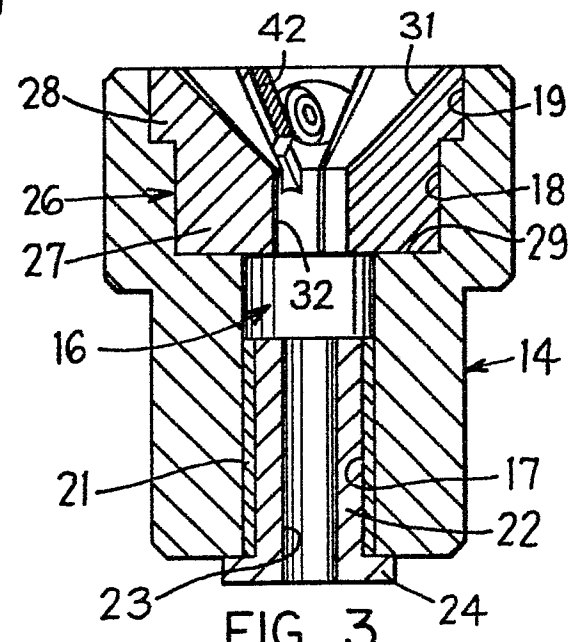


FIG. 3

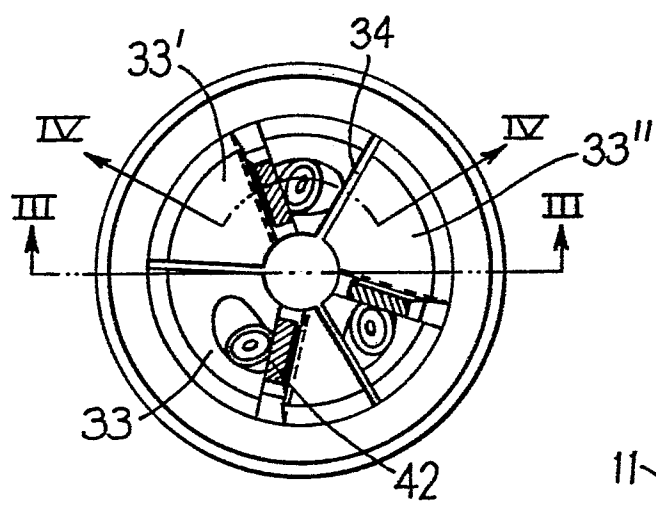


FIG. 2

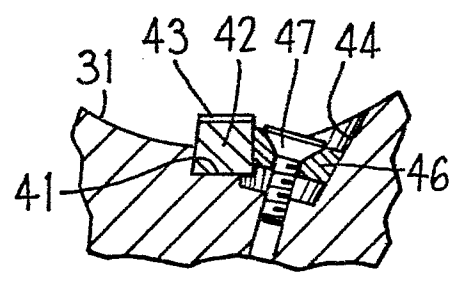


FIG. 4

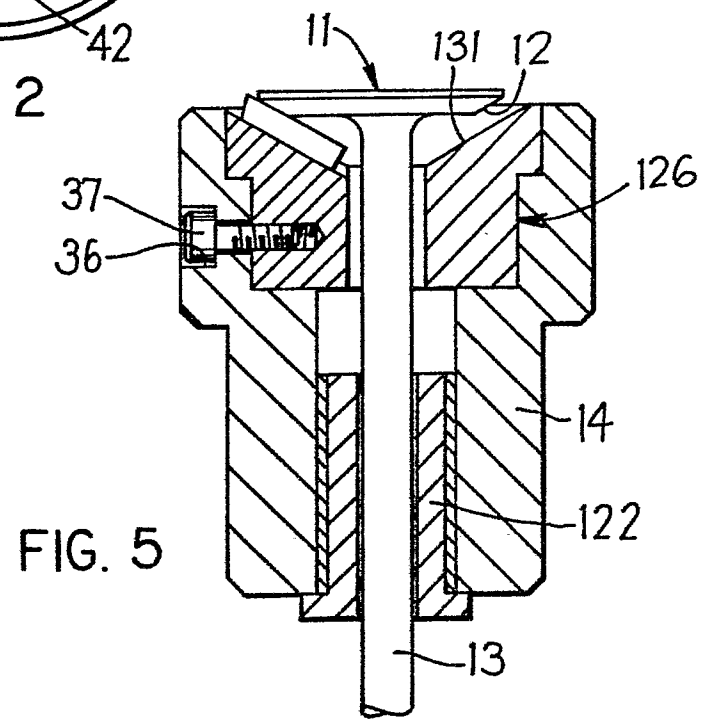


FIG. 5