March 11, 1941. C. T. ROTTLER 2,234,710

VALVE SEATING TOOL

Filed June 1, 1938

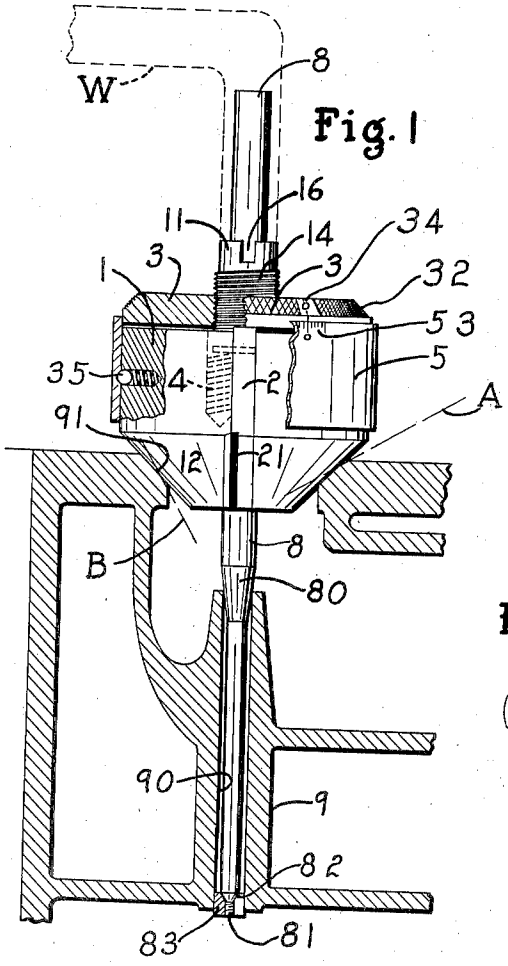


Fig. 1

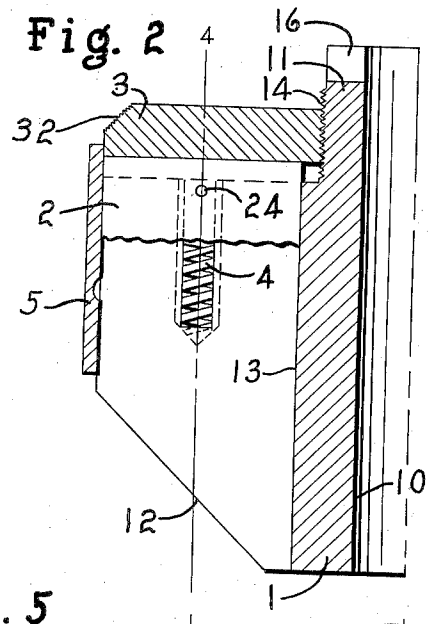


Fig. 2

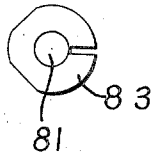


Fig. 5

Fig. 3

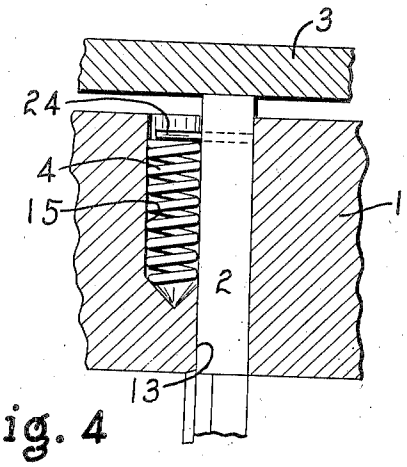


Fig. 4

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VALVE SEATING TOOL

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Application June 1, 1938, Serial No. 211,131

10 Claims. (Cl. 90—12.5)

My invention relates to the operation which is usually called "grinding the valves" of an internal combustion engine. More correctly it is a reseating or valveseating operation, and consists of forming a true surface upon the valve seat, upon which a true and perfect valve will seat substantially perfectly.

This operation is currently performed largely by extremely high-speed abrasive wheels. These wheels are dressed with a diamond to the precise angle of the seat desired, and then, rotating at high speeds (say at speeds of 15,000 R. P. M.), are brought momentarily in contact with the seat. Such valve grinding machines as are now commonly in use cause the grinding wheel repeatedly to effect the merest contact with the seat, and then to be quickly withdrawn. Such wheels operate with reasonable satisfaction only when rotating at the high speed for which they are intended, and if they are caused or permitted to remain in contact with the valve seat for any length of time they will be forced to slow down or will fill up with grit, so that they are no longer effective, and in any event the change of speed and working conditions will cause disturbance of the equilibrium of the wheel and inaccuracy in its work. Chattering and squealing will result, this being distracting, and objectionable also on the ground that it accompanies and indicates improper functioning. Nevertheless, because of the extremely high speeds of such abrasive wheels, some chattering and some inaccuracy can not be avoided, for tools rotating at such speeds can not be properly and accurately balanced, statically and dynamically, and are easily thrown out of balance by small forces, hence are bound to tend to wobble, or to depart from a true axis of rotation. This tendency is due primarily to the high speeds at which they are rotated, and arises in part because the valve pilot stem, positioned as accurately as possible within the axis of the valve stem guide, is necessarily and inherently unable to resist distorting forces, and to form an accurate guide, when the wheel is rotating at such speeds, even if only slightly unbalanced or thrown out of balance, and because the valve pilot stem may itself be inaccurately positioned. Moreover, a grinding wheel necessarily wears in use, and can not readily be trued up, hence it is bound to be inherently somewhat inaccurate most of the time it is in use.

Thus while these machines do a reasonably good job and do it with dispatch, because of the high speeds, they still leave a great deal to be desired in accuracy, and due to the fact that they take off an appreciable amount of metal, more than is necessary to obtain a true seat. They are, moreover, expensive.

Tools in the nature of reaming tools have also been provided for reseating valves, these comprising numerous cutting edges disposed about a tool body and each edge inclined to correspond to the angle of valve seat desired. Theoretically such seating tools can be guided as accurately as the present tool, and can cut more rapidly, since it can be argued that thirty edges necessarily cut thirty times as fast as one edge, but actually they are found to be inaccurate, they do not cut rapidly, and are far from satisfactory. They have been replaced almost wholly by the high speed abrasive tools referred to above, notwithstanding the recognized drawbacks of the latter.

The multiple cutters of such a tool cannot possibly be sharpened in such a manner that each one lies in the same cone. One will inevitably be higher than all the others. Another will be higher than all except the first, and so on. Even if these differences are only a thousandth of an inch or less, they still exist. The result is that the highest edge, if sufficiently sharp, accomplishes the cutting, and the others are largely or wholly inoperative. If the highest edge is not sufficiently sharp (and that would generally be the case) it merely serves as an obstruction to prevent proper access of the lower cutting edges to the work, with the result that no cutting is done, or if any is done it is inaccurate, due to the effort being made to force the lower cutters into the work. As a matter of fact, such edges can not be kept sharp because they must be formed in a solid steel body, and are not inserted carbide teeth. It may be possible to make inserted carbide teeth for such tools, but such was not the common practice, and indeed if they were to be so constructed it would still be impossible to grind the cutting edges so that they are all uniformly high, and so that no one is higher than all the others.

Still another difficulty with such multiple cutter tools is that they chatter. They tend to hang up and then to jump ahead, and the work is thereby rendered inaccurate and imperfect, requiring grinding in any event before the seat is finished. The probable reason for this is that one tooth bites into the metal of the seat, and builds up resistance until finally the torque applied to the tool overcomes this resistance. At the moment the resistance is overcome there is no resisting force tending to slow down the tool

other than the frictional bearing of such teeth as have edge bearings upon the seat, and these can only be a few teeth, in the nature of things. These few teeth, at the moment the torque overcomes the resistance of the metal, have but slight frictional engagement with the seat. Resistance to rotation builds up after the release has been effected, and as the cutting tooth again bites into the seat, but until it does the tool turns freely with substantially no resistance. As the resistance builds up, the tool slows down, and it is this alternate acceleration and deceleration of the rotative movement of the tool that constitutes or produces the chattering.

It is the general object of the present invention to provide a tool which is not a grinding tool, but a cutting tool, which is simple, quick, and extremely accurate, which can not chatter, which is controllable and operable manually, and which returns to the operator the proper feel, so that he may determine by the feel of the work, rather than by visual inspection of more elaborate tests, whether or not he has completed the operation.

More specifically it is an object of my invention to provide a tool for valve seating operations which is so formed and arranged that it cuts accurately whether the pressure is heavy or light, whether it is taking a light or a heavy cut, and especially at the start when the seat is inaccurate and the tool cannot be wholly guided by the seat but must be guided to a considerable extent by the necessarily light pilot stem, customarily employed, but usually as the sole and essential guide. Thus when the tool is guided by the pilot stem, especially at the start of an operation when the seat is inaccurate, the cutter will take off its full cut all around the seat (unless the seat is badly "off"), though the pressure may be inclined relative to the axis of the valve pilot stem, whereas a grinding wheel or diamond cutter will take off the heavier cut on the side toward which it is pressed, for the pilot stem will flex to some extent, and the seat will therefore be somewhat oval in shape, and perfect contact cannot be obtained. In part the superior accuracy of my tool results because there is only one cutter, cutting but slightly whether the pressure is heavy or light, and because the stem in my arrangement has actually some guiding function, since it has to resist only manual pressure which can be reasonably accurately aligned with its axis. After the cut has been roughened out and the cutter bit has been retracted to take off but a light shaving cut, the tool is more accurate, primarily because the body of the tool is guided by the accurately roughed out seat, and in the same way, but to a lesser degree, perhaps, it is more accurate than the old tools even during a roughing cut.

It is a further object to provide a tool which is rugged; a tool which, when the need arises, as in a finishing cut, may be adjusted by minute increments, of the order of fractions of a thousandth of an inch; a tool in which the body, when resting fully and fairly upon the valve seat as a guide, will not be disturbed in that condition by the minute projection of the cutting edge of the tool in finishing the cut, but which minute projection may be of the order of .0005 inch, that is to say, from zero up to perhaps as much as one thousandth of an inch, or even more, if desired; a tool which is capable of being taken apart and cleaned readily; a tool which may have differently shaped cutting tools to replace the normal cutting tool whereby the width of the seat may be trimmed to the proper width desired; a tool which is inexpensive, and one which restores to the operator the control and feel that he needs to determine when the work is properly and accurately done; a tool which is manually operable at low speeds, which assists in eliminating chattering and squealing; and in general, a tool with which more accurate work can be done, and done more quickly.

With these and other objects in mind, as will appear hereafter, my invention comprises the novel tool, and the novel parts and assemblage thereof, and the novel method of seating valves, as shown in the accompanying drawing, described in this specification, and as will be more particularly defined by the claims which terminate the same.

In the accompanying drawing I have shown the tool which forms a part of my invention, in a form which at present is preferred by me.

Figure 1 is a section through a part of an internal combustion engine, taken along the axis of a valve stem guide, and showing the valve seating tool in operative position.

Figure 2 is a section axially through a half of the tool, taken along the plane of the cutting tool, and Figure 3 is a bottom plan view of the same.

Figure 4 is a section along a plane parallel to the tool's axis, as indicated at 4—4 in Figures 2 and 3.

Figure 5 is an end view of the lower end of the pilot stem.

It will be understood that the tool is intended to operate upon various makes, and in fact upon any standard make of internal combustion engine, varying in size and arrangement as may be necessary, and the details of the engine which are shown may vary in different engines and are largely immaterial insofar as concerns my invention. The valve of the engine usually has its stem guided within a valve stem guide 90, formed within the casting 9 which constitutes the cylinder block, in axial alignment with the valve seating surface 91 which is arranged 45° to its axis in practically all such engines.

As a means of readily guiding the tool to its seat against minor tendencies to inaccuracy, and as a means of showing up inaccuracies, I prefer to employ a pilot stem 8, having a taper exaggeratedly shown at 80 and a reduced threaded lower tip 81, with a cone 82 thereabove. A split sleeve 83, threaded on the tip 81, may be expanded by forcing its tapered upper end against the complemental coned portion 82, thus to engage the lower end of the valve stem guide 90, whereby the stem 8 may be properly held and centered in axial alignment with the guide 90. Its upper end projects above the valve seat 91 to serve as a pilot stem.

A body 1, preferably cylindrical, has a bore 10 to fit closely about the upper end of the pilot stem 8. At its upper end the body is provided with a stem 11, and its lower end 12 is accurately coned to contact the entire area of an accurate valve seat 91. This conical end is made sufficiently hard (as by pack-hardening and then plating it with a hard metal, as chromium) that it will not wear in use and thereby become inaccurate, nor gall. Within this body is received a single cutter, to be described in detail hereafter, tapered to correspond to the cone 12.

It will be understood that if the valve seat has been accurately roughed out, the seat itself, contacting with the conical surface 12 of the body 1, will serve as a sufficient guide to center the tool

accurately within the valve seat, especially if the cutter is projected so slightly from the conical surface that it does not bite materially into the valve seat, or can be caused so to bite in by the slight manual pressure on the tool. When the tool is thus slightly projected it only serves to shave the seat and to make a fine finish cut. On the other hand, if the valve seat is inaccurate, it can not by itself serve as the guide for the body 1, and the stem is then the guide for the tool, and is sufficiently accurate, with reasonable care, for the roughing cut. Yet the stem 8 is somewhat flexible, and can not resist wholly sidewise pressure tending to displace it from true axial alignment with the guide 30. However, because of the fact that there is but a single cutter, and that this cutter is never projected so far but what it will easily take off a cut to the full depth of its projection, and due also to the bearing of the conical end 12 on the valve seat, producing a resultant tendency to center the body in the valve seat, any sidewise pressure will be resolved largely into axial pressure, and the single cutter will take off an accurate cut, even though the valve seat be inaccurate at the outset. In effect, if not actually, the valve seat itself, in conjunction with the accurately coned tip 12, serves as the principal guide for the tool. If the tool were an abrasive wheel, however, and especially if it were rotating at the extremely high speeds of the abrasive wheels now commonly used, were the pressure to be anything but precisely axial, the axis of the grinding wheel would be inclined and the resulting valve seat surface would be inaccurate, and inclined to be oval in shape. It may be thought that such a tool will squeal and chatter as much as other tools (the multiple-cutter type, for instance), or more so because of greater area of contact with the seat. Actually such greater area of contact is a preventive of chatter, for its friction so far exceeds the resistance of the tool to torque, that there can be no sudden decrease of resistance during turning of the tool, hence there can be no chattering.

Thus it will be seen that the present tool, because of its construction and because of the use of a single tool bit, is superior to the high-speed abrasive wheels now in use, and in addition it restores to the operator the opportunity to employ skill and judgment in determining when the seat has been properly refinished.

The precise form and arrangement of the tool bit, and the manner in which and the means by which it is moved, are largely immaterial, insofar as concerns the broad phases of my invention. The material of the valve seats varies in hardness from cast iron to very hard, tough steel. The cutting edge of the tool bit must be of such material, and the angles of its faces must be so ground, and have such clearance, as will best fit it to the particular seat to be worked upon, but again, these details are matters of experience and common knowledge, and constitute no part of my invention. The following description is of a typical arrangement, as now preferred by me, but by no means the only arrangement possible within the scope of my invention.

Along a radial plane, and preferably from its periphery inwardly, the body 1 is longitudinally slotted, as indicated at 13, and within this slot is received the cutting tool bit 2. At its upper end it projects somewhat above the upper surface of the body 1, and its lower end is tapered to coincide as exactly as possible with the conical surface 12. Its cutting edge is preferably formed with an inset piece of very hard tungsten carbide, as indicated at 21, and the conical surface is slightly relieved adjacent this cutting edge 21 for clearance of the shavings. I have found that extremely hard valve seats require not only very hard carbides, but greater clearance than normal.

Means are provided to normally and yieldingly urge the cutting edge 21 back within the slot 13, and opposing means are provided to press it outwardly, in opposition to the yielding means. Such adjusting means must be capable of adjusting the cutting edge by minute increments, and to this end I have shown threads 14 on the stem 11, which are of very low pitch but of appreciable diameter, a disk 3 being threaded thereon. This disk overlies and engages the upper end of the cutting tool 2. This acts to press the cutting edge 21 outwardly, and to retract it I may employ a spring 4, which is received within a bore 15 alongside of and communicating with the slot 13, and extending parallel to the axis of the body 1. A pin 24, carried by the upper end of the tool 2 and projecting within the bore 15, is engaged by the upper end of the spring 4, with the result that the spring tends to pull the tool 2 upwardly or within the slot 13.

In order to hold the tool 2 within the slot 13 it is convenient to supply a sleeve 5, surrounding the cylindrical body 1. This sleeve is shown as rotatable about the body 1, but is held against axial movement by a spring-pressed ball 35, in a recess in the body 1, engaging within a circumferential groove formed in the inner wall of the sleeve 5. The disk 3 may be provided with a knurled portion at 32, and an angular scale 53 may be provided on one element, as the sleeve, cooperating with an index, as 34, upon the other element, as the disk (see Figure 1). By rotating the sleeve to align its scale's indices with the disk's index 34, the zero position of no projection of the tool bit may be determined, or the extent of the tool's projection may be determined, regardless of wear, expansion, or other disturbing factors.

The upper end of the stem 11 is provided with notches 16 or equivalent means for the engagement of a sleeve wrench or the like, indicated at W, by means of which the whole assembly may be turned by hand.

The pilot stem 8 being first put accurately in place as a general guide, the body 1, with the associated parts assembled to it, is slipped upon the stem 8 and is brought to as good a seat upon the valve seat 31 as can be accomplished under the conditions of inaccuracy of the seat to be corrected. Preferably at this time the cutting edge 21 is retracted. Now the tool bit may be brought forward slowly until the operator, rotating the tool, can feel it touch the metal, but without taking off any appreciable cut at any point in the circumference of the valve seat. The zero point on the scale is thus determined, regardless of wear in sharpening the tool bit, and the scale is set. The tool may now be advanced, and usually a roughing cut is first taken off, to accomplish which the tool may be set out by as much as several thousandths of an inch. As previously explained, during this roughing cut the pilot stem 8 is the principal guiding means, though as the cut progresses and the seat becomes more accurate the seat itself, bearing against the accurate cone 12, takes up more and more of the guiding function, and causes the tool to be more and more accurately aligned with the axis of the guide 30, and serves more

and more to relieve the pilot stem 8 of the functions of guiding. No galling occurs, since the chromium-plated cone can not gall.

When the operator has determined by feel or by visual inspection that a sufficient roughing cut has been taken off of the valve seat, he retracts the tool bit until the tool projects but a very small amount, in order to take off a finish cut. Usually this is done by retracting the tool bit completely within its slot, and then projecting it until it just bites into the metal, upon application of normal manual pressure, and quite insufficiently to disturb the guiding engagement of the cone 12 with the rough-cut valve seat. The projection of the tool bit at this time may be as little as .0001 inch, or in other words, a projection of the order of a half of a thousandth of an inch (.0005 inch). Its projection may be somewhat more or may be somewhat less than .0005 inch, but a projection of this order, with a seat not extraordinarily hard, does not disturb the seating of the conical end 12 of the body upon its seat 91, nor disturb the guiding effect of the engagement of these two surfaces, yet it does permit the cutting edge of the tool to shave off some material to produce a finish cut, and this without undue or even appreciable pressure or effort. Because of the guiding of the board, true conical surface at 12 upon the similar conical surface at 91 the finish cut is a true cut, and is made without chatter because made at low speed, and because the friction throughout the conical bearing prohibits the occurrence of conditions which cause chatter, as previously pointed out. The operator can tell by the feel when the tool is cutting about the complete circle, and when the shaving is uniform throughout. When this stage is reached the tool is removed, and for all practical purposes the operation is complete upon this particular seat.

Some operators who do such work are naturally more skillful than others, or more careful in their work. With a careful, skillful operator no further operation is necessary after the finish cut has been taken off in the manner described, but since many or most operators will not be sufficiently careful or skillful to produce a perfect seat every time, it may be desirable to supply a hone, which may be slipped upon the pilot stem 8 in place of the body 1, this hone being accurately coned to fit a perfect seat, and by its use the seat is finally finished, although, as stated above, this is not necessary if the work has been accurately and carefully done with the tool bit 2. It must be borne in mind that the use of the hone is not necessary nor desirable where the work is sufficiently accurately done without it, and if a hone is used it is rotated only by hand and slowly.

It may be found that the width of the face, when finished, is too great. Only a narrow face is required, and the less width of active working face the less chance there is of pitting and flaking. Accordingly, if it is desired to narrow down the width of the valve seat, this may be done by removing the tool 2, and by putting in its place tools which have different angles, to cut along the line A at the upper side of the valve seat, and along the line B at the lower edge of the valve seat, respectively, whereby there is left a valve seat which is true throughout its circumference, and is of the width desired.

The entire operation is a manual one, and enables the operator to bring into play the full skill that he possesses as an expert workman. He knows by the feel of the tool when it has performed its work, and when it has not finished its work. He cuts only so much as is necessary to perform the required operation and no more. It is done quickly, and it is done accurately because the main guide, in the final stages, is the engagement of the true and hard conical face 12 of the tool, and the corresponding face of the valve seat 91, which gives a better guide than can possibly be supplied by the pilot stem alone. Nevertheless, such a tool, used with a pilot stem, can do more accurate work than a high speed abrasive wheel, for reasons given above.

While I have described the portion 12 of the body as conical, and while it is preferred that it be of sufficient area of bearing on the seat that the force required to overcome its friction is materially greater than the force required to push the cutter bit through the material, thus to prevent chattering, it is not outside the scope of my invention to have the portion 12 relieved by grooves or the like, so long as it bears truly about a cone as it rotates. It is preferred, however, that it be truly and throughout its extent a cone. The edge of the cutter bit should lie, with but little if any departure, in an elemental line (that is, in an axial plane) of such a cone. If it lies in any plane other than a strictly axial plane it becomes a parabola, an hyperbola, or an ellipse, all of which are curves, and it is impossible in practice designedly to sharpen a cutter bit other than with a straight edge; a very slight departure from a radial plane, as by the thickness of the cutter bit shown herein, does not, however, create any such inaccuracy outside the limits of normal unavoidable inaccuracy arising from the instrumentalities available for sharpening the bit.

What I claim as my invention is:

1. A valve seating tool for internal combustion engines, comprising a body formed with a conical end shaped to seat perfectly in a perfect valve seat, the periphery of said body being slotted in an axial plane, a tool bit slidable lengthwise within said slot, and having its cutting edge angled to coincide with the angle of the conical end, yieldable means urging such cutting edge within the slot, a sleeve surrounding the body and retaining the tool bit within its slot, a member threaded upon the body, and engageable with the tool bit for adjustment of the latter's cutting edge by minute increments, and means to slowly rotate the body, while it is seated and guided mainly by contact around the valve seat, to remove material from the seat by the tool's cutting edge, projecting insufficiently to raise the body from its guiding seat.

2. A valve seating tool forinternal combustion engines, comprising a substantially cylindrical body formed with a hard conical end shaped to seat perfectly in a perfect seat, and slotted radially and lengthwise to receive a tool bit, a tool bit slidable lengthwise in said slot, and having its cutting edge angled to coincide with the angle of the conical end, the body having a bore parallel to and communicating with said slot, a spring within said bore, a pin projecting from the tool bit into said bore, and engaged by the spring to urge the tool's cutting edge within the slot, means to press the tool's cutting edge outwardly of the slot by minute increments, and means to manually rotate the body, while it is held axially aligned with the valve seat.

3. A valve seating tool for internal combustion

engines or the like, comprising a substantially cylindrical body having a stem at one end and a hard conical opposite end shaped to seat perfectly in a perfect seat, and slotted from its periphery along an axial plane, to form a tool guide parallel to its axis, a tool bit slidable lengthwise in said slot, and having its cutting edge angled to coincide with the angle of the conical end, the body having a bore parallel to and communicating with said slot, a compression spring within the bore, a pin projecting from the tool bit into said bore, and engaged by the spring to urge the tool's cutting edge within the slot, a disk threaded upon the stem by low-pitch threads, for minute increments of adjustment, and engaged with the tool to project it in opposition to the spring, a sleeve encircling the body and covering the slot to retain the tool therein, the body being formed for engagement by a hand tool, for rotation while guided mainly by its seating upon the valve seat, and for determination by "feel" when the minutely projecting tool is cutting about a complete circle.

4. A tool for surfacing the valve seat of an internal combustion engine, or for like purposes, comprising a body formed with a conical end shaped to seat within and to be thereby accurately axially aligned with a perfectly surfaced valve seat, and having a generally radial slot extending inwardly from its periphery, the bottom whereof is disposed parallel to the body's axis, means cooperating with and mounted upon the body, to close the peripheral end of the slot, and to form, in cooperation with the bottom of the slot, guide means parallel to the body's axis, a single cutting tool bit received in said slot, and guided in said guide means for axial movement, the cutting edge of said bit being inclined to match the conical end of the body, yieldable means urging the tool bit towards retracted position, within the body, and means reacting between the body and the bit, by minute increments, to project the cutting edge of the bit from the body as required.

5. A tool for surfacing the valve seat of an internal combustion engine, or for like purposes, comprising a cylindrical body formed with a conical end shaped to seat within and to be thereby accurately axially aligned with a perfectly surfaced valve seat, and longitudinally slotted in an axial plane, a single cutting tool bit received in said slot, tapered to match the conical end of the body, and movable lengthwise between a retracted position, within the conical end, and an operative position, projected from such conical end, a closely-fitting sleeve surrounding the body, and retaining the tool bit in its slot, means urging the working edge of the tool bit towards retracted position, a disk threaded by low pitch threads upon the body, and engaging the tool bit, at the end opposite its working edge, to move it towards projected position, and means to rotate the body while it is held axially aligned with the valve seat.

6. A tool for surfacing the valve seat of an internal combustion engine or for like purposes, comprising a cylindrical body formed with a conical end shaped to seat within and to be thereby accurately axially aligned with a perfectly surfaced valve seat, and longitudinally slotted in an axial plane, a single cutting tool bit received in said slot, tapered to match the conical end of the body, and movable lengthwise between a retracted position, within the conical end, and an operative position, projected from such conical end, a closely-fitting sleeve surrounding and rotatable about the body, and retaining the tool bit in its slot, means urging the working edge of the tool bit towards retracted position, a disk threaded by low pitch threads upon the body, and engaging the tool bit, at the end opposite its working edge, to move it towards projected position, the sleeve and the disk having cooperating indices settable by rotation of the sleeve to indicate the position of the tool bit, and means to rotate the body while it is held axially aligned with the valve seat.

7. A tool for resurfacing the valve seat of an internal combustion engine, or for like purposes, comprising a body formed with a frusto-conical end shaped to seat substantially perfectly about a perfectly surfaced valve seat, and longitudinally slotted, a single cutting blade received in the body slot and having a cutting edge inclined like said frusto-conical body surface and adapted to lie flush therewith, a control disc mounted on the upper end of said body, having a portion of its lower surface abutting the end of said cutting blade remote from its cutting edge, and rotatable to move the blade contacting portion of its lower surface axially of said body, thereby to move said blade also in an axial direction, and resilient means urging said blade axially inward in the direction to withdraw the blade's cutting edge from such valve seat and to press its other end against the lower surface of said control disc.

8. A tool for resurfacing the valve seat of an internal combustion engine, or for like purposes, comprising a body formed with a frusto-conical end shaped to seat substantially perfectly about a perfectly surfaced valve seat, and longitudinally slotted, a single cutting blade received in the body slot and having a cutting edge inclined like said frusto-conical body surface and adapted to lie flush therewith, control means, accessible when said frusto-conical body is engaged with a valve seat, operable to move said blade axially of said body and having an index thereon, and a member carried by said body constituting an index cooperable with said control means index, and movable to align its index with said control means index when the cutting edge of said blade is flush with said frusto-conical body surface as determined by the contact feel of said body end with the valve seat.

9. A tool for resurfacing the valve seat of an internal combustion engine, or for like purposes, comprising a body formed with a frusto-conical end shaped to seat substantially perfectly about a perfectly surfaced valve seat, and longitudinally slotted, a single cutting blade received in the body slot and having a cutting edge inclined like said frusto-conical body surface and adapted to lie flush therewith, a control disc mounted on the upper end of said body, having a portion of its lower surface abutting the end of said cutting blade remote from its cutting edge, means cooperating between said body and said control disc to effect movement of said disc axially with respect to said body by relative rotation thereof, thereby to move said blade also in an axial direction, resilient means urging said blade axially inward in the direction to withdraw the blade's cutting edge from such valve seat and to press its other end against the lower surface of said control disc, said control disc having an index on the edge thereof, and a ring encircling said body having thereon an index cooperable with said

control disc index, and circumferentially shiftable to align its index with said control disc index when the cutting edge of said blade is flush with said frusto-conical body surface as determined by the contact feel of said body end with the valve seat.

10. A tool for resurfacing the valve seat of an internal combustion engine, or for like purposes, comprising a body formed with a frusto-conical end shaped to seat substantially perfectly about a perfectly surfaced valve seat, and longitudinally slotted, a single cutting blade received in the body slot and having a cutting edge inclined like said frusto-conical body surface and adapted to lie flush therewith, a control disc overlying substantially the entire upper end of said body, rotatable substantially about the axis thereof to move said cutting blade axially of the body, and having an index thereon, and a body index cooperating with said control disc index to indicate the position of said blade's cutting edge relative to the frusto-conical body end.

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