

Aug. 8, 1939.

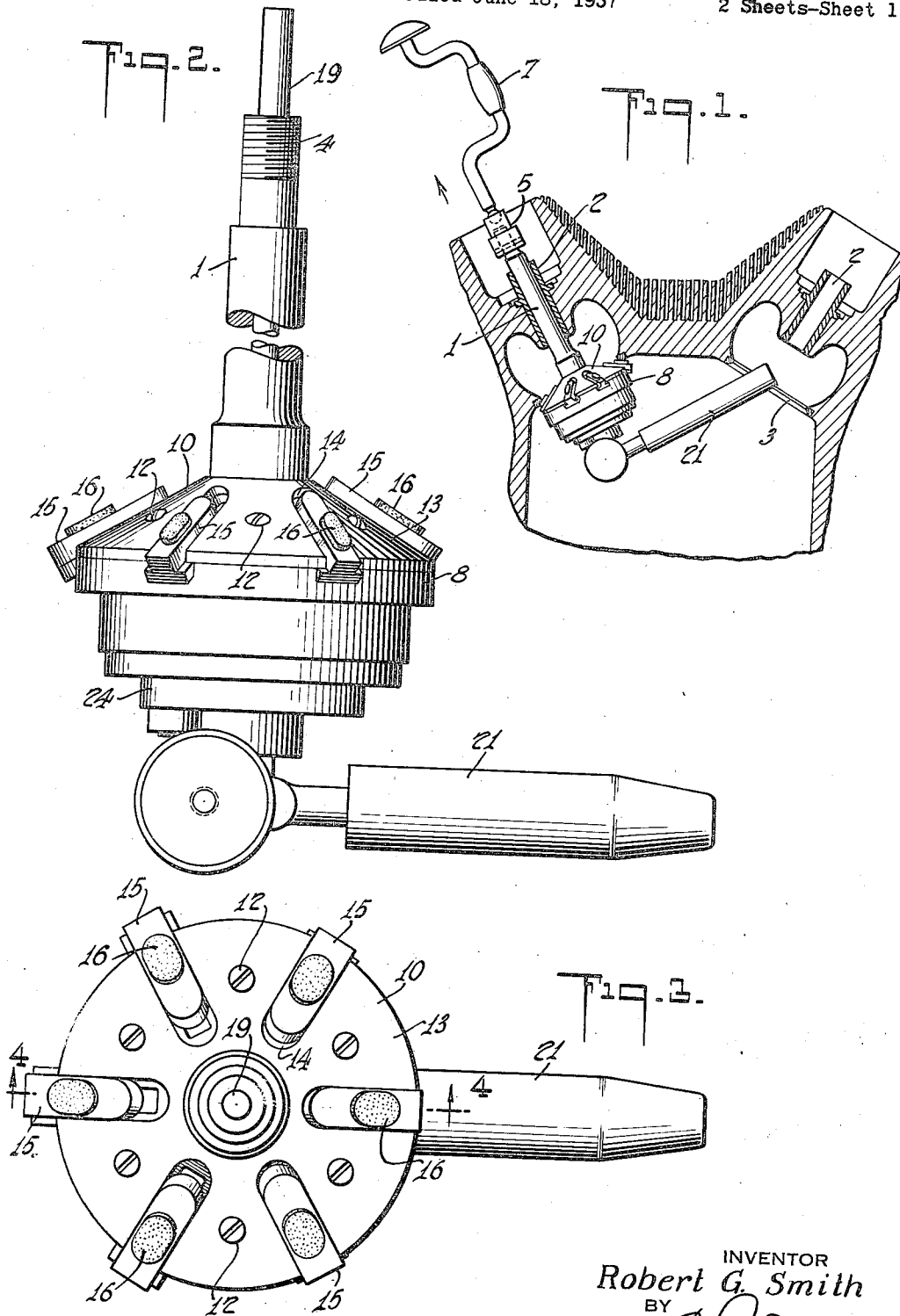
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2,168,753

TOOL FOR REFACING VALVE SEATS

Filed June 18, 1937

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

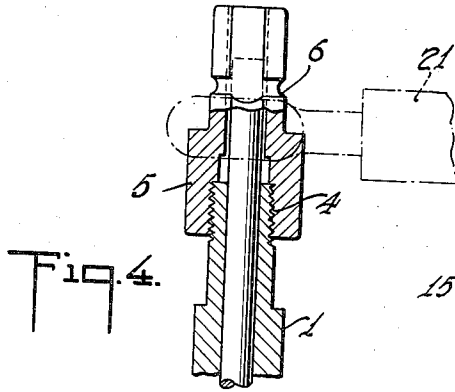


Fig. 4.

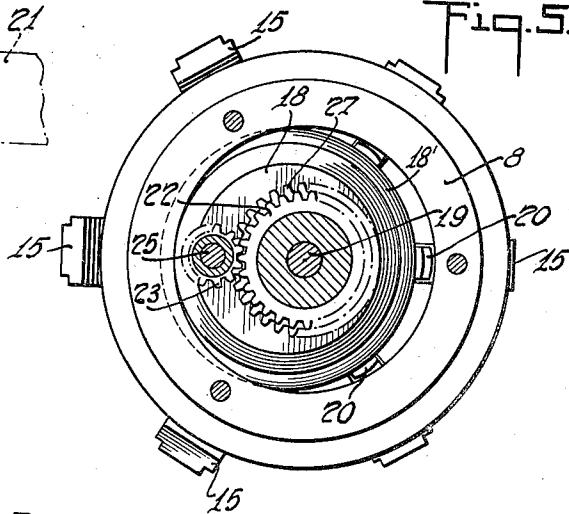


Fig. 5.

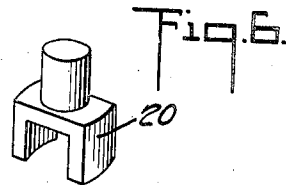
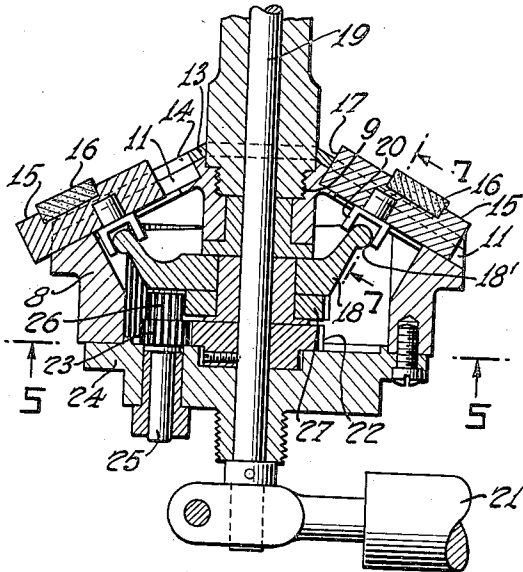


Fig. 6.

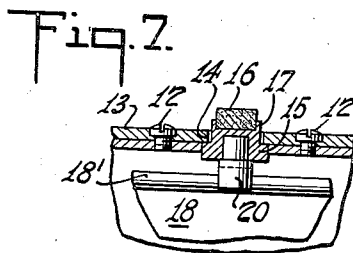


Fig. 7.

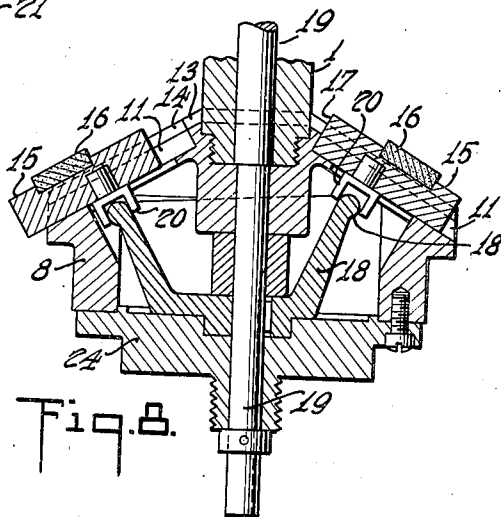


Fig. 8.

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2,168,753

TOOL FOR REFACING VALVE SEATS

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12 Claims. (Cl. 51—241)

The invention relates to a tool for refacing and shaping valve seats and like surfaces to true conformation.

The present embodiment of the invention is designed specially for refacing valve seats of internal combustion engines and is adaptable for use where the valve seats are located and accessible either exteriorly of the cylinders, as in automobile engines or interiorly thereof, as in aeroplane engines. In addition to the above mentioned field, the tool is generally applicable wherever refacing of annular surfaces is required.

For light work of the order described, an assembly of abrading elements is employed and the construction and manner of mounting the elements, as well as the principle of operation involved in the movement given the elements, constitute important features of the invention.

The elements are assembled in equi-spaced relation about a turning center and on rotation are given back and forth movement in loop shaped paths which cause them to repeatedly and progressively traverse different portions of the entire area of the surface being refaced.

The course of travel of the elements results from their being given motions in two directions; one an orbital along the annular surface being refaced, and the other a reciprocating movement across said surface.

To avoid grooving in the refacing operation such as would occur if the several abrading elements continuously traveled the same path, these elements in the preferred form of the invention are individually maintained at different constantly changing distances from their turning axis so that the work of each point in each abrading surface is distributed throughout and includes substantially the entire area being refaced.

This is effected preferably by having the radial movements of the abrading elements controlled by an eccentric cam, the direction of eccentricity of which is constantly shifting while the abrading elements are moving in their orbit. Consequently the path of each element is composed of a succession of loops each displaced slightly from the preceding one, so that until a complete cycle of these loops has been traced no given point on an abrading surface will twice pass over the same point in the valve seat being ground.

A tool of a form and construction suitable for carrying my invention into effect, is illustrated in the accompanying drawings, together with one modification thereof, but I do not wish to be understood as intending to limit myself to the present showing, as the same may be modified

generally and in detail without departing from the spirit and scope of the invention as outlined in the appended claims.

In the drawings:

Fig. 1 is a vertical sectional view showing the upper portion of an aeroplane engine with my refacing tool in operating position on one of the valve seats.

Fig. 2 shows the tool in side elevation, on a larger scale with the driving cap removed.

Fig. 3 is a top plan view thereof.

Fig. 4 is a central vertical section on the line 4—4 of Fig. 3.

Fig. 5 is a horizontal section on the line 5—5 of Fig. 4.

Fig. 6 is a detail perspective view of one of the forked studs employed to operatively connect the abrading elements to the cam by which they are reciprocated.

Fig. 7 is a detail cross section on the line 7—7 of Fig. 4, and

Fig. 8 is a vertical sectional view illustrating a modification.

Referring now to the drawings, 1 represents the driving spindle of the tool. The spindle is of tubular form for a purpose to be later on explained and is given an outside diameter through the greater portion of its length, to fit the valve stem bearings 2 of engine cylinders upon which the tool is designed to operate. Positioned by said valve stem bearing, the spindle is held in centered relation to the valve seat 3 being ground, which insures accurate work of the tool carried by the spindle. As the valve stem bearings of different types of internal combustion engines vary in diameter, interchangeable spindles are provided with each tool to conform to such variations.

At the upper end, the spindle is reduced in diameter and threaded, as indicated at 4, for connection with a driving cap 5, in which the slot element 6 of a bayonet joint is formed to receive the pin element of a hand brace 7, by which the spindle is rotated.

At the lower end the spindle is threaded into a chambered head 8, as indicated at 9. The upper portion of the head is coned or given a frusto-conical formation 10, corresponding to the beveled face of engine valve seats. Circumferentially equi-spaced slots 11 are cut through the coned top of the casing and extend radially outward from points near the spindle through the peripheral face of the head.

Shaped to fit the coned top of the head and

removably secured thereon by screws 12, there is a conical cover plate 13, in which coinciding slots 14 are formed. The slots 14 are of less width than the slots 11 in the head and combine there-

with to form, in effect, undercut guides for slide blocks 15 carrying the abrading elements 16.

The slide blocks are shaped to conform to the guides, as shown in Fig. 7, and project through the slots in the disk cover plate to provide raised carriers 17 for the abrading elements 16 which are cemented or otherwise secured in the recessed faces thereof in a manner to permit renewal from time to time as they become worn.

The abrading elements 16 may be individually molded or punched or cut from a sheet of material or otherwise formed to fit the recesses in the slide blocks and may be composed of emery and a binder or any of the other well known and commonly employed abrasives.

As will be evident from the foregoing, the assembly of the spindle, the coned head and abrading elements is such that all of these parts rotate together as a unit, and in order to cause the abrading elements, when thus rotated, to be simultaneously reciprocated radially in their guides, they are operatively connected for this purpose to a cup-shaped cam 18 mounted within the chambered head.

Said cam is eccentrically mounted, either rigidly or loosely, upon a shaft 19 which extends through the chambered head and upward through the center bore of the spindle, which may turn thereon.

The upper engaging edge 18' of the cup-shaped cam is rounded, and straddling this rounded edge there is a forked stud 20 depending from the slide block of each abrading element. Connected in the manner described the throw of the eccentrically mounted cam is sufficient to move the slide block of each abrading element back and forth in its guides a distance which would ordinarily exceed the width of the face of an engine valve seat upon which the abrading elements are operating and full traverse over such seat is therefore assured.

In the cheaper forms of the tool this cam may be fixed, as shown in Fig. 8. As there shown, it is keyed fast to the shaft 19 and the latter is held from turning by exteriorly applied means such as the handle 21, which is clamped to the projecting end of the shaft and is braced against an adjoining valve seat, as shown in Fig. 1, and can be held by the operator. As the tool is rotated, each of the abrading element carriers will be caused to travel in engagement with the stationary cam throughout a complete revolution and by reason of the eccentric mounting of the cam, each element will be given a full reciprocation for each revolution of the tool, but the path of each abrading element is the same for all revolutions of the casing.

In the preferred form shown in Figs. 1 to 7 repeated travel in the same path is avoided by giving the cam a follow-up movement with respect to the rotating abrading elements by means of reducing gearing shown in Figs. 4 and 5. In this case the cam is loose on the shaft 19 which is held against turning as above described and which has a gear 22 fast thereon. Meshing with the gear 22 there is a planetary pinion 23 which is fast on a stud shaft 25 journaled in the removable bottom section 24 of the chambered head. Also fast on the stud shaft 25, carrying the planetary pinion 23, is a smaller pinion 26 which meshes with a gear 27 fast to the cam.

The shaft 25 may be fixed and pinions 23 and 26 revolve thereon, being fastened together. In either case rotation of the tool carries the planetary pinion 23 around in mesh with the stationary gear 22 on the shaft 19 and so gives motion to it which, through the smaller planetary pinion 26, is transmitted to the cam gear 27, causing the cam to revolve in the direction of rotation of the tool, but a little more slowly. Thus the cam might make only twelve revolutions to every thirteen of the casing and there would then be twelve different successive loops in the path of each abrading element before a given loop was repeated. Consequently any groove cut during one loop of travel would be obliterated by the eleven other operations before it could be repeated.

The tool in Fig. 1 is shown in operating position on the valve seat of an engine cylinder of the type commonly used for aeroplanes in which the valve seat is accessible only from inside the cylinder. Placed as shown, the operator, while rotating the tool by means of the hand brace, keeps the tool drawn hard up against the valve seat. As the tool is held centered on the valve seat by the spindle thereof passing through the valve stem bearing, neither skill nor experience is required on the part of the operator in using the tool, as will be apparent.

To adapt the tool for operation on valve seats located and accessible outside of the cylinder, as in the type of engine used in automobiles, the driving cap 5 is unscrewed from the upper end of the spindle and after removing the handle 21 from the lower projecting end of the shaft 19, the cap is screwed on the threaded nipple projecting from the bottom section of the chambered head, thus providing a brace connection at the opposite end of the tool; and after clamping the handle 21 on the projecting end of the shaft 19, exposed by the removal of the cap 5, the tool is ready for use in this other position, the spindle having been inserted in the valve stem bearing to center the tool, as above described.

As the operation and many important advantages of the invention will be apparent from the foregoing, it will not be necessary to further describe the same.

An important feature of the operation of the form of apparatus shown in Figs. 1 to 7 consists in the constantly varying path of irregular curvature along which each abrading element travels around the valve seat. During each orbital revolution of each element each loop-shaped path of any given point on the surface of an element differs from those immediately preceding or following it because of the slow, progressive shifting of the position of the eccentric cam. This mode of operation prevents any grooving being produced by any irregularities in the face of any abrading element. Such irregularities might otherwise tend to cut grooves in the valve seat, if they travelled along the same paths throughout successive revolutions of the casing.

Another important feature is the portable self-contained form of embodiment of the invention, which enables the tool to be readily positioned for refacing valve seats located either interiorly or exteriorly of gas engine cylinders, the operation on the first mentioned type of valve seat requiring the tool to be so compactly built and proportioned as to be bodily insertable in the engine cylinder, as herein shown and described.

Having described my invention, I claim:

1. A portable self-contained tool for refacing valve seats and like surfaces to true conformation, comprising a rotatable spindle, a plurality of abrading elements individually non-rotatable and equi-spaced circumferentially about the spindle, and means for transmitting motion from the spindle to the abrading elements to simultaneously give them the rotary motion of the spindle and radially reciprocate them the said spindle being adapted to be placed in cooperative relation with valve seats formed either interiorly or exteriorly of gas engine cylinders with its axis of rotation in the position normally assumed by the valve stem and having a coupling at its outer extremity for means to drive said spindle when in such position.

2. A portable self-contained tool for refacing valve seats and like surfaces to true conformation, comprising a rotatable spindle, a plurality of abrading elements individually non-rotatable and equi-spaced circumferentially about the spindle, guides for the abrading elements radially disposed in inclined relation to their plane of rotation, and means for transmitting motion from the spindle to the abrading elements to simultaneously give them the rotary motion of the spindle and reciprocate the elements the said spindle being adapted to be placed in cooperative relation with valve seats formed either interiorly or exteriorly of gas engine cylinders with its axis of rotation in the position assumed by the valve stem and having a coupling at its outer extremity for means to drive said spindle when in such position.

3. A tool for shaping valve seats and like surfaces to true conformation, comprising a rotatable spindle terminating in a chambered head exteriorly of frustro-conical form provided with circumferentially equi-spaced radially disposed guide grooves therein, abrading elements individually non-rotatable and movable in the guide grooves, and means within the chambered head for transmitting motion from the spindle to the abrading elements to reciprocate said elements in the guide grooves as the elements are rotated by the spindle.

4. A tool for shaping valve seats and like surfaces to true conformation, comprising a rotatable spindle terminating in a chambered head exteriorly of frustro-conical form provided with circumferentially equi-spaced radially disposed guide grooves therein, abrading elements individually non-rotatable and movable in the guide grooves and spaced at different distances from the spindle, a cam mounted in the chambered head and operatively connected with the abrading elements to give them reciprocating motion in the guides as they are rotated by the spindle, and means for connecting the spindle in driving relation with the cam.

5. A tool for shaping valve seats and like surfaces to true conformation, comprising a rotatable spindle terminating in a chambered head exteriorly of frustro-conical form provided with circumferentially equi-spaced radially disposed guide grooves therein, abrading elements individually non-rotatable and movable in the guide grooves and spaced at different distances from the spindle, a cam mounted in the chambered head and operatively connected with the abrading elements to give them reciprocating motion in the guides as they are rotated by the spindle and a driving connection from the spindle to the cam such that the speed of rotation of the spindle exceeds the speed of rotation of the cam.

6. A tool for shaping valve seats and like surfaces to true conformation, comprising a rotatable spindle terminating in a chambered head exteriorly of frustro-conical form provided with circumferentially equi-spaced radially disposed guide grooves therein, abrading elements individually non-rotatable and movable in the guide grooves, a cam mounted in the chambered head and operatively connected with the abrading elements so as to give them reciprocating motion in the guides as they are rotated by the spindle, and reducing gearing connecting the spindle in driving relation to the cam.

7. A tool for shaping valve seats and like surfaces to true conformation, comprising a rotatable spindle terminating in a chambered head exteriorly of frustro-conical form with equi-spaced radially disposed guide grooves therein, abrading elements individually non-rotatable and movable in the guide grooves, a cam mounted in the chambered head and operatively connected with the abrading elements to give them reciprocating motion in the guides as they are rotated by the spindle, and gearing connecting the spindle in driving relation to the cam, adapted to drive it at a speed different from that at which the spindle is revolving one of the members of said gearing being fast on a shaft that is held exteriorly of the tool against rotation.

8. A tool for shaping valve seats and like surfaces to true conformation, comprising a spindle terminating in a separably attached frustro-conical flange having equi-spaced slots therein radially disposed to the spindle, a detachable cover shaped to fit down upon the flange and having slots therein corresponding to the flange slots but of less width, the slot formation of the flange and of the cover combining to form a plurality of similar under-cut guideways, abrading elements carried by members slidably fitted in the guideways, and means for transmitting motion from the spindle to the members carrying the abrading elements to simultaneously rotate them orbitally about said spindle and also reciprocate them radially thereof.

9. A tool for shaping valve seats and like surfaces to true conformation comprising a tubular spindle terminating in a separably attached chambered head exteriorly of frustro-conical form with equi-spaced radially disposed guide grooves therein, abrading elements movable in the guide grooves, a cam mounted in the chambered head and operatively connected to reciprocate the abrading elements in the guide grooves, and gearing connecting the spindle in driving relation with the cam, the said gearing employing a gear-carrying shaft loosely mounted within the tubular spindle and non-rotatably held exteriorly of the tool.

10. A tool for shaping valve seats and like surfaces to true conformation, comprising a spindle terminating in a separably attached chambered head exteriorly of frustro-conical form with equi-spaced radially disposed guide grooves therein, abrading elements movable in the guide grooves, a cam mounted in the chambered head and operatively connected to reciprocate the abrading elements in the guide grooves, gearing connecting the spindle in driving relation with the cam, and an attachable driving cap for connecting a power member to either the spindle or the chambered head.

11. In a tool for grinding valve seats the combination of a revoluble casing having radially disposed guide slots, an abrading element mount-

ed in and movable along each of said slots, a fixed cam eccentric to the axis of said revoluble casing, and means whereby said abrading elements are maintained in operative contact with said cam so that as they revolve with said casing they are also moved back and forth in said slots across the valve seat.

12. An apparatus such as defined in claim 11 in which the eccentricity of said cam is sufficient to cause a point on said abrading element to travel all the way across a valve seat of standard width.

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