May 24, 1938. H. W. ZIMMERMAN 2,118,720

CYLINDER SURFACING TOOL

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Fig. 1.

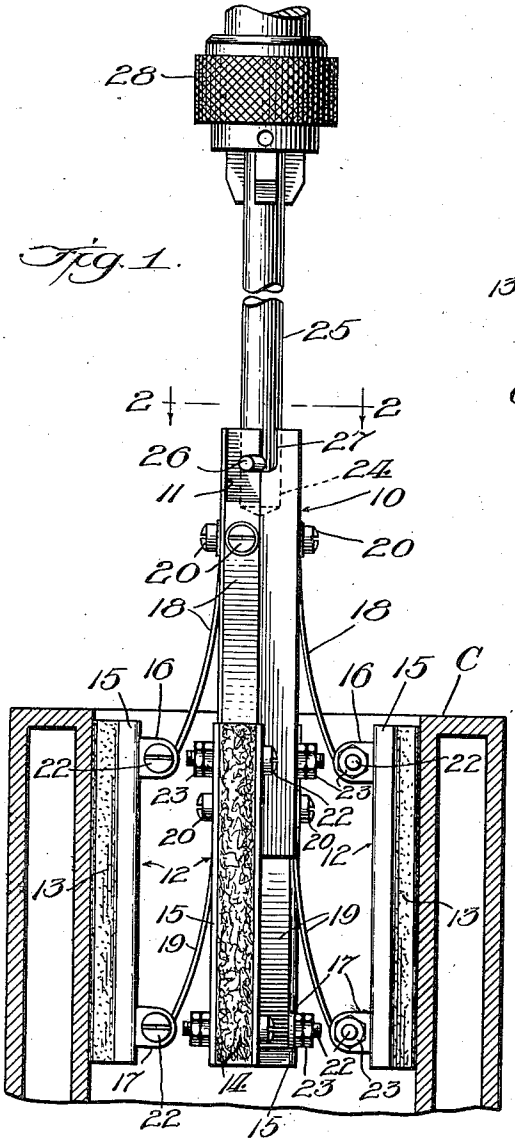


Fig. 2.

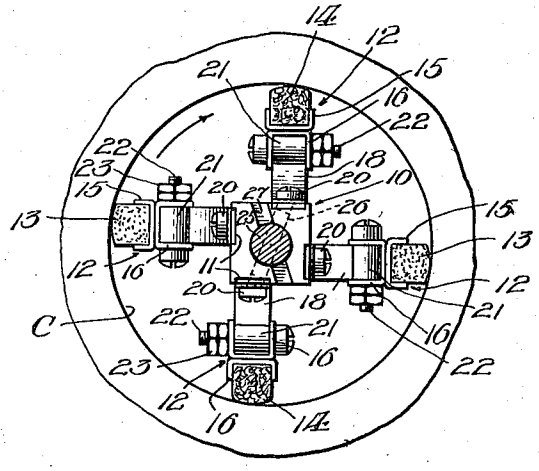
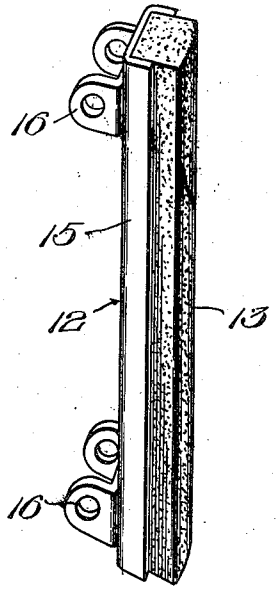


Fig. 4.



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Fig. 3.

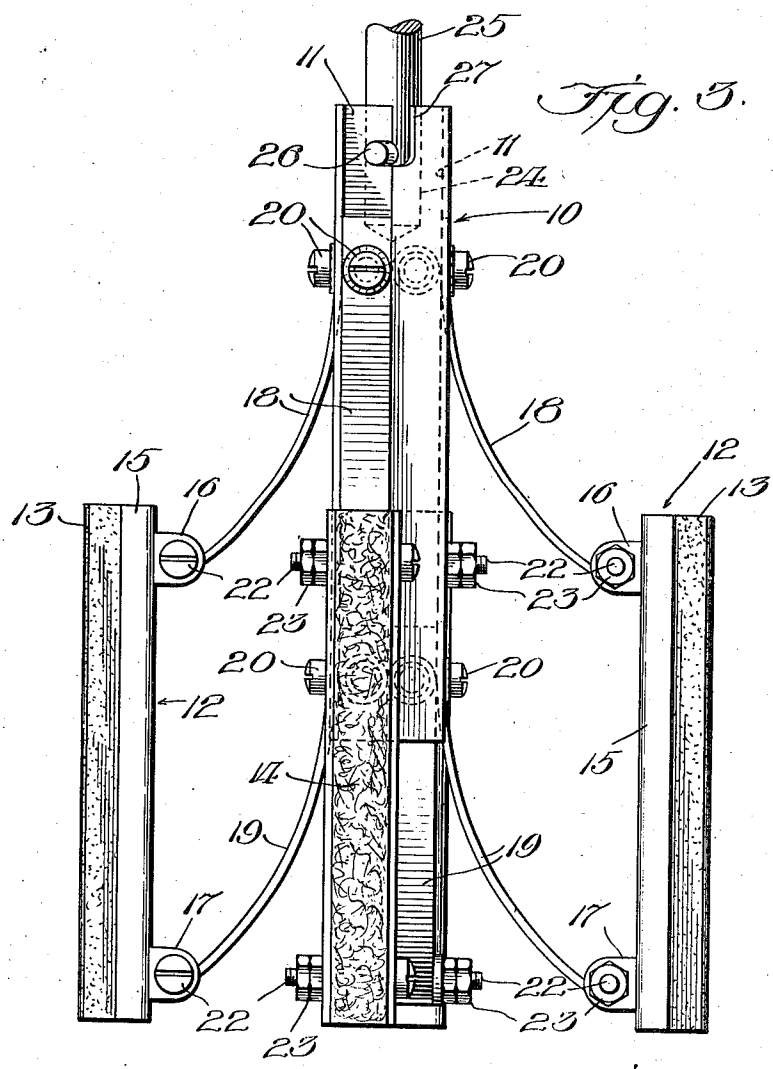


Fig. 5.

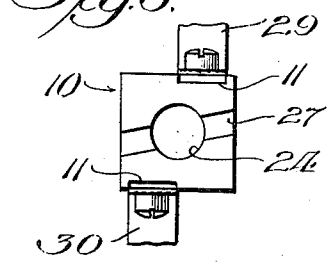
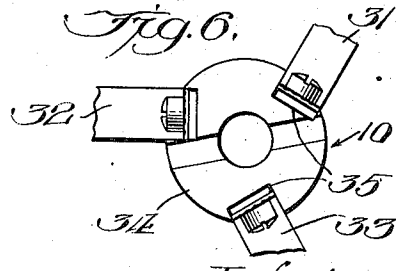


Fig. 6.



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UNITED STATES PATENT OFFICE

2,118,720

CYLINDER SURFACING TOOL

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Application March 28, 1936, Serial No. 71,519

9 Claims. (Cl. 51—184.2)

My invention relates to surfacing tools and it has to do more particularly with tools of this character adapted for servicing cylinders, such, for example, as those used in automobile engines.

One of the objects of my invention is to provide a simple and inexpensive tool of the foregoing character, and which is adapted for highly efficient and uniform surfacing operations, even in the hands of unskilled operators.

Another object is to provide a surfacing tool adapted for refinishing rebored as well as worn and glazed cylinders, which tool is adapted to restore the cylinder wall to substantially factory-production surface condition and without removing sufficient metal to disturb existing cylinder wall dimensions.

Still another object is to provide a surfacing tool adapted to condition the cylinder wall surface in such a way that it takes the form of minute, diagonal, criss-cross lines presenting a minutely roughened surface which is conducive to rapid wearing-in and seating of piston rings and which is also adapted to aid in forming and holding the desired oil film.

Additional objects are to provide a tool of the foregoing character adapted to automatically and continuously urge surfacing elements toward and into engagement with the cylinder wall with a substantially uniform, but slight, pressure; to provide surfacing elements supported wholly by spring members constantly urging such elements in expanding direction, the arrangement being such that the surfacing elements are all floatingly and uniformly supported in parallelism so that they are capable of self-adjustment for uniform servicing action, and so that the loads on the surfacing elements are substantially equalized, thereby avoiding chatter; to provide spring supports for the surfacing elements which accommodate disalignment between the tool body and its driving means; and to provide a surfacing unit that may be readily and easily replaced with a minimum of cost.

Other objects and advantages will become apparent as this description progresses and by reference to the drawings, wherein,—

Figure 1 is an elevational view, partially in section, illustrating a tool embodying my invention applied to an engine cylinder;

Fig. 2 is a horizontal plan sectional view taken substantially on line 2—2 of Fig. 1;

Fig. 3 is an enlarged elevational view of the tool shown in Fig. 1, part of the drive connection being omitted;

Fig. 4 is a detached perspective view of one of the surfacing units shown in Fig. 3; and

Figs. 5 and 6 are fragmentary top plan views of other forms of tools embodying my invention.

My invention meets a particular need in the automotive service field. It is to be understood, however, that it has utility in various other fields where similar conditions of use are to be met.

With respect to new, production engine cylinders, it will be appreciated that the cylinder wall surface is in a condition conducive to best engine performance. In most cases, such surface, while appearing quite smooth, actually is minutely roughened, the same consisting of very fine, minute, diagonal, crisscross lines. This surface not only lends itself to rapid wearing-in and seating of piston rings so that they act with intended performance, but it also tends to aid in the forming and holding of the desired oil film on the cylinder wall.

It is desirable, in the servicing of worn cylinders, that this same kind of cylinder wall surface be restored as far as possible. It is quite customary to rebore worn cylinders, and this reboring operation is usually carried out in such a way that the cutting tool leaves very fine, circular lines on the cylinder wall presenting a "fuzzy-like" surface. Also, cylinders that have been in use for some time and which have not been rebored, ground, or the like, have a very hard, smooth and glazed surface and, at times, some carbon may be deposited thereon. If new piston rings are installed with a cylinder wall condition of this latter kind, it would take a considerable length of time to wear in the rings and then there would be some chance that the rings would not wear in properly and uniformly so that unsatisfactory performance would result. Many times, this very condition has caused complaints with respect to newly-installed rings when, in fact, the fault was not with the rings at all.

My invention provides a tool which is so inexpensive that it may well be afforded in practically every automotive service shop where either, or both, of the above kinds of work are done. I provide a tool having surfacing elements that contact the cylinder wall with comparatively light pressure while the tool is both rotated and reciprocated, thereby scouring, so to speak, or resurfacing the cylinder wall in such a way that it is given the desirable diagonal, crisscross line surface above mentioned. This tool is sufficiently fool proof that in the hands of even unskilled workmen the proper surfacing operation may be carried out without removing sufficient material

from the cylinder wall to disturb the established dimensions thereof.

One form of tool embodying my invention and capable of accomplishing the foregoing results is shown in Figs. 1 to 4 of the drawings. This tool includes a rigid, elongated body 10 which may be of rectangular shape in cross section, as shown, or it may be circular (Fig. 6) or any other desired shape. This body 10 (Fig. 2) is provided on each side with a rectangular groove 11 extending (preferably, but not necessarily) throughout the length of the body. Each of the grooves 11 is offset forwardly, with respect to direction of rotation, of the center line of its respective side and the axis of the tool body, the purpose of which, as will be well understood from my prior Patent No. 1,987,457, is to avoid any tendency of the surfacing units 12 to bind against the cylinder wall.

In the form of tool shown in Figs. 1 to 4, I employ four surfacing units 12 that are arranged in oppositely-disposed pairs, two of which units support abrading or surfacing elements 13 and the other two support non-abrasive guide elements 14, preferably, of that character disclosed in my prior Patent No. 1,912,025. The surfacing and guiding units are identical except for the cylinder wall engaging portions 13 and 14 thereof, and I will describe in detail only one of the same. Each unit 12 includes a channeled carrier member 15 in which the surfacing or guiding element, 13 or 14, as the case may be, is fixedly secured. The carrier 15 is provided at each of its ends with a pair of spaced, aligned, depending lugs or ears, 16, 17 to which the carrier supports, which will now be described, are secured.

The carrier supports take the form of a pair of similar, bowed leaf springs 18, 19 for each carrier 15, the bow of each of which extends toward the body 10. The springs 18, 19 are of substantially the width of the body grooves 11, and one end of each of these springs is rigidly secured in spaced relation in the respective groove 11 by a screw 20. The other ends of these springs are looped as at 21 and are pivotally connected between the ears 16, 17, at the opposite ends of the carriers 15, by bolt-like pivot members 22 carried by the ears 16, 17 and secured in position thereon by the lock nuts 23. The opposite ends of the springs 18, 19 are similarly spaced apart, and they tend to hold all of the carriers in parallelism and in a fully-expanded condition.

To insert the tool in the cylinder C, as shown in Fig. 1, the carriers 15 may be grasped and collapsed to a diameter permitting of their insertion. When the tool is in the cylinder, and the springs 18, 19 are pressed inwardly at their carrier ends toward the body 10, such springs are under compression and they constantly exert an expanding pressure on the carriers and cylinder wall contacting elements. These springs are, however, sufficiently light in weight to exert only enough pressure to apply the scouring action above described rather than a material-removing or positive abrading action. It will also be noted that the pivotal supports at the opposite ends of the carriers permit the carriers to "float", so to speak, and self-adjust themselves to the shape of the cylinder wall surface so as to accommodate worn and irregular conditions therein.

This particular arrangement, while quite simple in construction and inexpensive, provides a very efficient tool and one which will stand up under very severe conditions of use. This is aided somewhat by mounting the springs 18, 19 in the rectangular body grooves 11, which grooves are of sufficient depth to hold the springs against lateral movement so that the carriers, although flexibly supported for expansion and contraction, are rather rigidly supported against lateral deflection and displacement. Whatever lateral displacement takes place due to the springs, does not interfere with the desired operation of the tool due to the offset relation of such springs and carriers with respect to the center line of their supported surfaces and the axis of the tool. If desired, the body ends of the springs 18, 19 may be secured by a pair of spaced screws or the like which will hold the same against lateral or longitudinal displacement.

In the use of the tool, as above stated, it is both rotated and reciprocated and this is accomplished in the following manner. The upper end of the body is provided with a central socket-like opening 24 adapted to receive the lower end of a drive stem 25. The lower end of this stem is provided with diagonally-opposed pins 26 adapted to engage a bayonet slot 27 in the upper end of the body, providing a bayonet lock connection. The upper end of the stem 25 is adapted for connection to a chuck 28, or the like, of a power driving means, for example, an electric drill (not shown). The operator may hold the power drive means in his hands and reciprocate the tool manually while it is rotating or, if desired, this operation—particularly in the larger service shops—may be carried out entirely by mechanical means. The connection between the drive stem 25 and the tool body 10 is substantially rigid, and disalignment between the power driving means and the tool 10 is accommodated in the operation of the tool through the self-adjusting and "floating" action afforded by the supporting springs 18, 19.

The number of cylinder wall engaging elements may be varied and, in Figs. 5 and 6, I have shown tools having two and three, respectively, such elements. The tool illustrated in Fig. 5 is the same as that shown in the previous figures except that only two pairs of supporting springs 29, 30, oppositely mounted, are employed. In this case, the springs preferably support carriers having the abrasive type surfacing element (not shown) carried thereby.

The structure illustrated in Fig. 6 is similar to that previously described except that three sets of supporting springs 31, 32, 33 are employed, and these springs support carriers in which are mounted only the abrasive type surfacing elements. In this case, the body 34 is, preferably, of circular shape, being provided with rectangular grooves 35 arranged at equal intervals around the circumference of the body, and, in each case, the grooves are so positioned that they are located forwardly, with respect to direction of rotation, of the center of the tool.

It is believed that the operation and advantages of my invention will be well understood from the foregoing. By rotating and reciprocating the tool in the cylinder, the desired surface composed of diagonal, crisscross lines of minute form is provided. The self-adjusting and self-expanding action of the tool assures this surface, even in the hands of an unskilled workman, without disturbing the fixed dimensions and shape of the cylinder.

It is also to be understood that while I have shown and described three forms of my invention, other changes in details and arrangement of parts may be resorted to without departing from the spirit and scope of my invention as defined

by the claims that follow. For example, the supporting springs may be hinged at one end to the tool body and fixedly secured at the other end to the abrasive carrier.

I claim:

1. In a tool of the class described, a body, elongated cylinder wall surfacing units, and separate spring means positively connected to said body and to the opposite end portions of said units and serving as the sole connecting support for said units upon said body, as well as to both expand and oppose contraction of said units, with said units each extending throughout its length substantially parallel with each other and the axis of said body.

2. In a tool of the class described, a body, cylinder wall surfacing units, and leaf spring members supporting said units upon said body, said spring members being rigidly connected at one end to said body and pivotally connected at the other end to said units, said spring members holding said units in expanded condition, and said units being free and unobstructed for contraction merely upon the application of pressure thereto in an inward direction.

3. In a tool of the class described, an elongated body having longitudinal grooves therein, cylinder wall engaging units, and means for supporting said units upon said body for expansion and contraction movements, including a pair of spring members for each said unit, each spring member of each said pair having one end secured in one of said body grooves and the other end secured to the respective unit with said spring members in substantially parallel relation, said spring members being shaped to hold said units normally in expanded condition, and said units being otherwise free to contract upon the application of pressure inwardly thereto.

4. In a tool of the class described, a body, cylinder wall engaging units, and means for supporting said units upon said body for expansion and contraction movements, including a pair of flat spring members for each said unit, each said spring member being of the same length and similarly bowed toward said body, means for rigidly connecting one end of each spring member of each pair to said body in spaced relation, and means hingedly connecting the other end of each spring of each said pair to said unit in spaced relation similar to the spacing of the other ends of said spring members.

5. In a tool of the class described, a body unit, cylinder wall surfacing units, and leaf spring members for mounting said units upon said body, means for securing one end of each spring member to one of said units, spaced ears or lugs on the other of said units, and means for hingedly connecting the other end of each said spring member between the ears or lugs of the respective unit, whereby each said unit is free to self-adjust itself to the surface engaged thereby.

6. A surfacing unit for a tool of the class described which comprises a channeled body member, a surfacing element fixedly mounted in and extending substantially throughout the length of said body member with a part thereof exposed for engagement with the surface to be treated, and spaced lugs on the opposite ends of said body member opposite and intermediate the ends of said surfacing element and having provision for hinged attachment of said unit to supporting means whereby said unit, as a whole, may self-adjust itself to the surface engaged by said surfacing element.

7. In a tool of the class described, a body member, cylinder wall surfacing members, and leaf springs supporting said surfacing members upon said body, said springs being rigidly connected at one end to one of said members and pivotally connected at the other end to the other said members, said springs holding said surfacing members in expanded condition, and said surfacing members being free and unobstructed for contraction merely upon the application of pressure thereto in an inward direction.

8. In a tool of the class described, a body member, cylinder wall surfacing members, and elongated spring elements serving as the sole support for said surfacing members upon said body member, said spring elements being arranged in pairs, one pair for each said surfacing member, the spring elements of each pair being each rigidly connected at one end at spaced points to one of said members and being pivotally connected at their other ends to the other of said members in substantially parallel relation, said spring elements being constructed and arranged to constantly hold said surfacing members away from said body and to urge said surfacing members toward an expanded condition, while said surfacing members are free to contract upon moving same toward said body member.

9. In a tool of the class described, a body member, cylinder wall engaging members, and means for supporting said wall engaging members upon said body member for expansion and contraction movements, including a pair of elongated spring elements for each said wall engaging member, each said spring element being of the same length and constructed and arranged to similarly project outwardly away from said body member, means for rigidly connecting one end of each said spring element of each pair to one of said members with said rigidly connected ends in spaced relation, and means hingedly connecting the other end of each spring element of each said pair to the other of said members in spaced relation similarly to the spacing of the other ends of said spring elements.

HERMAN W. ZIMMERMAN.