

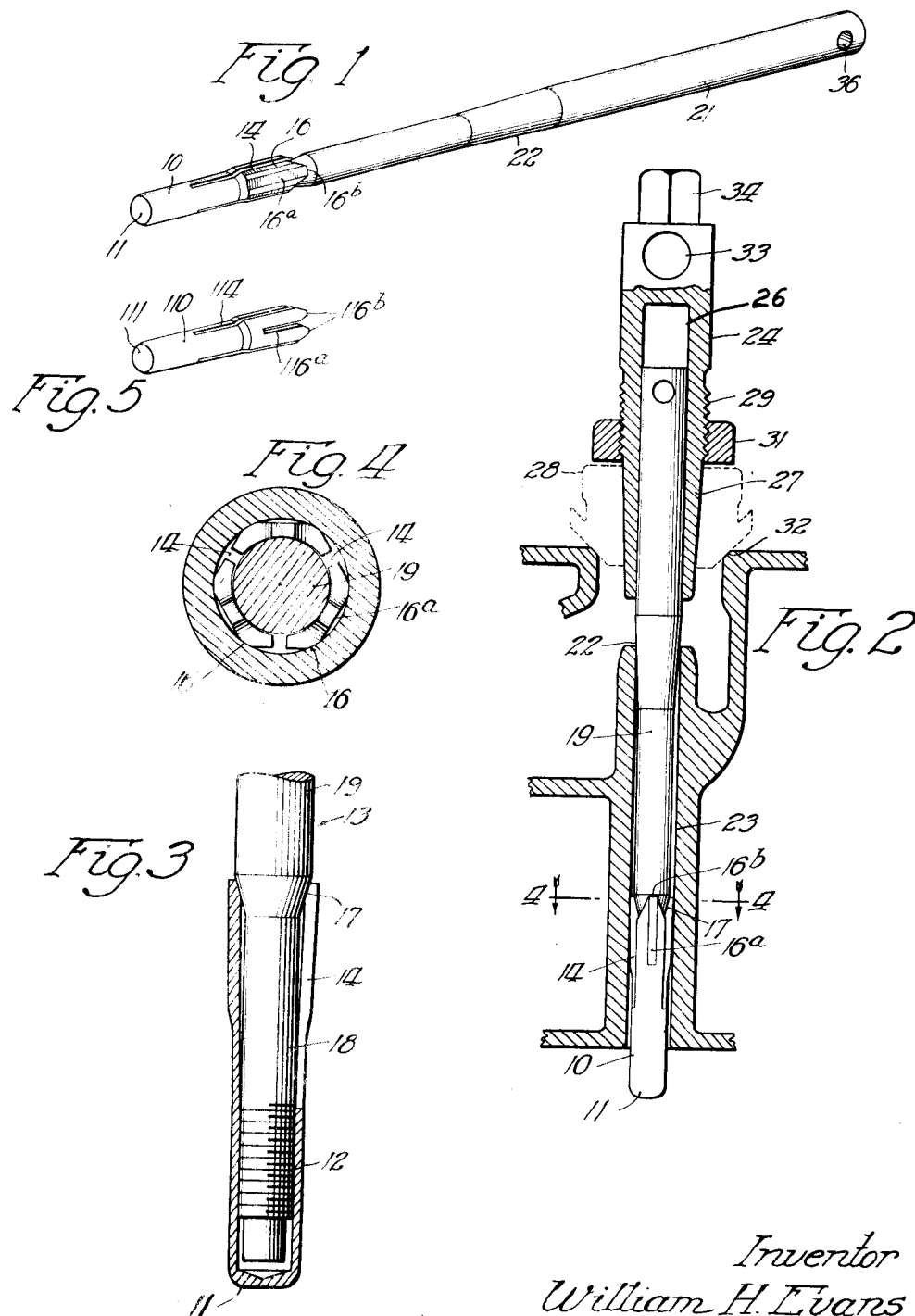
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W. H. EVANS

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EXPANSION PILOT

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UNITED STATES PATENT OFFICE

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EXPANSION PILOT

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My invention relates in general to expansion pilots, and more in particular to a pilot adapted to serve as a guide for a reamer used on internal combustion engines.

When a valve seat is dressed up with a reaming tool, it is of prime importance that the axis of the reamer be held positively and directly in line with the center line of the valve and stem. When the valve is in place on a motor, the stem, of course, extends into the valve stem guide and the valve, as a whole, reciprocates therein. Pilots for reamers are made to utilize the valve stem guide for centering purposes. Many types of pilots have a guide shank formed integral therein and are adapted to project into the valve stem guide to center the pilot and the reamer carried by the pilot. The diameter of valve stem guides varies considerably, however, and it has been the vogue recently to employ a separate pilot guide with the contact points where they engage the inside walls of the valve stem guide adjustable, whereby the same pilot guide may be employed for several different stem guide diameters. The pilot head has an internal central bore of standard diameter corresponding with the standard diameter used in the top of the pilot guide, which is adapted to enter said central bore. In this way only a single pilot head is required, and a smaller number of pilot guides, than would otherwise be necessary, due to the adjustable feature thereof.

I have found that the pilot guides heretofore employed have not been capable of adjustment over a sufficiently large diameter. Some of the best of them, I have found, can be adjusted only over a range of about ten thousandths of an inch. While such guides are an improvement in some respects over the old style pilot having an integral guide shank, they are deficient in several respects. I wish to make it clear that any pilot guide shell can be made to expand over $\frac{1}{2}$ " for instance, but it cannot be held from turning over such a range, and consequently, in actual use, can be expanded only approximately a few thousandths of an inch. This is the case when the guide is operated solely from the top of the valve stem guide, but when and if

the shell can be held at the bottom, a relatively wide range of adjustments is easily possible.

Accordingly, one of the principal objects of my invention is the provision of an improved reamer pilot.

Another object is the provision of an improved reamer pilot guide.

Another object is the provision of a reamer pilot guide capable of adjustment over a much wider range of diameters.

Other objects and features of the invention will be apparent from a consideration of the following detailed description, taken with the accompanying drawings, wherein—

Fig. 1 is a perspective view of the improved pilot guide;

Fig. 2 shows the pilot guide in use for centering a reamer during operation on a valve seat;

Fig. 3 is an enlarged fragmentary sectional view showing some of the features of the guide;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a perspective view of a modified form.

Referring now to the drawings, the pilot guide includes a shell 10, of general tubular shape, having a closed end 11 and interior threads 12 into which a guide shank 13 is adapted to be threaded. The shell 10 is provided with a number of end slots 14, so positioned that when the shank is screwed into the shell, the resulting tines or prongs 16 on the shell are adapted to ride up over a cam surface 17 on the shank, formed by the sharply increasing diameter of the shank at this point. The shell 10 is made of a high grade spring steel and the tines 16, therefore, can be expanded outwardly a considerable distance, or forced inwardly without strain on the material thereof.

In order further to understand the construction and operation of the shell 10, the pilot and details thereof will now be referred to. The guide shank 13 has three sections 18, 19, and 21, each of substantially constant diameter of some lineal range, but the diameter between each one increasing slightly. The

portion 18 is relatively narrow and is adapted to be wholly enclosed by the shell 10. The cam portion 17 connects the sections 18 and 19, the section 19 being narrow enough to clear the walls of the valve stem guide under all circumstances without binding. Between portions 19 and 21, there is a tapered portion 22, and the portion 21 is larger than the largest diameter valve stem guide on which this particular pilot will be used. The tapered portion 22 is adapted to be wedged down into the top of the valve stem guide, so that with the tines 16 of the centering shell expanded and the tapered portion 22 wedged down into the top of the valve stem guide, the pilot guide as a whole will be positively centered with respect to the valve stem guide because it will be supported at three points.

Looking at Fig. 2, a small section of a motor block is shown with a valve stem guide 23 and the pilot guide positioned therein. A pilot head 24 is shown provided with a central bore 26, into which the portion 21 of the pilot guide extends. A tapered portion of the head is adapted to receive a reamer 28 supported thereon frictionally, as is customary in the art. Above the tapered portion 27, threads 29 are provided on which a nut 31 is threaded, this nut being employed for the purpose of forcing the reamer 28 off its tapered support.

The reamer is shown in position to dress up a valve seat 32. The pilot head has a transverse opening 33 for receiving a suitable tool for turning the same, and also has a square upper end 34, also adapted for use with a suitable tool to turn the reamer. The pilot guide is also provided with suitable tool engaging means for the purpose of turning it within the valve stem guide, a transverse opening 36 being shown.

I shall now refer more fully to the construction of the pilot guide shell and its tines 16. The shell is designed so that, under all circumstances, within the range of adjustment for which the pilot is adapted, the friction between the inside of the shell and the shank 13 will be less than the friction between the outside of the shell and the inside surface of the valve stem guide. This is brought about by the utilization of certain details of construction which may be modified, within certain limits.

As the drawings show, the tines are provided with relatively sharp points 16b and have flat places 16a resulting in the formation of longitudinal ridges or relatively raised portions, two in number, for each tine. The result of this construction is that the cam portion 17 engages the points of the tines, while at the outside of the tines there are two points of engagement between the tines and the inner surface of the valve stem guide. Not only does less friction result on the inside than on the outside, but in this construc-

tion the friction is double on the outside of what it is on the inside. With three tines as shown, there are three points of engagement on the inside of the shell with the cam surface 13, while there are six points of engagement between the outside of the shell and the inside of the valve stem guide.

The design of the shell will be still further understood by a consideration of the manner in which it is produced, it being understood, of course, that I am not limited by any particular method of manufacture.

The shell is first produced unslotted, the outside diameter thereof being the mean between the maximum and minimum adjustment to which the shell will be subjected. For example, if a one thirty-second adjustment will be required above and below three-eighths of an inch, the size of the shell itself would be made exactly three-eighths of an inch, so that a one sixty-fourth adjustment would take place each way. The shell is then subjected to a forming operation to produce six equally spaced flat portions such as shown at 16a, and is then slotted or kerfed by means of a saw or other suitable tool, with the slots extending through alternate flat portions, leaving the remaining flat portions equally spaced between the slots. This produces a somewhat flat construction in the neighborhood of the slots, as the slot does not quite occupy the entire width of the flat portion. The tines are then shaped to a point, usually by making a pair of side angular cuts into the main cuts, and the inside is then reamed to form a flat taper on the under side of the tine ends as shown. The radius of curvature of the outside of the shell is less than the inside of the valve stem guide, as a rule, but independent of the relative radii of curvature, the two engaging portions on the outside of the shell will compensate for any difference in diameter and will always engage independent of the diameter. The radius of curvature of the under side of the tines is less than the curvature of the shank, so that independent of the engagement of the points on the tines, there is no possibility of the entire area of the inside of the tines bearing upon the shank so as to increase the friction therebetween.

As previously stated, the specific construction of the shell can be modified. Instead of three tines 16, a larger number can be employed and the flat place 16 can be made concave or any shape to relieve the metal at this point, and offer increased friction to the turning of the shell in the guide. This flat portion can be cut clear through, if desired, forming a number of smaller tines, as in the modified view, Fig. 5, shows. The point 116b or each one of the smaller tines is brought down to limit the engagement with the cam surface 17 in the manner shown. The corresponding parts of the shell are indicated

by the same numerals as employed in the main figures, but with the prefix "1" added.

Another advantageous feature of the invention, which I wish to point out, is that the shell 10 is closed at its lower end. This positively protects the inside of the shell, the screw threads, and other parts of the device, from contamination and injury by carbon or other matter which may be encountered in the valve stem guide. This arrangement also prevents the injury of the threads during the time the tool is handled about a shop.

The operation of the tool appears clear from the description thereof, but, in general, I wish to say that in inserting the tool into the valve stem guide, it is customary to turn the shell partly off the shank, so that the cam surface 17 is entirely clear of the tines. This permits the tines to be forced inwardly as the tool is thrust into position, and, as previously described, the spring tension of the tines themselves is sufficient to hold the shell in place as the shank is drawn up tightly.

The advantage of my tool over those of the prior art may be apparent when it is stated that one guide of this character is sufficient for a large number of valve stem guides, and I have found that practically every make of automobile can be fitted with a set of three guides of this character. I know of no pilot guide heretofore in use which can be made to operate on all types of automobiles, unless at least eleven different guides were furnished.

I have described my invention somewhat in detail in order that those skilled in the art will understand the same fully, but I do not restrict myself to the details shown and described, the invention being limited only by the scope of the claims.

What I claim as new and desire to protect by Letters Patent of the United States is:

1. In a pilot for a valve seat reamer, a pilot guide including a shell with end slots to form a plurality of tines and a shank threaded into the shell with a cam surface for engaging the tines at a single point to expand them inside a valve stem guide, the tines having single cam engaging points at the ends and having a central longitudinal area below the normal curved surface thereof, whereby a greater frictional engagement exists on the outside of the shell than on the inside.

2. In a pilot for a valve seat reamer, a pilot guide including a guide shank having a cam surface and a centering shell threaded thereon, said shell being slotted to form a plurality of tines, said tines having outside longitudinal ridges to offer relatively great friction to turning of the shell within a valve seat guide, but permitting free bodily longitudinal movement of the shell along said valve stem guide the tines having a single point of engagement on the cam surface and a plurality of points of engagement with the valve seat guide.

3. In a pilot for a valve seat reamer, a

pilot guide including a guide shank having a cam surface and a centering shell threaded on said shank, said shell having a plurality of tines provided with relatively pointed ends, and longitudinally disposed flat sections forming side ridges, the ridges at the sides of the flat sections engaging the inside surface of a valve stem guide to prevent turning of the shell independent of the diameter of the guide within the limits for which the pilot is designed, and said pointed ends engaging said shank at only a single point on the cam independent of the relative adjustment.

In witness whereof, I hereunto subscribe my name this 16th day of October, 1929.
WILLIAM H. EVANS.