Oct. 13, 1931. W. H. EVANS 1,827,511

REAMER

Filed Aug. 28, 1929

Fig. 1.

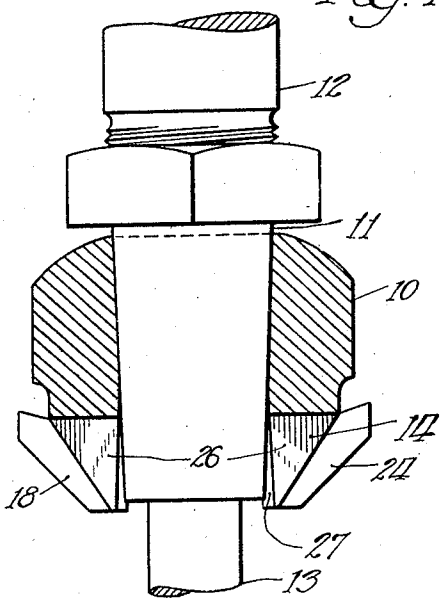


Fig. 3.

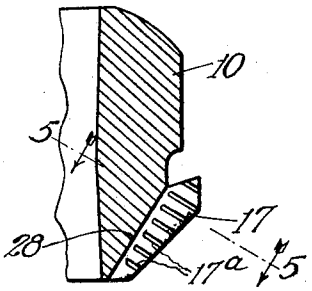


Fig. 2.

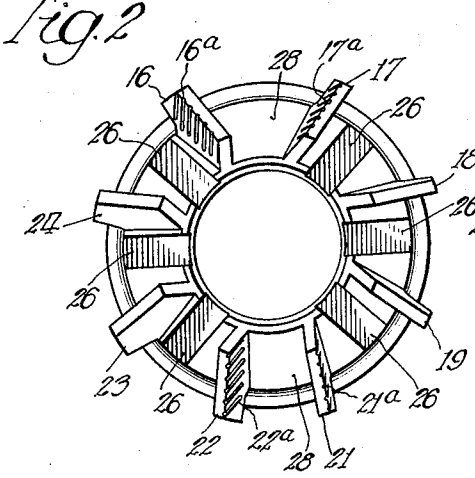


Fig. 4.

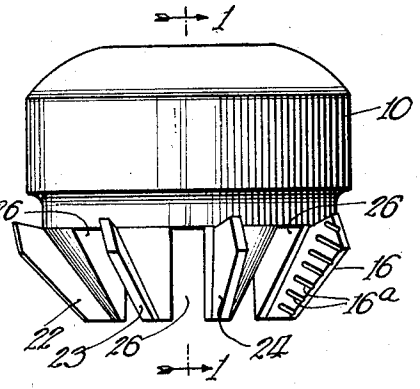
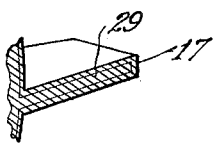


Fig. 5.



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Patented Oct. 13, 1931 1,827,511

UNITED STATES PATENT OFFICE

WILLIAM H. EVANS, OF CHICAGO, ILLINOIS, ASSIGNOR TO EVANS FLEXIBLE REAMER CORPORATION, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

REAMER

Application filed August 28, 1929. Serial No. 388,925.

My invention relates to reamers and has to do particularly with a reamer adapted for treating valve seats on internal combustion engines.

In the overhauling of the valve mechanism of internal combustion engines it is frequently necessary to treat not only the valve proper but the seat as well. This requires a reaming operation which is best accomplished under ordinary circumstances by means of a hand reamer. Due to the character of the operation, the condition of the valve seat and the construction of the reamers this operation in the past has been accomplished with rather inferior results. One difficulty is that the surface of the valve seat is so affected by carbon that a very hard scale is formed thereon and this must be broken up and removed before the reaming tool can be used. With most types of reamers this requires the use of two tools and necessitates two operations. Another difficulty is that most reamers chatter to such an extent that the seat is left in a rough condition which can be remedied only by grinding.

Now in my Patents Nos. 1,680,510 and 1,680,466 I disclose a reamer which will overcome many of these difficulties. In my copending application, Serial No. 146,258, filed November 4, 1926 I disclosed a reamer containing still further improvements whereby the scale can be removed and the valve seat reamed in a single operation with the same tool.

While very good results are obtained with these tools on usual sizes of valve seats, I have found that recently in some small sizes of motors, the valve seats are so decreased in diameter that my prior constructions can not readily be used, although the principles are as readily adaptable to small sizes of reamers as to large sizes.

Accordingly one of the principal objects of my present invention is the provision of a relatively small reamer having the same desirable features as set forth in my prior patents and applications.

Another object is the provision of a reamer of this type which can be used with a standard reamer spindle.

Another object is the provision of a reamer of improved design.

Another object is the provision of improved type of valve seat reamer having an exceedingly hard cutting edge with the reamer head constructed to prevent chipping of said edge.

Other objects and features of the invention will be apparent from the consideration of the detailed description taken with the accompanying drawings wherein Fig. 1 is a fragmentary vertical sectional view showing my improved reamer in use with a standard type and size of spindle.

Fig. 2 is a face view of the reamer showing the cutting blades or teeth.

Fig. 3 is a fragmentary sectional view.

Fig. 4 is an elevational view.

Fig. 5 is an enlarged view showing a detail of the cutting blades.

Referring now to the drawings which exemplify one embodiment of the invention, the reamer includes a head 10 with an interior longitudinally disposed tapered opening adapted to engage the tapered face 11 of the usual reamer pilot or spindle 12. The pilot is equipped with the usual centering piece 13 and is in all respects the same as the present standard reamer pilot.

The head 10 has integral therewith, a frustro conical tooth bearing portion 14 with integral teeth 16, 17, 18, 19, 21, 22, 23 and 24. This frustro conical portion and the teeth carried thereby are all formed in a particular manner to secure certain definite desirable results, and there is no part of the structure nor any detail of construction which does not contribute to the unique operation of the tool as a whole.

It will be seen that the teeth 16 and 17, 21 and 22 are provided with corrugations 16*a* and 17*a*, 21*a* and 22*a* respectively, while the front faces of the reaming teeth are smooth. This means that the teeth 16, 17, 21 and 22 are designed to break up and remove the carbon film and high carbon content steel on the valve seat while the reaming teeth are principally instrumental in performing the reaming operation per se.

In order to secure this result the smooth

face teeth are arranged with sufficient resiliency so that they can ride over the hard scale while the grooved teeth are made more rigid to hold their position and cut through the scale. This is obtained in the present embodiment by the following construction.

At both sides of each smooth tooth the conical portion of the frame or body of the reamer is cut through to form a slot 26 and with the number of teeth shown these slots are six in number. Instead of forming the inside annular surface of the cone portion so as to fit snugly against the face of the spindle, it is formed substantially parallel with the longitudinal axis of the spindle so that an annular clearance or opening space 27 is provided. This space allows sufficient movement for the individual portions of the cone formed as a result of the presence of the slots 26 so that these individual cone portions can spring or flex inwardly and so permit the tooth cutting surface to ride over the top of the scale.

It will be noticed that the space (indicated by the character 28) between the grooved teeth is unslotted. This so strengthens this portion of the cone that it is flexed with difficulty and so that with normal pressure on the reaming teeth, the grooved teeth can cut through the scale and remove it before any substantial work is performed by the smooth face teeth.

The teeth are inclined at varying angles to the radius of the reamer so that a different cutting angle is assumed by each one, and this tends to prevent chattering and also serves to preserve a smooth surface at all stages of the reaming operation. The top surface of the cutting edges has sufficient slant or drop (about three mills) so that they can cut with sufficient depth to obtain adequate cutting speed but will not penetrate to such depth as to promote chattering. The drop also maintains the cutting edge sharp for a greater length of time than if a greater drop from the front to the rear edge existed. The teeth all lie backwardly and the tool as a whole has sufficient resiliency in the cone portion which holds the teeth so that even if unusually great pressure is applied to the tool chattering will not result.

In order that those skilled in the art will have a complete understanding of my improved reamer I wish to point out that it is formed from a single piece of mild steel, so that an integral structure is obtained throughout. The shape is obtained by suitable machine operations of a type which will be readily understood. When the tool has been completed it is pack hardened throughout with the result that a very hard cutting edge is obtained, but cracking and chipping of the teeth or other parts of the tool are absolutely prevented by the underlying softer metal. Fig. 5 illustrates the hardened condition of the teeth. The inside portion of the teeth indicated in the enlarged view by the character 29 is soft. On both sides of this soft area the tooth is hard and accordingly it can be resharpened to its very base and still the same cutting edge can be obtained.

I wish to call attention to the fact that my present type of reamer has a longer life than the reamers of the prior art. Before the invention of my prior reamer, it was customary to employ a solid substantial construction of high grade tool steel, and then to prevent the concomitant chipping of the hard cutting edge, the reamer was tempered by drawing it down to about a straw color. The reamer so produced did not chip, but neither did it have a long life when used on the relatively hard metal of the valve seats. With frequent resharpening, however, fair results as far as life is concerned, were obtained.

Now I obviated these difficulties in my prior inventions referred to, by stamping the reamer head from sheet metal so as to have a normal inherent resiliency. It was then possible to case harden the cutting edge to a glass hardness, and depend as a safety factor, on the spring of the metal head to relieve unusual strains and so prevent the subjection of the cutting edge to such strains as might cause chipping. So unusual were the results so secured, that I have used many of my old reamers to renew as many as 2500 seats, as compared to an average of not more than ten or twenty for old reamers.

With the present reamer constructed from a solid piece of milk steel and then pack or case hardened, I have obtained similar results. It is the entire construction which enters into this result. The resiliency obtained by the shape of the head is a feature of great importance, also aided by the angle at which the teeth are set, the use of two distinct sets of teeth on the two hemispheres spiralled in opposite directions. Although generally I prefer to pack harden the entire reamer, similar results may be obtained by hardening only the blade portion thereof.

The present invention operates in substantially the same way as the reamer described in my co-pending application. The spindle or handle is inserted in the reamer head and the reamer teeth brought to position against the valve seat. By turning the tool in a clockwise direction the grooved teeth immediately operate to remove the hard outside surface of the seat, the smooth teeth in the meantime flexing sufficiently to ride over the hard surface. This continues until metal is reached soft enough for the smooth teeth to make an impression after which all of the teeth operating at different angles in the manner described cut a smooth finish seat. This is done in a single operation in the manner set forth.

The present embodiment of the reamer is

machined in its entirety from a solid piece of metal and this is the preferred construction but it will be understood that some of the features of the invention are applicable to a reamer made in different ways. For example some of these features may be incorporated in a reamer of the general type shown in my prior patents spoken of previously.

While I have described the details of the present embodiment of my invention in order that those skilled in the art will have a full understanding thereof, I do not restrict myself to the construction shown, the invention being limited only by the scope of the appended claims.

I claim:

1. In a reamer of the character described, a reamer head having a tapered longitudinal opening for friction application to a tapered shank, a portion of the opening being shaped to form a clearance with the shank, and a plurality of teeth carried by the head adjacent said clearance so that such teeth may flex into said clearance when under pressure.

2. In a reamer of the character described, a reamer head with a longitudinal opening adapted frictionally to engage a tapered shank, and a plurality of teeth carried by the head, the head being shaped in the region of the teeth to provide resiliency therein, and the head opening being spaced from the shank at such point to allow the teeth bearing portion of the head to flex inwardly under pressure.

3. In a reamer of the character described, a reamer head with a longitudinal opening adapted frictionally to engage a tapered shank, a plurality of teeth designed to remove carbon scale and a plurality of teeth designed to ream a smooth finish to a valve seat, the head being shaped in the region of the teeth to provide resiliency therein and with greater resiliency imparted to the reaming teeth than to the scale removing teeth, and the head being spaced away from the shank in the region of such teeth to allow the teeth bearing portion of the head to flex inwardly under pressure.

4. In a reamer of the character described a reamer head with a longitudinal opening adapted frictionally to engage a tapered shank, a plurality of teeth designed to remove carbon scale, and a plurality of reamer teeth, the head being shaped in the region of said reamer teeth to impart flexibility thereto and including a clearance between the head or shank in the region of such teeth to permit the same to flex inwardly under pressure.

5. In a reamer of the character described, a solid reamer head having a longitudinal opening for receiving a tapered shank, and having one end slanting generally inwardly to form a frustro cone, and a plurality of teeth carried by the cone and placed at an angle to the path of movement thereof, the cone being slotted at the sides of some of said teeth to impart resiliency thereto, and the balance of said teeth remaining relatively stiff and function as scale removers.

6. A reamer comprising a reamer head with a cone shaped end having radial slots therein with a longitudinal opening for receiving a pilot, and a plurality of teeth carried by the cone end, said teeth being spiralled and slanted away from the direction of rotation of the reamer, the cone end disposed with respect to the pilot to be out of contact therewith whereby tooth supporting portions thereof may be flexed inwardly under pressure.

7. A reamer comprising a reamer head with a cone shaped end having radial slots therein with a longitudinal opening for receiving a pilot, and a plurality of teeth carried by the cone end, said teeth being spiralled and slanted away from the direction of rotation of the reamer, the cone end disposed with respect to the pilot to be out of contact therewith whereby tooth supporting portions thereof may be flexed inwardly under pressure, the reamer being case hardened to form a glass hard cutting edge and the position of the teeth and resiliency of the cone end of the head serving as a safety factor to prevent chipping of the glass hard edge.

8. A reamer as defined in claim 7 wherein some of the teeth are secured to an unslotted portion of the head and roughened on their cutting edges to serve as scale removers.

9. In a reamer of the character described, a reamer head with a longitudinal opening adapted frictionally to engage a tapered shank, a plurality of teeth designed to remove carbon scale and a plurality of teeth designed to ream a smooth finish to a valve seat, the head being shaped in the region of the teeth to provide resiliency therein and with greater resiliency imparted to the reaming teeth than to the scale removing teeth, the head being spaced away from the shank in the region of such teeth to allow the teeth bearing portion of the head to flex inwardly under pressure, said scale removing teeth being roughened on the entering faces to facilitate breaking up the scale.

In witness whereof, I hereunto subscribe my name this 23rd day of August, 1929.

WILLIAM H. EVANS.