

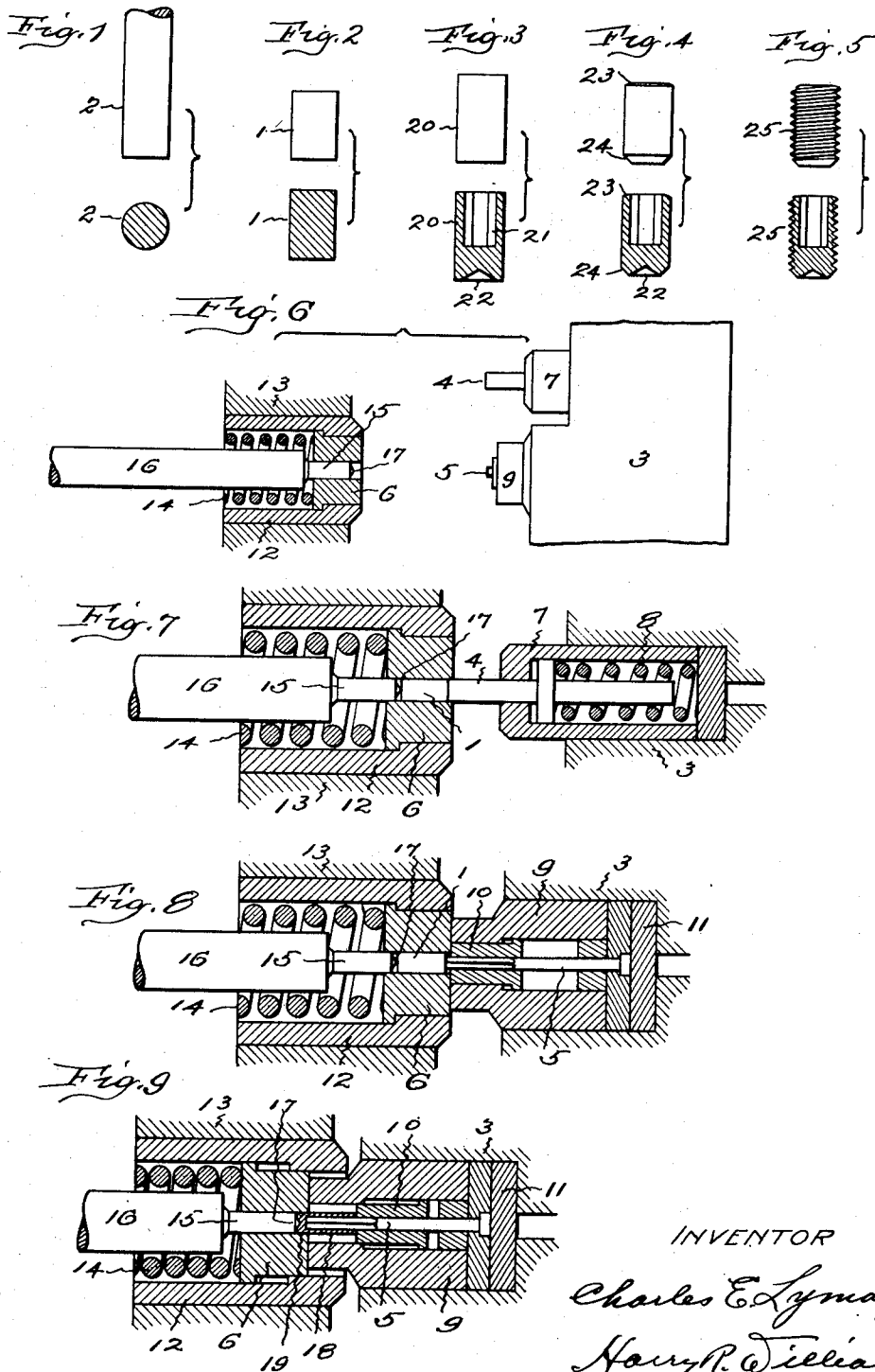
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METHOD OF FORMING SET SCREWS

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METHOD OF FORMING SET SCREWS.

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This invention relates to a method of making set screws of the type that have in their heads angular sockets which are adapted to receive a key wrench for turning the screws into and out of place.

The object of the invention is to provide a process by means of which such screws may be produced from cold slugs of metal very rapidly and cheaply, there being few operations and no waste metal, and the metal of the slugs being so flowed as to produce deep and accurately sized and shaped sockets with strong walls, thus ensuring a good fit for the wrench and eliminating danger of splitting or breaking the screws or wearing or stretching the sockets so that the wrench will not turn the screws when they are screwed into place tightly, or when it is desired to remove the screws after they have been in place for a long time and have become corroded.

In attaining this object a slug of cold metal of uniform diameter cut the proper length from a rod or wire is fed into a die cavity of slightly larger diameter than the diameter of the slug, and while confined therein is subjected to percussive force in such manner that coincidently a conical cup is formed in one end and the other end extruded from the die cavity onto a punch which acts as a mandrel and about which the extruded metal flows to form the socket, the exterior of the slug about the socket during this action being given approximately final shape and size by the contour of the wall at the mouth of the die cavity from which the metal is extruded. The cupped end of this blank thus produced is then bevelled and coincidently the socketed end is rounded, and finally a thread is cut or rolled on the exterior of the blank. By the practice of this process, without heating, strong and accurate "grub set screws" can be produced by three operations or by three machines only.

The blank forming step of this process may be taken by such tools as are described in my co-pending application #752,161, filed Nov. 25, 1924, although other tools can be employed, and those tools are especially adapted to be used in a solid die cold header of well known type, such as is set forth in United States patent to Campbell #569,406, Oct. 13, 1896, although other heading machines could be used.

In the accompanying drawing Fig. 1

shows a side view and a transverse section of a rod from which a slug may be cut. Fig. 2 shows a side view and longitudinal section of the slug. Fig. 3 shows a side view and longitudinal section of the socketed and cupped blank produced from the slug by the first step of the process. Fig. 4 shows a side view and longitudinal section of the blank after it has been rounded and bevelled by the second step. Fig. 5 shows a side view and longitudinal section of the finished set screw, that is, the blank after a thread has been rolled or cut on its exterior. Fig. 6 shows a die, feed pin and punch, and their supporting parts of a heading machine, which may be used in practicing this invention. Fig. 7 is a section of the die with a slug fed into it by a feed pin. Fig. 8 is a section showing the punch or mandrel advanced and about to act upon the slug in the die. Fig. 9 is a similar view showing the relation of the parts after the slug has been percussively acted upon to produce the cup at one end and the socket at the other end.

In the practice of this invention the slugs 1 can be cut from a rod 2 of uniform diameter fed into a cold header in the usual manner, or they may be produced in another machine and fed individually into the header in the well known way.

In the views 3 indicates the forward end of a punch bed which is mounted on the reciprocating ram of a header so that it may be raised and lowered for first presenting the feed pin 4 and then the punch 5 in line with the die 6, and also carried back and forth for feeding the slug into the die cavity and then for acting upon the slug in the cavity, as is well understood. The feed pin of the tools illustrated is mounted in a thimble 7 set into the punch bed, and is pressed forward by a spring 8. The punch is mounted in the punch block 9 set into the punch bed with its forward end supported and guided by a sliding sleeve 10 and its rear end abutting against a hardened backing plate 11. The forward end of the punch projects a slight distance beyond the front end of the punch block and its cross sectional shape is that which will produce the required cross sectional shape, preferably hexagonal, of the socket in the screw to be made.

The die is slidably fitted in a sleeve 12 that is secured in the front wall 13 of the frame of the header. The die cavity has a

cross sectional shape that will impart the exterior outline to the screw blank to be produced, and the die is normally pressed forward by a spring 14. Projecting into the die cavity from the back is a pin 15 attached to the end of the knock-out plunger 16. The length of this pin is varied according to the length of the slug that is to be operated upon and it has a conical tip 17 which is designed to form a cup in the bottom end of the slug.

With the parts in their normal positions and doing no work the die is pressed forward by its spring and the tip of the pin is a short distance inside of the face of the die, while the forward end of the punch is slightly forward of the face of the punch block, as illustrated in Fig. 6. In the standard two-blow cold header for which the tools shown are especially designed the slug that is slightly smaller in diameter than the die cavity is fed in the usual way and pushed into the die cavity by the feed pin that at this time is in line with the die. As this takes place the backing pin and knock-out plunger are forced back as illustrated in Fig. 7. After the feed pin is withdrawn and raised and the punch brought into line with the die, the punch is driven forward. As the punch enters the die opening and engages the slug the face of the punch block engages the face of the die and presses the die back. The die is forced back a distance equal to the distance the punch is driven into the slug, and as the slug is held by the backing pin the metal 18 displaced by the punch is extruded from the die cavity forming around the punch as a mandrel. Fig. 9. with this action the surface of the wall 19 at the mouth of the die cavity which controls the exterior shape of the metal extruded is always the same.

With the slug confined in the die in this manner and backed by the conically tipped pin, the blow given by the punch produces the elongated blank 20 of uniform diameter, Fig. 3, with the hexagonal socket 21 at one end and the conical cup 22 at the other end. This step of the process may be performed by the well known heading machines, and it produces the required cupped blanks very rapidly and cheaply with accurate and well formed sockets and exact exterior diameter.

These blanks can then be fed to a common screw machine which is tooled to round off the socketed end 23 and taper the cupped end 24, Fig. 4, which cutting operations may be performed coincidentally, after which a

thread 25 may be cut or rolled on the exterior, producing the screws shown in Fig. 5.

The invention claimed is:—

1. The method of forming socketed set screws which consists in inserting a cold metal slug entirely within a die cavity, and while holding the slug stationary driving a punch into the mouth of the die a limited predetermined distance and thereafter moving said die with the punch for causing metal of the slug to progressively extrude from the die cavity and elongate in a direction opposite to the movement of the punch and die, and subsequently threading the exterior of the blank thus produced.

2. The method of forming socketed set screws which consists in feeding a cold metal slug of uniform diameter entirely within a cavity, holding the inner end of the slug in a fixed position, forcing a punch of smaller diameter into the outer end of the slug thus confined and held and coincidentally retreating the cavity a distance equal to the advance of the punch into the slug, whereby metal of the slug is caused to flow longitudinally out of the cavity and along the punch, and threading the exterior of the blank thus produced.

3. The method of forming socketed set screws which consists in feeding a cold metal slug of uniform diameter entirely within a die cavity and while the slug is confined and held stationary by percussive force exercised against the slug, coincidentally forming a cup in the inner end of the slug and causing the outer end of the slug to elongate and extrude from and be shaped by the mouth of the die cavity, in a direction opposite to the application of said force and produce a socket in said elongated end, and threading the exterior of the blank thus produced.

4. The method of forming socketed set screws which consists in feeding a cold metal slug of uniform diameter entirely within a die cavity and while the slug is confined and held stationary by percussive force applied to the slug simultaneously cupping the inner end of the slug and causing metal of the outer end of the slug to extrude out of and be shaped by the mouth of the die cavity onto the means for applying, and in a direction opposite to the application of, said force and form a socket therein, subsequently bevelling the cupped end, rounding the elongated end, and threading the outer surface of the blank thus formed.

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