

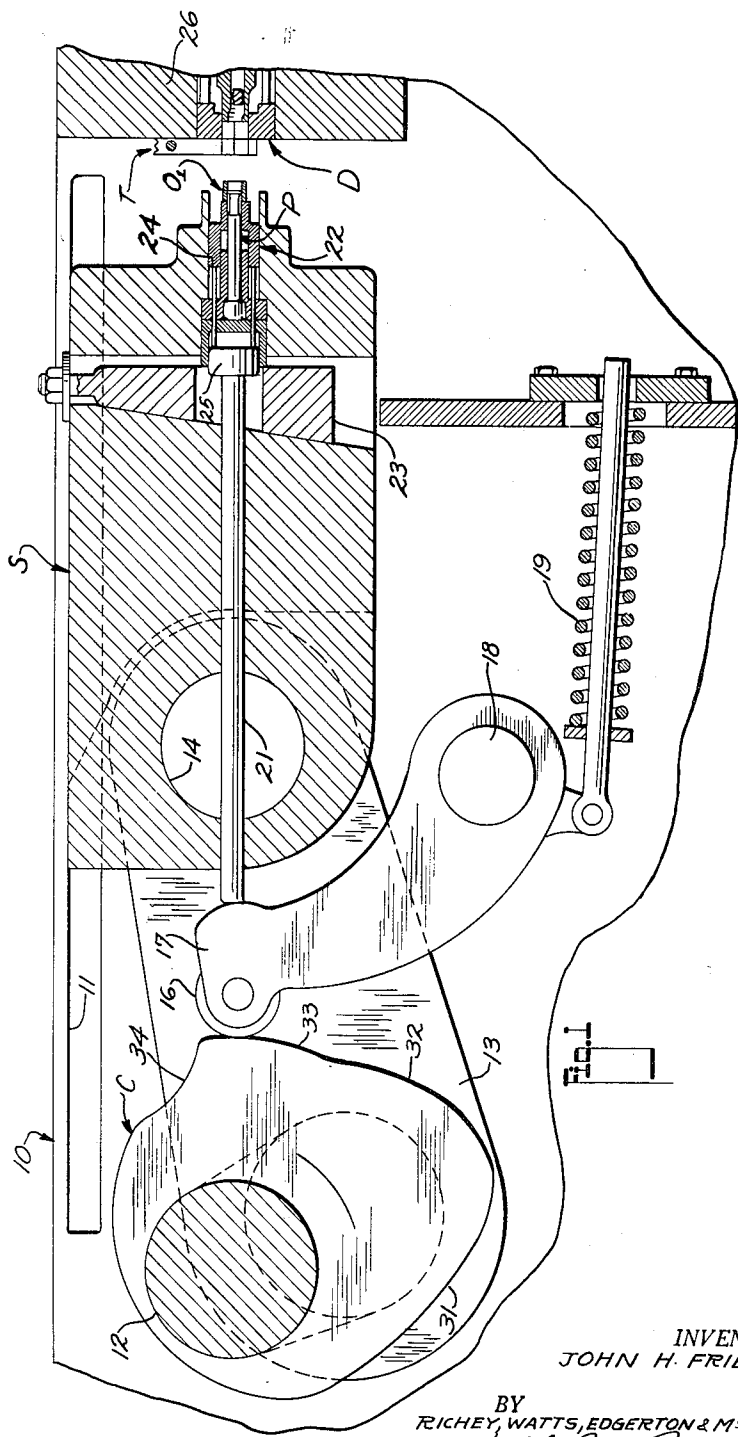
Feb. 21, 1956

J. H. FRIEDMAN
NUT PIERCING MACHINE

2,735,487

Original Filed June 17, 1949

3 Sheets-Sheet 1



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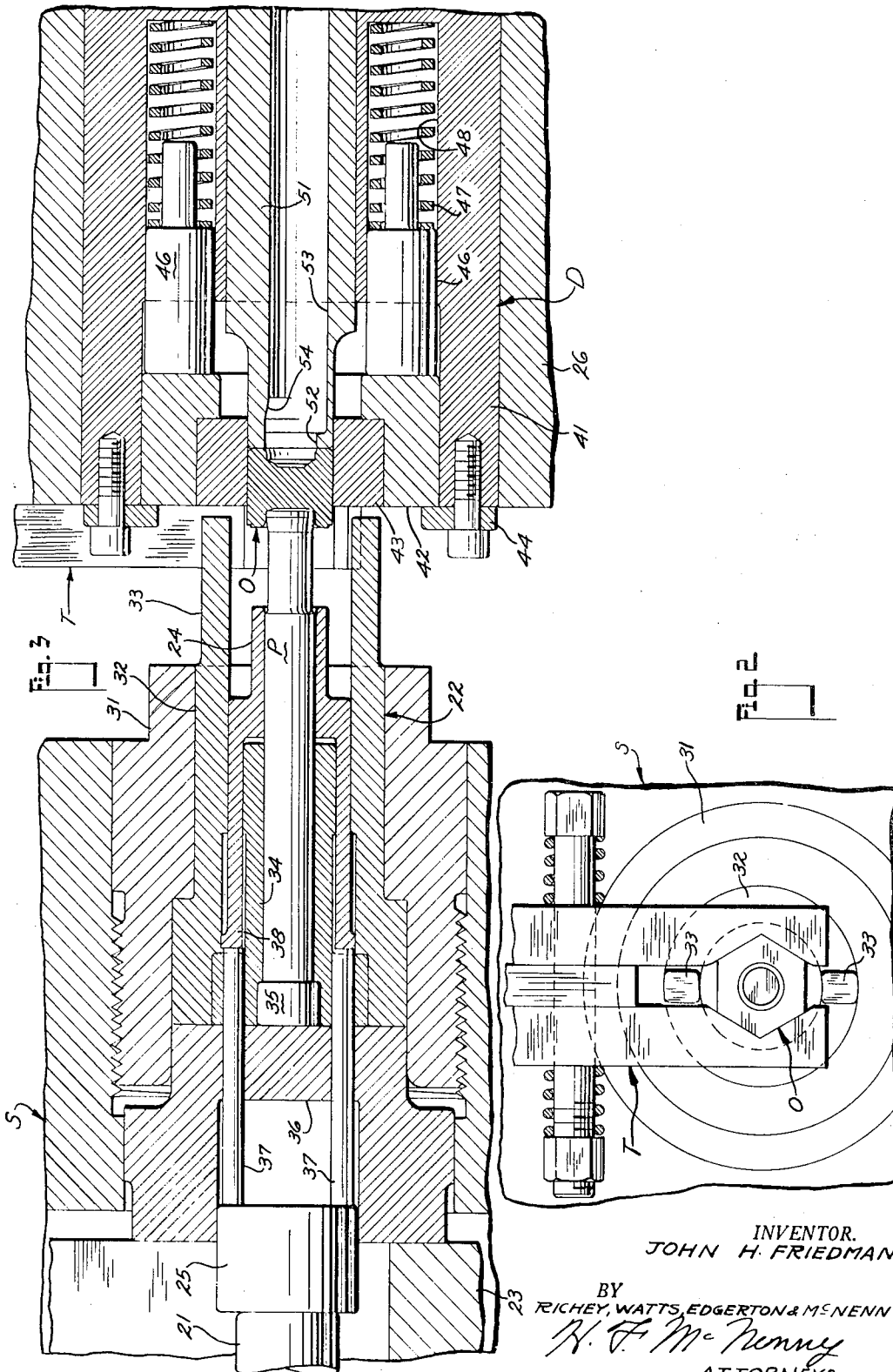
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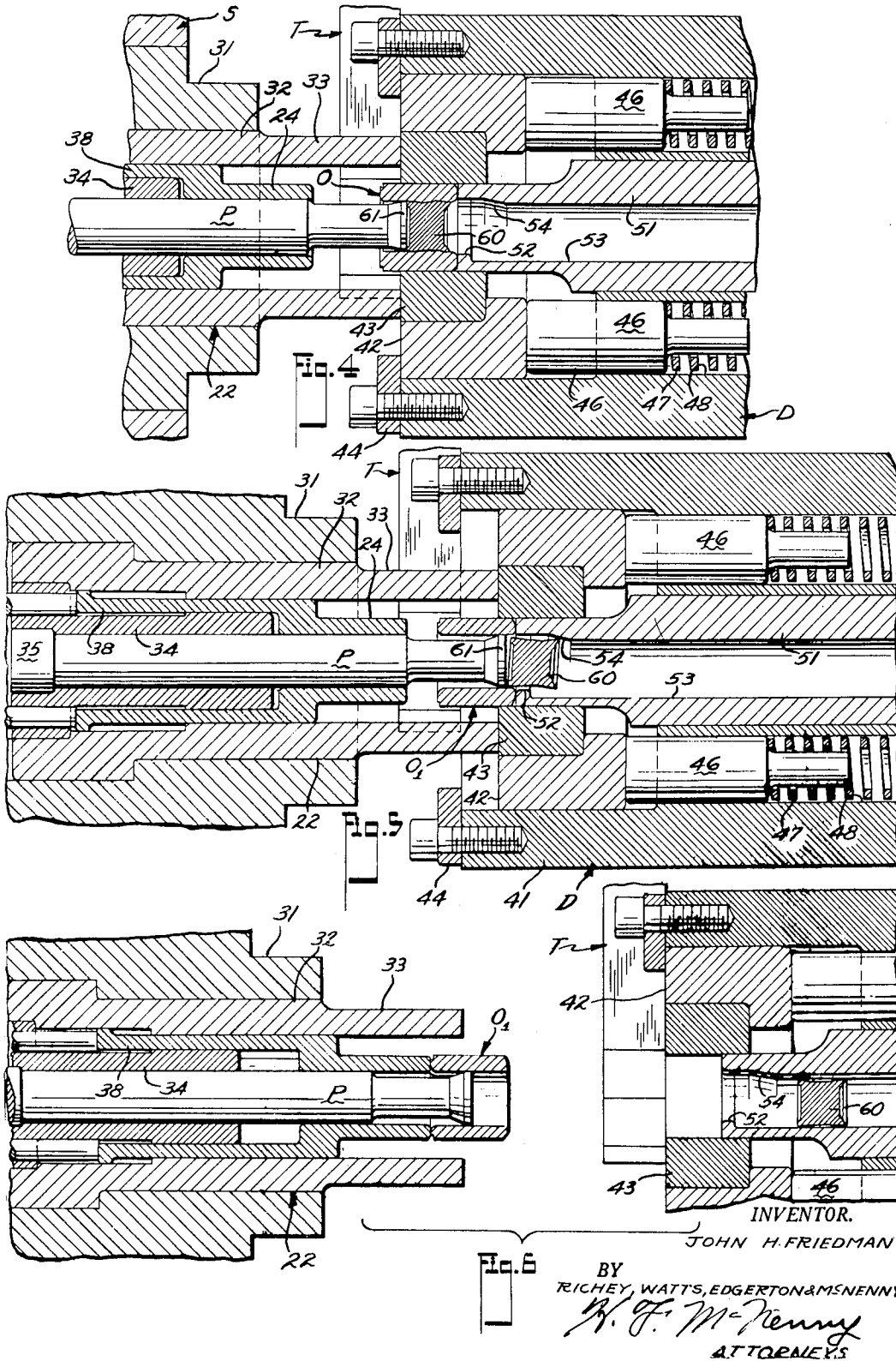
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2,735,487

NUT PIERCING MACHINE

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Original application June 17, 1949, Serial No. 99,770.
Divided and this application November 25, 1952, Serial No. 322,490

8 Claims. (Cl. 164—86)

This invention relates to apparatus for piercing blanks and is particularly adapted for use in connection with a cold header. Reference is made to my co-pending application Serial No. 99,770 filed June 17, 1949 now Patent No. 2,645,793 issued July 21, 1953 of which the instant application is a division.

This invention is particularly advantageous where the diameter of the punched hole is relatively large with regard to the diameter of the blank, in which case difficulty has been encountered due to expansion and permanent set of the blank as a result of a socketing or punching operation. It is an object of the invention to pierce blanks, such as nut blanks, while cold, without expanding the blanks and with a minimum of tool wear and breakage. Briefly, this is accomplished by confining the blank side wall in a sliding die, bringing a punch or tool against the blank, socketing the blank or piercing the blank while confined and until a slug has broken loose, and if punching, continuing the punching motion to force the slug clear of the blank while simultaneously removing the confinement of the blank side wall. Thus, the slug-severing operation takes place while the blank is confined; although the blank may have thin side walls, it will not be stretched or expanded beyond its elastic limit.

In order to prolong tool wear in accordance with the invention, the punch is withdrawn from the blank after the latter has been carried clear of the die by the punch, so that the blank is unconfined during the stripping operation. In a preferred form of the invention, this is accomplished by stripping mechanism carried by the header slide which may be positioned independently of the punch. The punch is stripped from the blank after the latter has been withdrawn clear of the die, which produces little or no wear on the punch. The blank can spring slightly during stripping which facilitates withdrawal of the punch, but this expansion is not enough to cause a stress that exceeds the elastic limit, so that the blank returns to its original diameter.

Another object of the invention is to positively and firmly break the punched slug clear of the nose of the punch after the punch has expelled or pushed the slug into the slug discharge tube. The initial pressure necessary to sever the slug from the blank is often high enough to cause the slug to adhere firmly to the punch nose so that the slug tends to be withdrawn with the punch to remain in the blank, instead of being deposited in the discharge tube provided for the slugs. In a preferred embodiment of the invention withdrawal of the slug with the punch is consistently and positively prevented by disposing a tapered shoulder inwardly of the mouth of the slug-receiving passageway, which shoulder is in the path of the slug as the punch projects it into the passageway. Thus, as the punch carries the slug against the shoulder the slug is cammed radially by the shoulder and broken clear of the punch nose.

Another object of the invention is to insure that the

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blank comes away with the punch upon retraction of the slide. This is accomplished by utilizing motion of the punch or tool-carrying means to retract the sliding die that confines the blank after the slug has been severed from the blank. It is also an object to accomplish this even though blank transfer fingers may be at and remain at the punching station during the punching operation. In the preferred arrangement, these objects are attained by providing one or more prongs or extensions movable with the header slide that straddle or clear the transfer fingers and protrude axially forwardly. These extensions engage the sliding die or sleeve that surrounds the blank after the slug has been severed from the blank by the punch, and force the die clear of the blank.

The manner in which these and other objects are accomplished will be apparent from the following detailed description of a preferred embodiment of the invention.

In the drawings:

Fig. 1 is a simplified section of a cold heading device suitable for carrying out the invention;

Fig. 2 is a fragmentary elevation showing the tool assembly and a portion of the transfer fingers;

Fig. 3 is a section through the tool and die assembly of the apparatus disposed just as the punching operation begins;

Fig. 4 is a section showing the apparatus just as the slug is severed from the blank;

Fig. 5 shows the slug broken loose from the end of the punch; and,

Fig. 6 shows the header slide retracted and the punch partially stripped from the blank.

Although in its broader aspects the invention is not limited to cold headers, it is particularly adaptable to cold heading machines such as that shown in the patent to Clouse, 1,856,027, April 26, 1932, and is also applicable to a nut machine such as disclosed in my pending application, Serial No. 663,569, filed April 19, 1946 now Patent No. 2,542,864 issued February 20, 1951. Cold headers adaptable to effecting the invention include generally a die block, a reciprocable header slide and tools, means to feed stock to the die blank, means to shear off blanks, means to transfer the blanks between stations in the die block, means to advance and retract the header slide to perform work on the blanks, and means to knock out the blanks from the dies into the transfer means. In Fig. 1 elements of a cold header essential to the invention are shown, and other elements typical to cold heading apparatus are disclosed, it being understood that except as disclosed herein and claimed the details of the header construction and particularly the feed, shear, knockout, and transfer mechanism form no part of the present invention.

As seen in Fig. 1, the header frame 10 has guides 11 for reciprocably mounting a slide S. Slide S is reciprocated by the usual crankshaft 12 rotatable in the machine frame which drives the crank or pitman 13 pivoted to the header slide as at 14. In a preferred embodiment of the invention, a cam C is mounted on the crankshaft to control the operation of means to strip the punch from the blank. A roller 16 is mounted on a cam follower 17 which is pivoted to the frame as at 18 and urged by spring apparatus 19 so that the roller bears against the cam. The follower controls a plunger 21, slidably mounted in the header slide. The combined punching and stripping mechanism 22 is mounted in the header slide, the actual construction thereof being somewhat simplified in Fig. 1. It includes the punch or tool P, in independently movable stripping sleeve 24, and an operating plunger 25 for controlling the sleeve.

Suitable transfer mechanism such as that disclosed in my application Serial No. 663,569, filed April 19, 1946, operate transfer fingers T to transfer blanks from station to station. A die block 26 and a punch or die station D are also provided which will be described hereinafter in more detail.

Preferred constructional details of the tool and die assemblies are illustrated in Figs. 2 and 3. As seen in those figures, the header slide S has screwed therein a sleeve 31 which acts as a retainer for a bushing 32 having forwardly projecting fingers 33 arranged to pass between the transfer fingers T. The stripping sleeve 24 surrounds the punch P and slides within the sleeve 32. The punch P is retained in the slide by an inner sleeve 34 and a head 35 on the punch shank, these elements being forced against the bushing 32 by means of a plug 36 and a clamping wedge 33 in accordance with practice well-known in the art. The plunger 23 has forwardly extending pins 37 which extend through apertures in bushing 34 and engage the rearward portion 38 of the stripping sleeve 24.

The die block 26 incorporates special die or punch station mechanism D. A hardened sleeve member 41 is fastened in the die block and slidably mounts a two-part confining sleeve or die member made up of an outer member 42 and an inner hardened blank-confining sleeve or die 43. The sliding die assembly is retained in the die block by means of narrow clips 44, and are urged against the clips by an assembly of plungers 46 and compression springs 47 fitting within recesses 48 in the sleeve 41. In order to receive the slug punched from the blank, a discharge tube 51 is mounted centrally in the die station, and includes a slug-receiving passageway 53, a tapered shoulder 54 for breaking the slug clear from the punch, and a slug-receiving mouth 52 concentric with the punch.

In operation, and in accordance with the usual practice, a blank is transferred by the transfer fingers T and their controlling mechanism to a position in front of the sliding die member 43. As the header slide advances, the nose of punch P engages the blank O and forces it into sleeve member 43, springs 47 holding the sleeve member in its outermost position during this operation. As shown in Fig. 1, cam C is contoured so that surface 31 engages the follower 16 during this phase of the cycle and causes the stripping members to move generally forward with the header slide on the advance stroke. The position of the parts in Fig. 3 is such that the punch P has engaged the blank and forced it against the shoulder of the discharge tube 51.

Further motion of the header slide causes the punch to pierce and sever the slug 60 from the blank, as seen in Fig. 4. The relationship of parts and the length of fingers 33 is such that just as the slug 60 is severed from the blank, fingers 33 are brought into engagement with the sliding die member 43. It will be noted from Fig. 4 that the blank is confined during the slug severing operation, and even though it has relatively thin walls it cannot expand or stretch past its elastic limit. As advancing motion of the slide continues, the punch forces the slug 60 through the punched blank O₁, and fingers 33 force the sliding die 43 clear of the blank. The advancing punch smooths and trues the punched hole, and, as seen in Figs. 4 and 5, I may form the parts so that the blank is unconfined except at the working zone or nose 61 of the punch.

When the punch approaches the end of its stroke, a corner of slug 60 is forced against the tapered or camming surface 54 of the discharge tube. This radially cams the slug and breaks it clear of the nose of the punch to which it tends to adhere or weld, due to the high pressures resulting from punching the confined blank. The punch advances somewhat further than its position in Fig. 5 until the working zone 61 passes through the punched aperture in the blank. As the header slide re-

tracts, this causes the punch to remove the blank from the die block.

Initially, the stripping assembly moves back with the slide, because the cam surface 32 of cam C falls away from under the roller 16 as the header slide retracts. However, a point is reached wherein the surface 33 of the cam C is turned under the roller 16, which surface is substantially equi-distant from the center of rotation of the crankshaft 12. This causes the stripping plunger and sleeve apparatus to remain stationary, or substantially so, while the header slide and punch are retracted. As a result, the punch is stripped from the blank which is brought against the forward nose of the stripping sleeve 24 during the stripping operation. It is noted that the stripping operation occurs when the blank has cleared the transfer fingers and while it is unconfined so that no permanent expansion may occur, and wear on the tool is greatly reduced. After the blank has been stripped from the punch the surface 34 of the cam is turned under the follower which permits the entire slide, including the stripping assembly to retract with the header slide. Although I prefer to use a crankshaft-mounted cam to operate the stripping assembly as herein disclosed, any means having a similar mode of operation may be employed to effect independent motion of the punch and stripping sleeve.

Those skilled in the art will recognize that in carrying out the invention, thin-walled blanks can be pierced or punched without danger of permanent expansion of the blanks. However, retraction of the tool is effected while the blanks are unconfined so that tool life is greatly prolonged. Likewise, there is no possibility of the pierced slug being retracted with the tool and blank due to the slug-clearing means formed in the slug receiving passageway at the die. Furthermore, the tool is stripped from the blank with the blank well clear of the die and transfer fingers so that no interference will be encountered.

Although I have illustrated a preferred form of apparatus for effecting the objects and advantages of the invention, it will be recognized that other constructional details and arrangements may be had without departing from the essence and mode of operation of the invention as defined by the appended claims.

What is claimed is:

1. In a cold header, a die block and a relatively reciprocable header slide, a punch on said slide, said die block having formed therein in a slug-receiving bore surrounded by a fixed shoulder for backing up a blank to be punched, a sleeve slidably mounted on said die block and having a bore for surrounding and confining the side wall of a blank disposed against said shoulder, means for positioning said sleeve to confine the blank before the blank is punched, means to advance said punch to punch and sever a slug from the blank while the latter is confined, means carried by said slide spaced from the outer periphery of said blank to engage and progressively move said sleeve as the punch advances, said sleeve being moved clear of the blank, means to hold said blank against said shoulder, and means to withdraw said punch means from the blank with the sleeve clear of the blank and the side wall thereof unconfined.

2. In a cold header, relatively reciprocable slide and die means, said die means having formed therein a slug-receiving bore surrounded by a shoulder for backing up a blank to be punched, a sleeve slidably mounted on said die means and having a bore for surrounding and confining the side wall of a blank disposed against said shoulder, a punch on said slide for positioning a blank in said sleeve to confine the blank, means to advance said slide to punch and sever a slug from the blank while the latter is confined, means movable with said slide spaced from the outer periphery of said blank to progressively move said sleeve clear of the blank

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simultaneous with movement of said punch, means to withdraw said punch means and blank from the die means, and means to strip the punch from the blank with the sleeve clear of the blank and the side wall thereof unconfined.

3. Apparatus for piercing blanks comprising relatively reciprocable punch and blank supporting means, said blank supporting means having formed therein a slug-receiving bore surrounded by a fixed shoulder for backing up a blank to be punched, a sleeve slidably mounted on one of said relatively reciprocable means, and having a bore for surrounding and confining the side wall of a blank disposed against said shoulder, means for positioning said sleeve to confine the blank before the blank is punched, projecting means spaced from the outer periphery of said blank and substantially aligned with said punch means, means to advance simultaneously said punch means and said projecting means to punch and sever a slug from the blank while the blank is confined by said sleeve, said projecting means contacting said sleeve after the punch means contacts the blank to progressively move said sleeve relative to said blank until said sleeve is clear of the blank, means to withdraw said punch means and blank from the sleeve supporting means, and means to strip the punch from the blank with the sleeve clear of the blank and the side wall thereof unconfined.

4. Apparatus for piercing blanks comprising relatively reciprocable punch and blank supporting means, said blank supporting means having formed therein a slug-receiving bore surrounded by a fixed shoulder for backing up a blank to be punched, a sleeve slidably mounted on one of said relatively reciprocable means and having a bore for surrounding and confining the side wall of a blank disposed against said shoulder, means for positioning sleeve to confine the blank before the blank is punched, projecting means spaced from the outer periphery of said blank and substantially aligned with said punch means, means to advance simultaneously said punch means and said projecting means to punch and sever a slug from the blank while the blank is confined by said sleeve, said projecting means contacting said sleeve to progressively move said sleeve relative to said blank until said sleeve is clear of the blank, means in the wall of said slug-receiving bore to break the slug loose from the nose of the punch means, means to withdraw said punch means and the blank from the sleeve supporting means, and means to strip the punch means from the blank with the sleeve clear of the blank and the side wall thereof unconfined.

5. In a cold header, a die block and a relatively reciprocable header slide, a punch on said slide, said die block having formed therein a slug-receiving bore surrounded by a fixed shoulder for backing up a blank to be punched, a sleeve slidably mounted on said die block and having a bore for surrounding and confining the side wall of a blank disposed against said shoulder, means for positioning a blank in said sleeve to confine the blank before the blank is punched, projecting means spaced from the outer periphery of said blank and substantially aligned with said punch means, said means advancing said punch and projecting means to punch and sever a slug from the blank while the blank is confined, said projecting means contacting said sleeve after the punching has started and progressively moving said sleeve relative to said blank until said sleeve is clear of the blank, and means to withdraw said punch from the blank with the sleeve clear of the blank and the side wall thereof unconfined.

6. In a cold header, a die block and a relatively reciprocable header slide, a punch on said slide, said

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die block having formed therein a slug-receiving bore surrounded by a fixed shoulder for backing up a blank to be punched, a sleeve slidably mounted on said die block and having a bore for surrounding and confining the side wall of a blank disposed against said shoulder, means for positioning a blank in said sleeve to confine the blank before the blank is punched, projecting means spaced from the outer periphery of said blank and substantially aligned with said punch means, said means advancing said punch and projecting means to punch and sever a slug from the blank while the blank is confined, the said projecting means contacting said sleeve after engagement of the blank by the punch, said projecting means progressively moving said sleeve relative to the blank as the punch advances until said sleeve is clear of the blank after the slug is severed from the blank, and means to withdraw said punch means from the blank with the sleeve clear of the blank and the side wall thereof unconfined.

7. In a cold header, a die block and a relatively reciprocable header slide, a punch on said slide, said die block having formed therein a slug-receiving bore surrounded by a fixed shoulder for backing up a blank to be punched, a sleeve slidably mounted on said die block and having a bore for surrounding and confining the side wall of a blank disposed against said shoulder, resilient means for urging said sleeve toward said slide, means to position said blank into the sleeve to confine the blank before the blank is punched, abutment means spaced from the outer periphery of said blank and substantially aligned with said punch means, said means advancing said punch and abutment means, said punch means severing a slug from the blank while the blank is confined, said abutment means engaging said sleeve after the punch has entered the blank, said abutment means progressively moving said sleeve as the punch passes through the blank moving the sleeve clear after the punch removes the slug from the blank, and means to withdraw said punch means from the blank with the sleeve clear of the blank and the side wall thereof unconfined.

8. In a cold header, a die block and a relatively reciprocable header slide, a punch on said slide, said die block having formed therein a slug-receiving bore surrounded by a fixed shoulder for backing up a blank to be punched, a sleeve slidably mounted on said die block and having a bore for surrounding and confining the side wall of a blank disposed against said shoulder, means for positioning a blank in said sleeve to confine the blank before the blank is punched, abutment means spaced from the outer periphery of said blank and substantially aligned with said punch means, said punch entering the blank prior to the engagement of said abutment means on said sleeve, said means advancing said punch through the blank with said abutment means progressively moving the sleeve relative to the blank as the punch advances to sever the slug and to unconfine said blank, means in said slug-receiving bore to engage and break the slug clear of the punch, means to withdraw said punch with the blank thereon from the die block, and means to strip the blank from the punch with the sleeve clear of the blank and the side wall thereof unconfined.

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