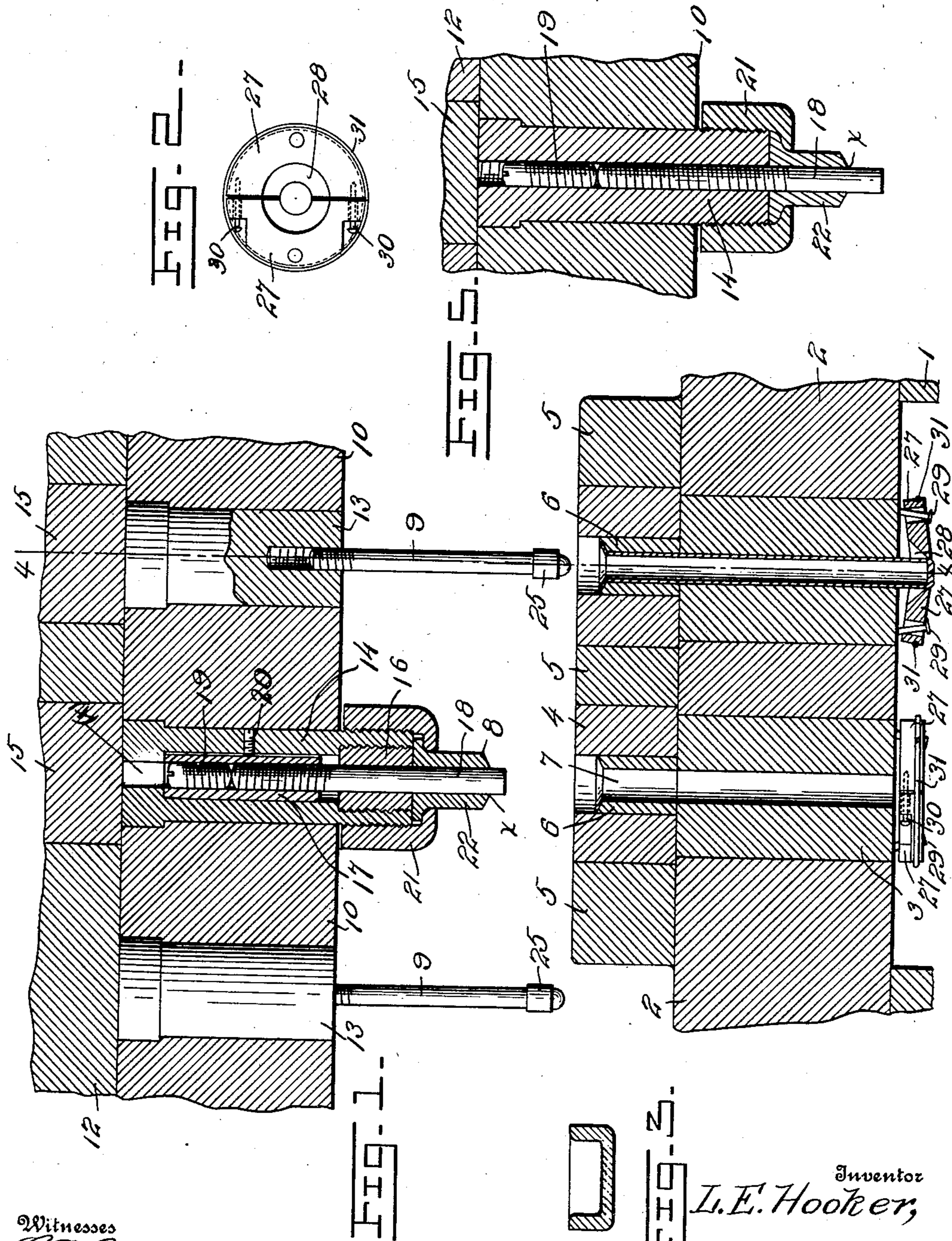


L. E. HOOKER.
METAL TUBE MACHINE.
APPLICATION FILED APR. 17, 1908.

918,154.

Patented Apr. 13, 1909.

2 SHEETS—SHEET 1.



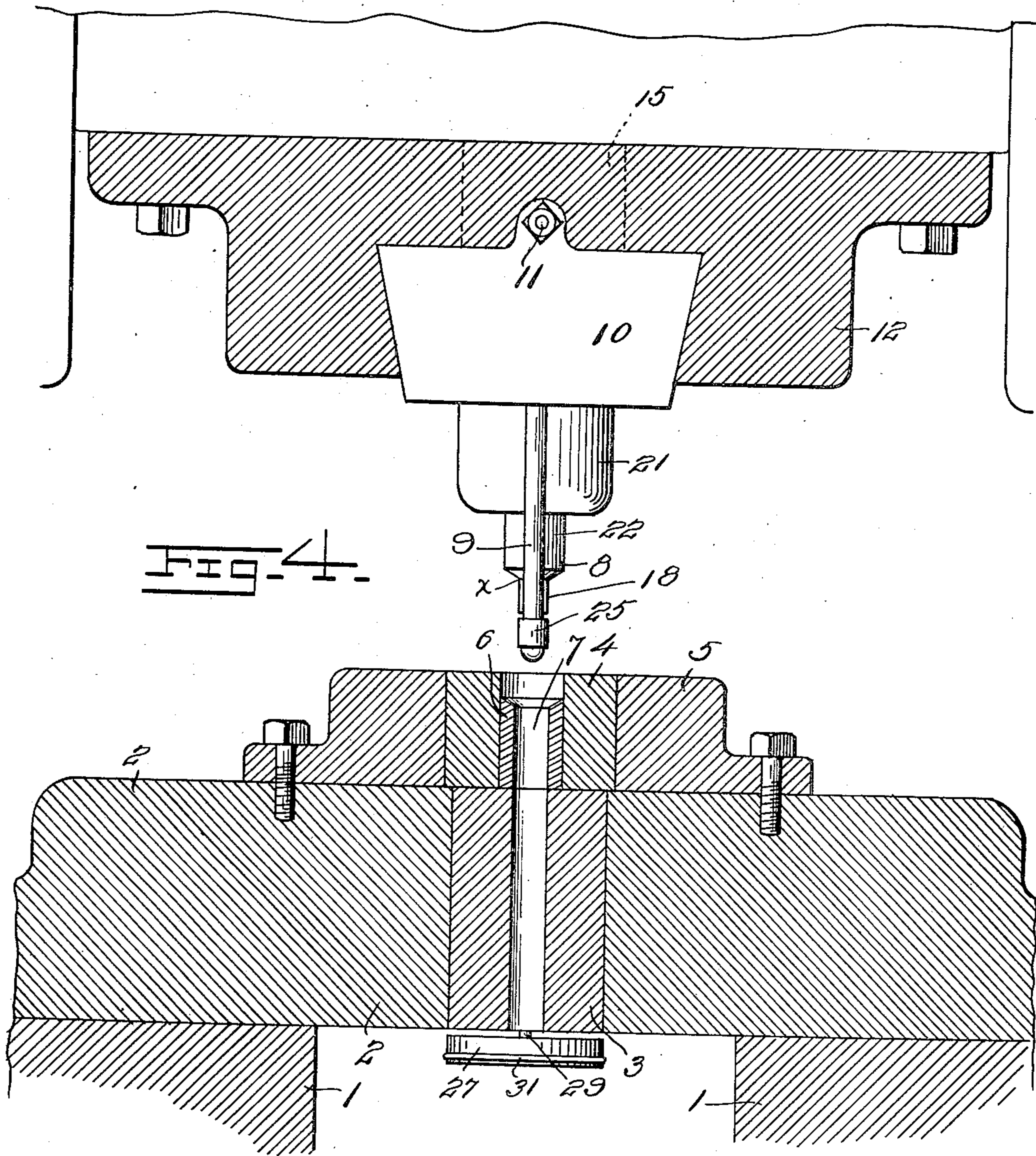
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UNITED STATES PATENT OFFICE.

LESLIE E. HOOKER, OF PAWTUCKET, RHODE ISLAND.

METAL-TUBE MACHINE.

No. 918,154.

Specification of Letters Patent.

Patented April 13, 1909.

Application filed April 17, 1908. Serial No. 427,591.

To all whom it may concern:

Be it known that I, LESLIE E. HOOKER, a citizen of the United States, residing at Pawtucket, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Metal-Tube Machines, of which the following is a specification.

My invention relates to the manufacture of tubes by the method disclosed in the patent to G. W. Lee issued June 5th, 1906, No. 822,285, and consists in certain improvements which I have made in the construction of the apparatus by which said method is carried out.

I have found by experiment that much stronger tubes can be made by starting the extrusion with a cup-shaped blank formed by folding up the edges of a disk around a punch or mandrel than when starting with a disk, as described in the above mentioned patent, but, when working with a hard metal, such as brass, the strains upon the dies and punches, are so great as to cause frequent breakage.

The improved construction of these, hereinafter described, removes practically all danger of breakage, and enables tubes to be made suitable for cartridge shells, which are stronger and lighter than those made by the present process of drawing. So that, my present invention consists in certain improvements in the construction of the dies in which the blanks are placed to be extruded into tubes, in the provision of mechanism for detaching and removing the flange scrap from the tubes and dies; in improvements in the construction of the forming and extruding punch, and, finally, in the combination and arrangement of the parts going to make up a practical and efficient machine for carrying out the process.

In the accompanying drawings, Figure 1 is a central longitudinal section through the dies and the punch-carrying slide of a press equipped with my improvements, Fig. 2 is a plan view of the tube-retaining means to prevent their withdrawal from the dies with the forming punch, Fig. 3 is an enlarged section of a blank to be operated upon, Fig. 4 is a cross-section of Fig. 1, taken on the line 4-4 of said figure, and Fig. 5 is a sectional view of a modified form of the punch holder.

Any suitable form of press may be used, that illustrated being by way of example

only. On top of the apertured bed-plate 1 of the press is bolted a plate 2, in which are inserted two hardened plugs 3, 3, which are centrally bored and lie directly beneath the dies 4, 4. The dies are held in a plate 5, which is shrunk onto them, thus constituting a sustaining jacket for the same, said plate 5 being bolted down onto the plate 2. The dies have each a central aperture, of substantially equal diameter with the blanks, in which is placed a hardened bushing 6, the upper end of which slopes slightly inwardly toward the central aperture 7, as shown. This bushing constitutes one of the most essential features which renders the present apparatus so efficient and practical. Heretofore, in carrying out the process of the said patent the die was made integral and it would not last when working on hard metal, such as copper, for example. In the present construction, the bushing has merely a driving fit in the die and rests on the hardened plug 3, which takes the downward strain instead of the die, which is subjected to a radially outward strain only. It is essential that the bushing 6 should pass entirely through the die 4 and rest upon the hardened plug 3, as practice has demonstrated that when the bushing is sustained by a shoulder within the die, breakage always occurs at that point. In this connection I may say that the construction of die just described is useful wherever a drawing operation is used and I therefore do not wish to be understood as limiting my invention in this respect to use in extruding presses.

In the machine herein illustrated, I have shown two dies, with which cooperate, at each stroke of the press, one forming and extruding punch 8 and one of two trimming punches 9, all three of which tools are carried in the slide 10, mounted in a transverse guide of the reciprocating press-head 12. The slide 10 is moved from one extreme position to the other by the hand of the operator, or by any ordinary slide-moving mechanism, between each stroke of the press, adjustable stops 11 for said slide being provided. Each trimming-punch is adjustably threaded into a stem 13, set in the slide, and a similar stem 14 carries the forming and extruding punch. In the head 12 of the press are set two hardened plugs 15, similar to the plugs 3 and directly above the same, pressure being exerted through them to the punches. Obviously a rotary turret could be used instead of the slide.

The forming or extruding punch is constructed as will be now described. Instead of being an integral structure, as represented in the drawing of the above cited method patent, I make it in two parts with the same excellent results as with the construction of die above described. The stem 14 has a countersunk central bore, as shown, in the lower end of which is fitted an anvil 16, above which, in the smaller portion of the bore, is slidably mounted a nut 17. Into this latter is adjustably threaded the central portion of the punch 18, which I will designate as the "former", a set-screw 19 being provided, if desired, to lock said former in adjusted position. To keep the nut 17 from rotating when the former is adjusted, a set-screw 20 is, or may be provided in the stem, the same engaging in a lateral slot in said nut.

Surrounding the lower part of the former 18, and clamped against the anvil 16 by the chuck 21, is the extruding plunger 22. It will thus be seen that the former can move relatively to the extruding plunger, by which construction important results are obtained. While the above is the preferred construction, it is not absolutely essential that the former should be capable of sliding longitudinally relatively to the plunger, although it is essential, for a practically efficient machine, that it should be made separate therefrom. In other words, the former may be threaded directly into the stem 14, as shown in Fig. 5. Either construction enables me to make these punches of the requisite hardness without incurring danger of their breaking at the point of junction (X), which they very soon did when made integral, owing to the tremendous strain, tending to pull the former downwardly and to force the plunger upwardly while the tube was being extruded, and the inelasticity of the integral construction. The new constructions give elasticity to the tool which enables them to yield under the strain and thus avoid breakage. As will be obvious, the amount of movement of the block or nut 17 in the stem may be adjusted by increasing or diminishing the length of said nut.

In practice, it is usually necessary to pass the tubes through a straightened die or through a shaping die, as when they are to be finished hexagonal in cross-section, for instance. There is, of course, a practical limit to the diameter of the blanks which can be extruded,—under present conditions I find that the outer diameter of the blank should not be more than one-quarter of an inch greater than the inner diameter thereof—so that, when a longer tube is needed, the walls of the cup-shaped blank are increased in height. The former 18 is accordingly adjusted downward in the stem, so that it will contact with the bottom of the blank just before the extruding punch commences to act.

There remains to be described the construction and operation of the trimming-punches. The action of these is to push the tube away from the flange left on the top of the bushing, and the only essential feature of their construction is that their diameter where they enter the dies must be intermediate the inside diameter of the bushing and the inside diameter of the tube. Thus they tear the walls of the tube away from the flange, and as they go up again, the flange is carried with them, by reason of the contraction of the metal onto the punch and also of the dish-shaped form of the flanges which, when the upward movement of the punch tends to straighten them out, causes them to bind on the punch. As shown, the punches are formed with heads 23, having shoulders at both ends, the smaller front end of the punches serving as guides to center them in the tubes, and the shoulders to act on the metal of the tube, one to sever and push away the wall from the flange and the other to engage the flange and with-draw it on the upward stroke, but this construction is not essential, it being only necessary that the diameter of the trimming punch bear the relation stated to those of the bushing and tube, and that it be sufficiently solid or resistant to sever the metal. The scrap flanges may be stripped from the trimming punches, or allowed to collect thereon and be subsequently removed by unscrewing the punches from the stems 13.

To prevent the tube from sticking to the former 18 as the latter rises from the die, I provide a spring clamp 27 adjustably located below the plate 2, so as to grip the end of the tube as it is extruded. Any form of clamp or catch may be used, that shown consisting of two semi-circular plates 27 having a conical aperture 28 at their center and with their meeting edges beveled. Screws 29 loosely and adjustably secure the plates to the plate 2 and screws 30 in connection with a wire 31 passing around the periphery of the clamp, hold the plates together. Their action will be obvious; they yield apart as the tube passes down but are caused to bite the same when it starts to go up, thus releasing it from the former.

The operation is as follows: A blank being placed in one of the dies, resting on the top of the bushing, the slide is moved so as to bring the punch 8 over said die and the press is started. The former 18 first strikes the bottom of the blank and starts to draw it downwardly. Immediately thereafter, the extruding plunger 22 commences to press against the top of the wall of the blank and forces the metal downwardly between the former and the inside of the bushing. This causes the metal to grip the former very strongly, and, if the former and extruding plunger were integral, as previously con-

constructed, the strain would be likely to cause the punch to break at the junction of the former and extruding plunger. In the present construction, the former is carried downward into the throat of the die by the metal as it is extruded at the commencement of the operation, until the lower end of the nut 17 strikes against the anvil 16, which also takes the upward pressure exerted by the plunger 22.

The threaded connection of the former with the nut provides a certain elasticity, and all danger of breakage of the former is obviated. Furthermore, another important result is obtained by permitting the former to move downwardly at first into the die, which is that the interior of the closed end of the tube is perfectly finished in this operation, that is to say, a square corner is formed, whereas, when the former was rigidly attached to the plunger, the metal would flow in around the end of the former leaving a round corner at the inside end of the tube, which had to be removed in the finishing operation or else a greater length of the tube had to be sawed off. In the manufacture of cartridge shells, when the closed end of the tube forms the head of the shell, it is difficult to square up the said round corner without causing cold-shuts in the metal, for a great deal of pressure has to be exerted in the operation of shaping the head of the shell to get rid of said round corner, whereas all such difficulty is avoided when the corner is left square, as it is with the apparatus constructed as above described.

Having thus described my invention, what I claim is:

1. In a machine of the class described, the combination with the bed-plate, of a perforated hardened plug held therein, a jacketed die secured on said bed-plate and a bushing inserted in said die and resting on said plug.

2. In a press of the class described, the combination with the die plate and the reciprocating head, of a punch carrier movable in said head, a forming and extruding punch and a trimming punch carried in said carrier, whereby they are alternately brought into alinement with said die.

3. In a machine for forming tubes by extrusion, the combination with a die containing a bushing of less length than the thickness of said die, of a support for said bushing underneath the die, a punch comprising an extruding plunger of a diameter to fit the aperture in said die and a former of a diameter less than the inside diameter of said bushing, means to adjust said former relatively to said plunger and means to reciprocate said punch.

4. In a machine for forming tubes by extrusion, the combination with the bed-plate and reciprocating head of the press, a plate

secured to said bed-plate and containing a pair of dies, a carrier movably mounted in said head, and containing a forming and extruding punch and two trimming punches, the different positions of said carrier being adapted to cause said forming and extruding punch to coact with one of said dies and to cause one of said trimming punches to coact with the other of said dies, whereby, at each reciprocation of said head, one tube is extruded from a blank and another tube is separated from its scrap flange and the latter removed.

5. In a machine for forming tubes by extrusion, a die having a central aperture and a bushing therein, of a punch, comprising a former adapted to enter said bushing and an extruding plunger of a diameter to fit the aperture in said die, and a trimming punch, the diameter of which is less than the internal diameter of said bushing and greater than the diameter of said former.

6. The combination with a die having an aperture with a reduced lower portion forming an internal shoulder, a punch having a central former of less diameter than the reduced portion of said aperture and an annular plunger fitting the upper portion of said aperture, and a trimming punch the diameter of which is intermediate that of said reduced portion and that of said former.

7. A machine for the purpose described, comprising in combination a supporting plate containing an apertured hardened plug, a die secured on said supporting plate and containing a bushing, the lower end of which rests on said hardened plug, a reciprocating head containing a hardened plug, a slide, containing a forming and extruding punch and a trimming punch, movable transversely in said head to bring said punches alternately beneath said last mentioned plug and over said die, said forming and extruding punch comprising a central former of less diameter than the aperture in said bushing and said trimming punch being of a diameter intermediate that of said former and that of the aperture in said bushing.

8. A machine for the purpose described, comprising in combination a supporting plate containing an apertured hardened plug, a die secured on said supporting plate and containing a bushing, the lower end of which rests on said hardened plug, a reciprocating head containing a hardened plug, a slide containing a forming and extruding punch and a trimming punch, movable transversely in said head to bring said punches alternately beneath said last mentioned plug and over said die, said forming and extruding punch comprising a central former of less diameter than the aperture in said bushing and said trimming punch being of a diameter intermediate that of said former and that of the aperture in said bushing and

means beneath said first mentioned plug to prevent withdrawal of the tube from the die by said forming and extruding punch.

9. In an apparatus of the class described for forming a tube by extrusion from a circular blank, the combination with an apertured die, of a device for separating the formed tube from the flange left thereon, the same consisting of a punch having a diameter less than that of the aperture in the die but greater than the internal diameter of the tube formed, and means to reciprocate said punch into said die.

10. In a machine of the class described, the combination with the die, and the reciprocating press-head, of a stem carried by said head, and an anvil secured in the lower portion of said stem, a block slidably mounted in said stem above said anvil, a former adjustably secured in said block, an extruding plunger surrounding the lower end of said former, and means to clamp said plunger against said anvil.

11. In a machine of the class described, the combination with a die, of a reciprocatory head, a hollow stem secured therein, an annular plunger bearing against the end of said stem, means to secure said plunger in position, and a central forming-punch passing through said plunger and adjustably secured to said stem.

12. In a machine of the class described, the combination with a die containing a hardened bushing of less length than the thickness of said die, and an apertured hardened plug beneath said die and bushing to support the latter in place independently of the die, of a reciprocating head having rigidly secured thereto a hollow extending plunger of a diameter to fit said die, and a central forming punch of a diameter less than that of said bushing and movably secured in said head.

13. In a machine of the class described, the combination with a die containing a bushing of less length than the thickness of said die, and a support for said bushing independent of said die, of a reciprocatory head carrying an apertured extruding plunger, of a diameter to fit the aperture in said die, and a forming punch of a diameter less than the inside diameter of said bushing, and projecting centrally through said plunger, but secured to said head independently of the same, and means to reciprocate said head.

In testimony, whereof I have affixed my signature, in presence of two witnesses.

LESLIE E. HOOKER.

Witnesses:

HORACE B. EDGECOMB,
FREDERIC W. ENTWISTLE.