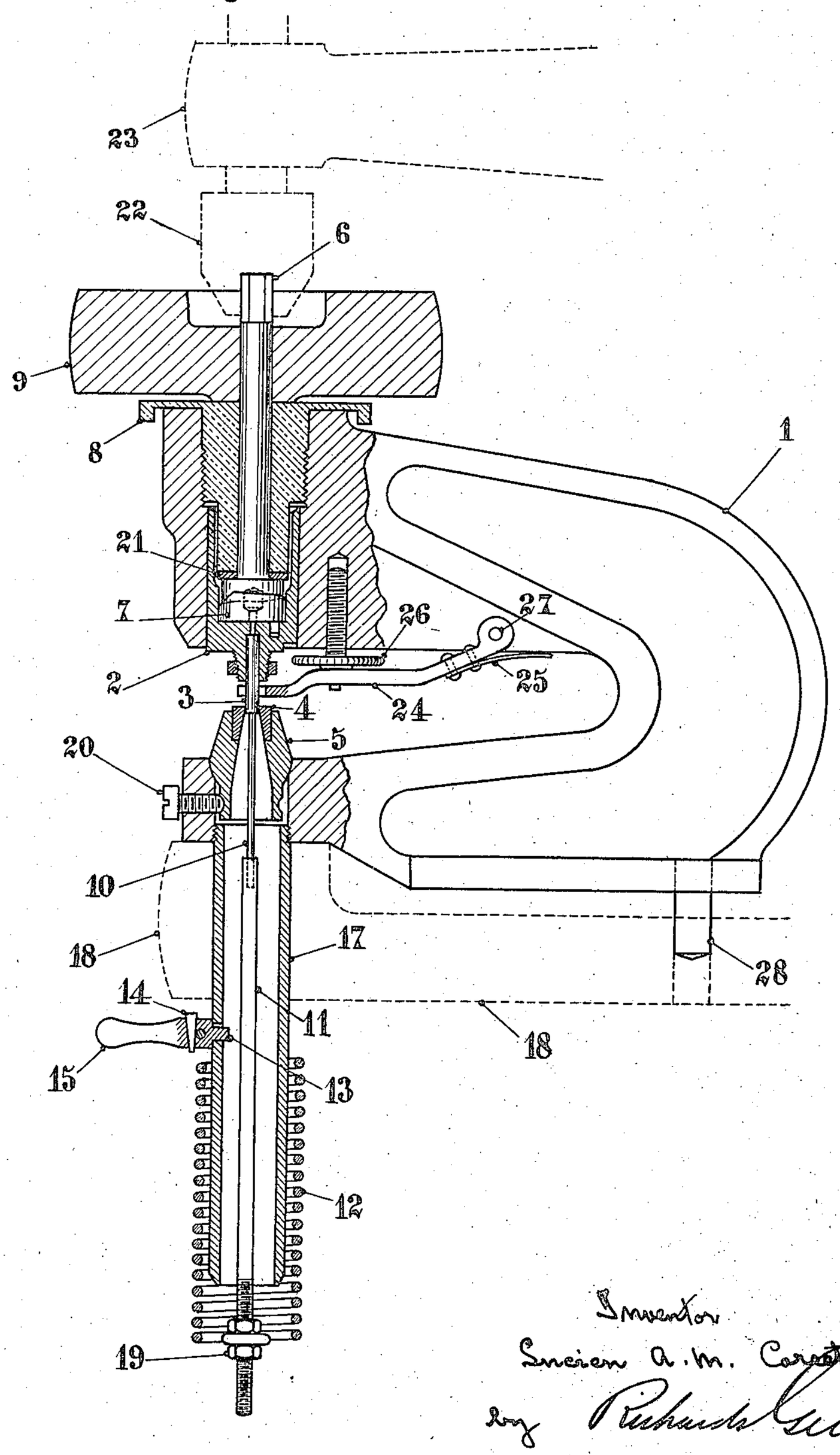
June 19, 1923. 1,459,320

L. A. M. CORSET

PUNCHING MACHINE

Filed Aug. 26, 1921 5 Sheets-Sheet 1

Fig. 1



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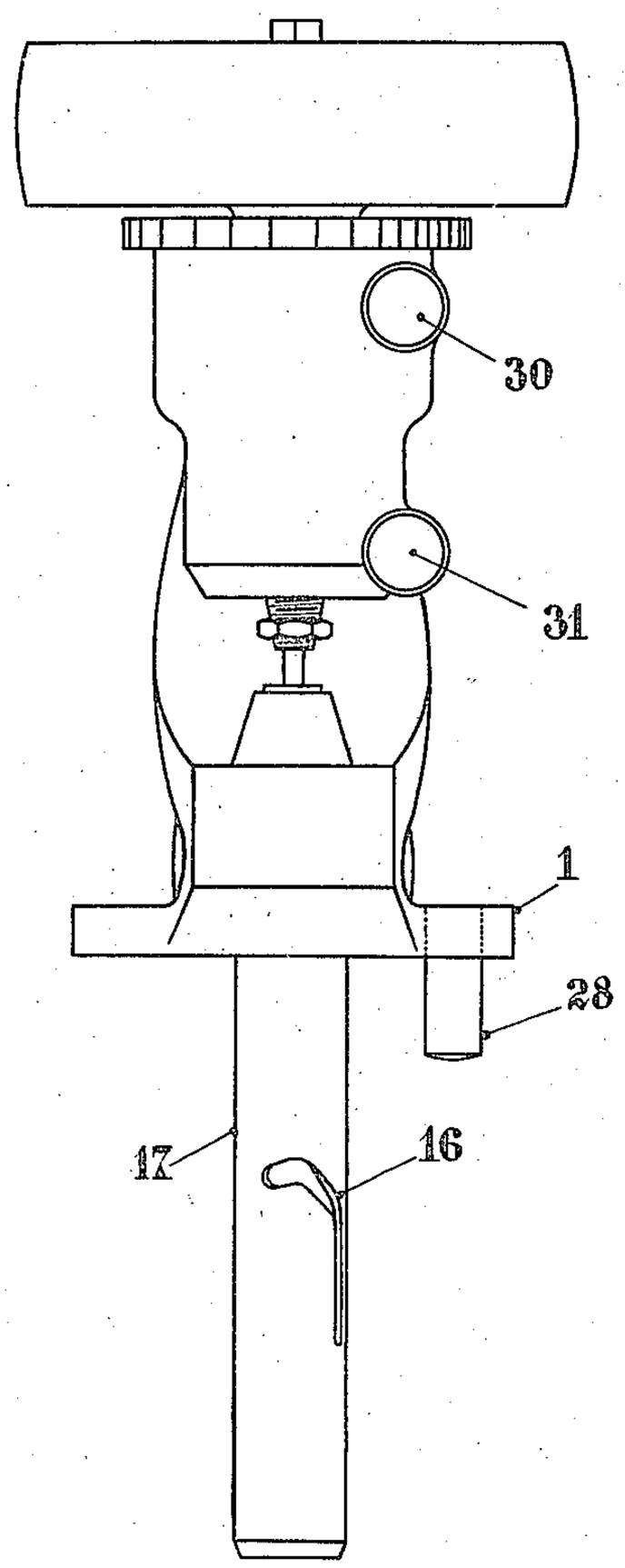
Filed Aug. 26, 1921

5 Sheets-Sheet 2

Fig. 2



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PUNCHING MACHINE

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Fig. 3

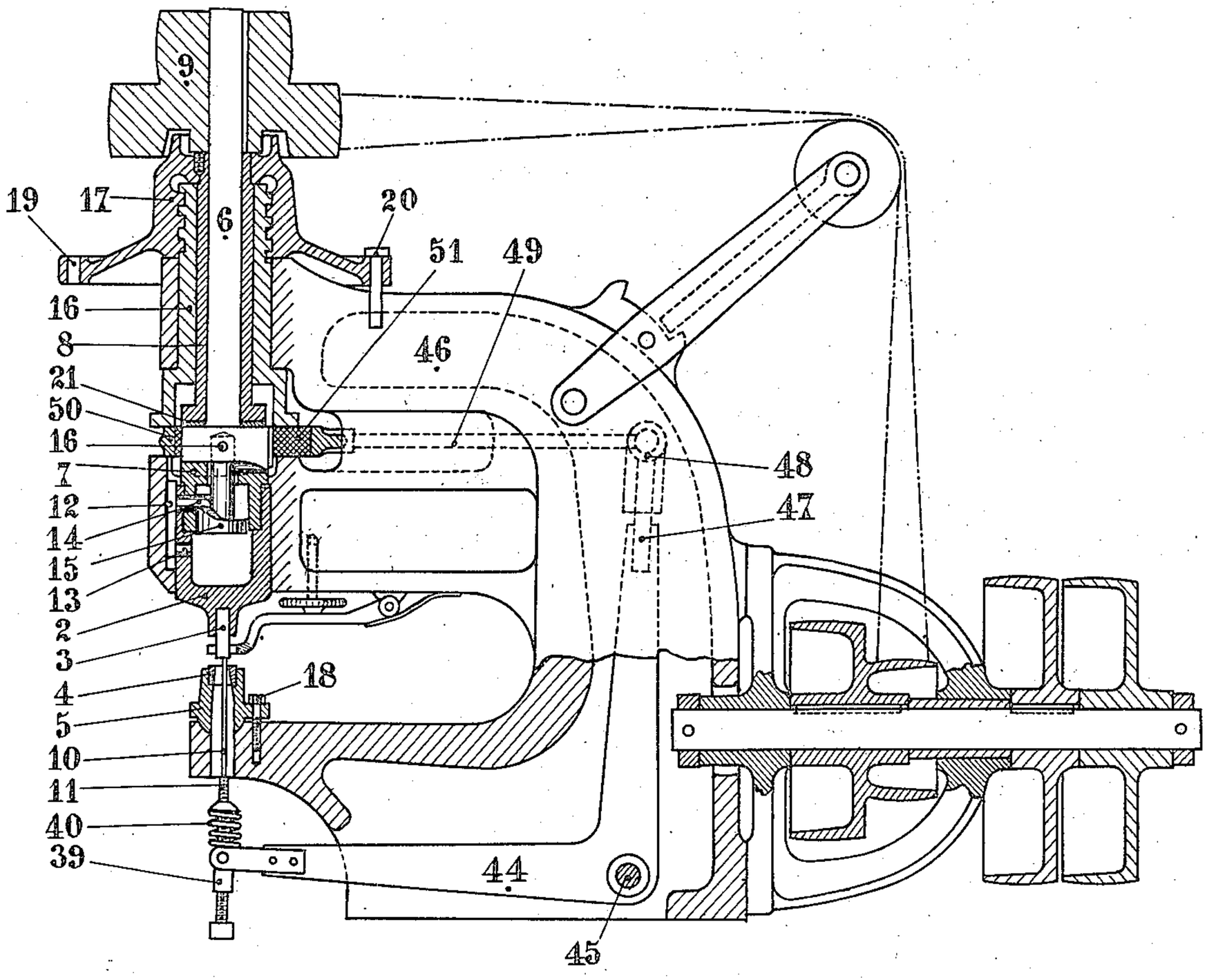
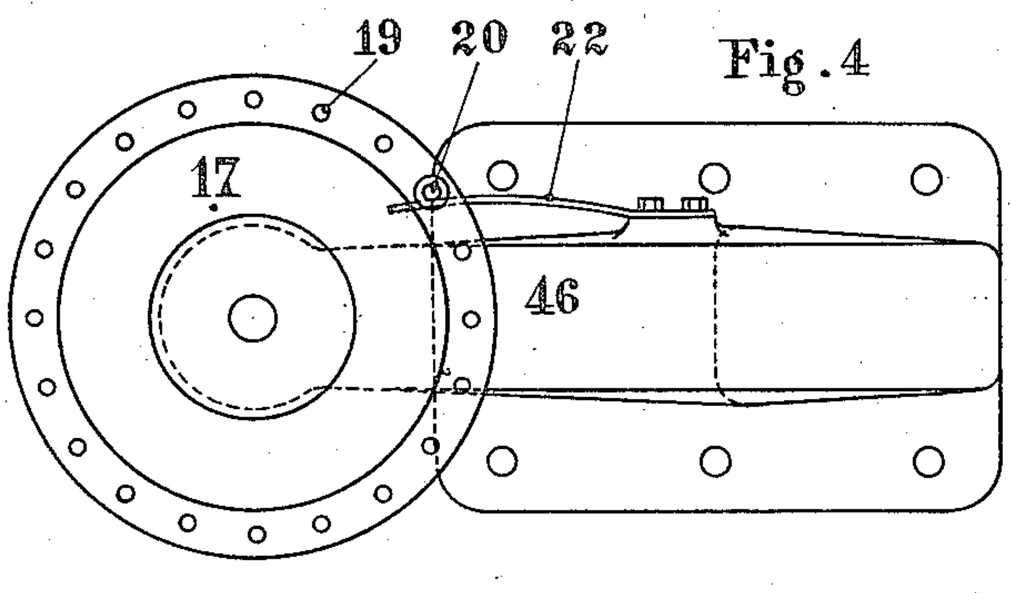


Fig. 4



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5 Sheets-Sheet 4

Fig. 5

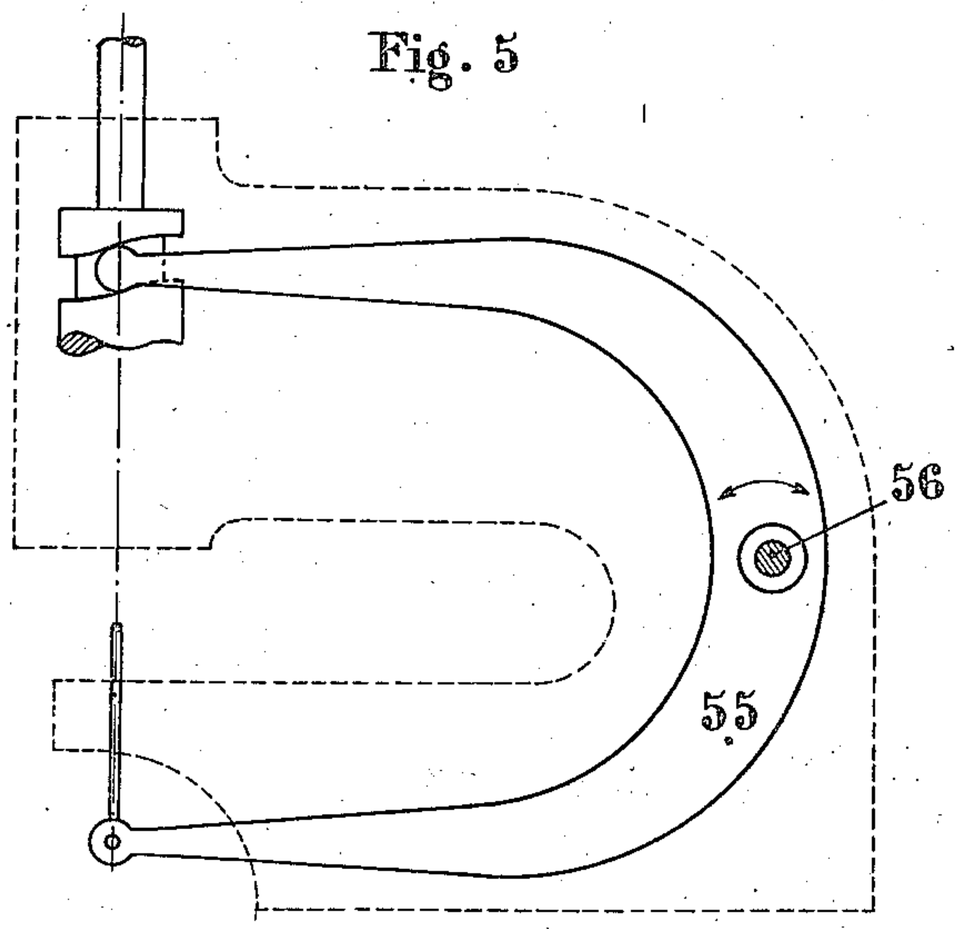
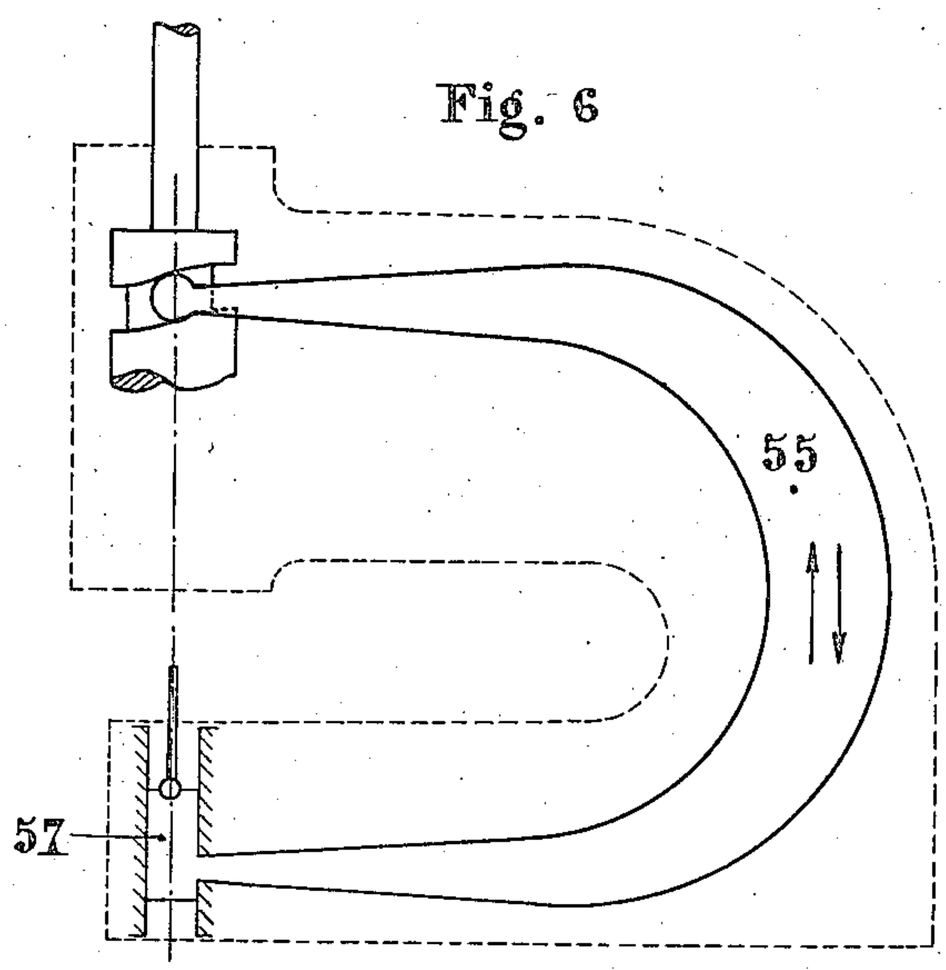


Fig. 6



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1,459,320

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PUNCHING MACHINE

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5 Sheets-Sheet 5

Fig. 7

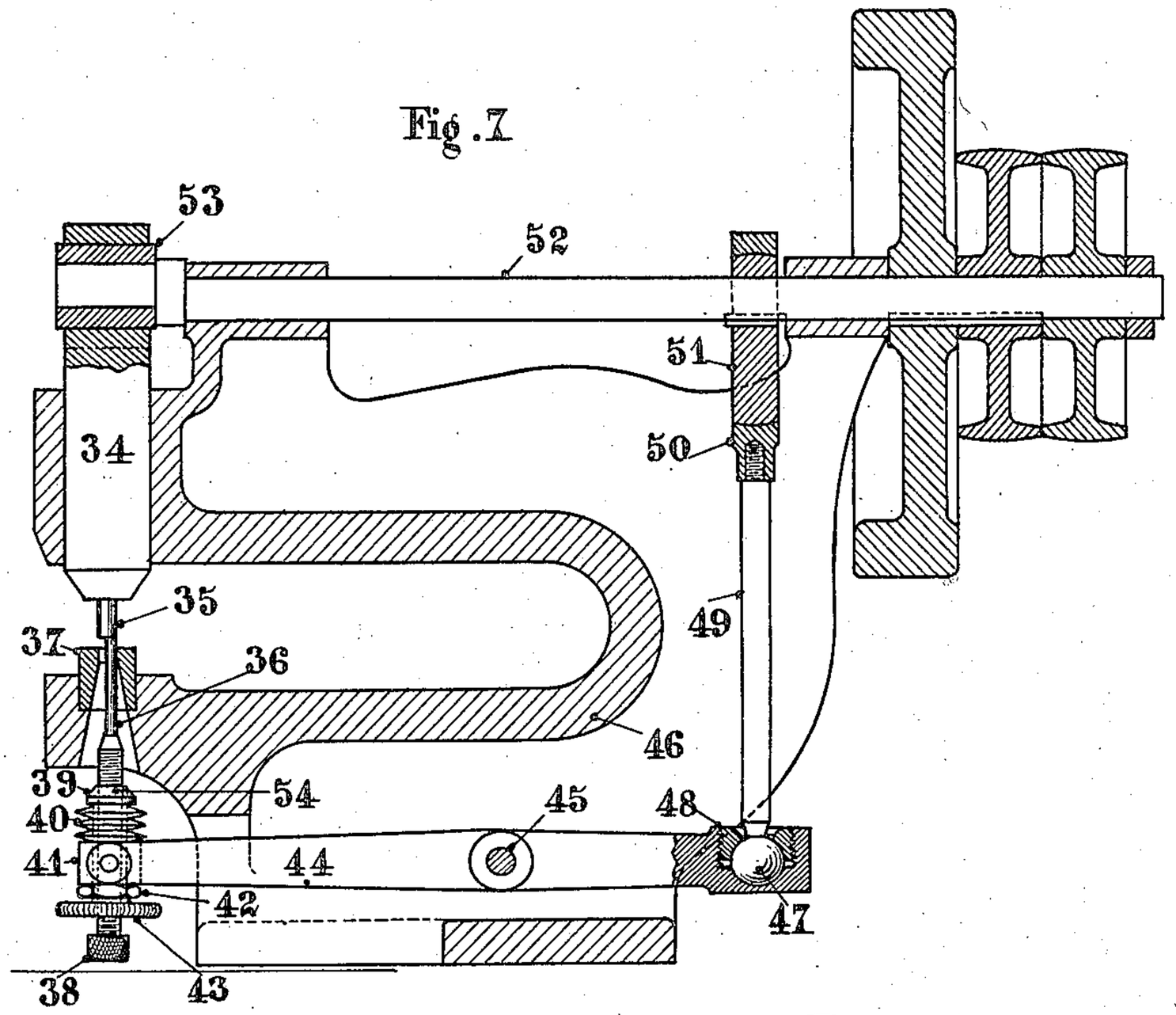


Fig. 10

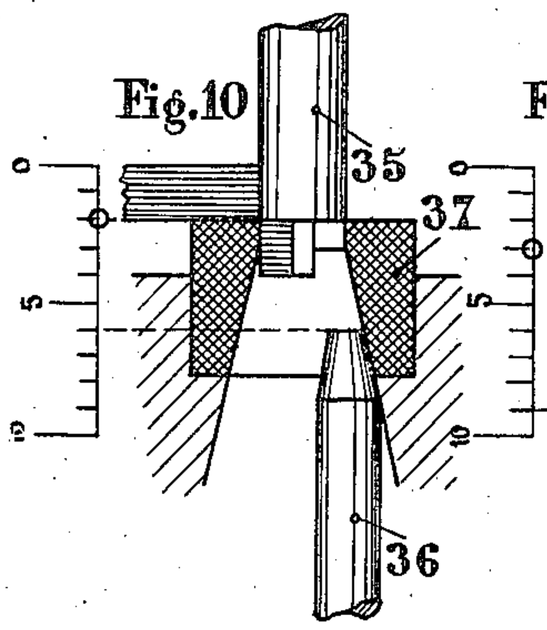


Fig. 11

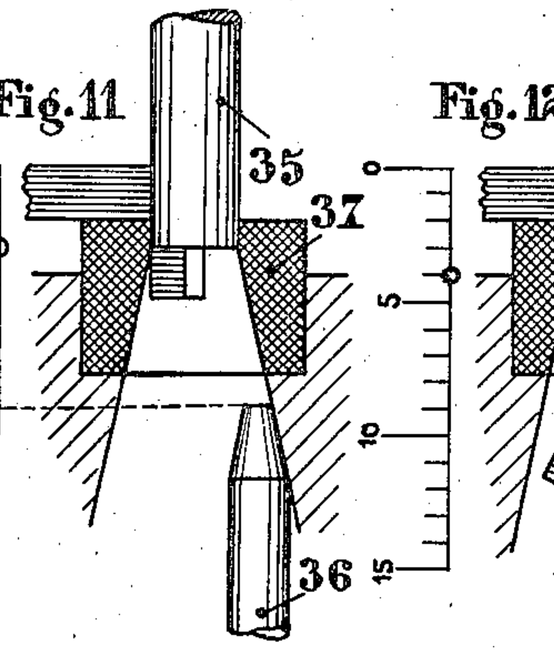


Fig. 12

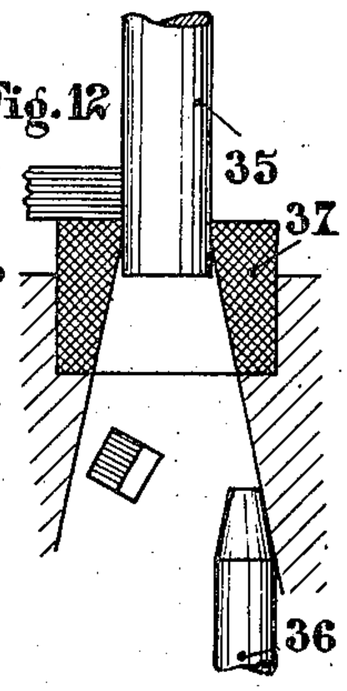


Fig. 8

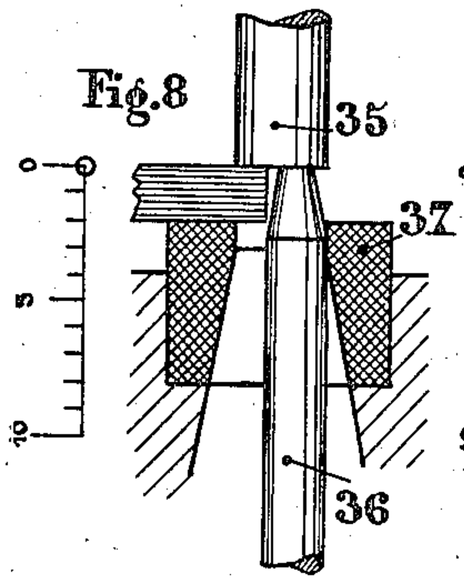
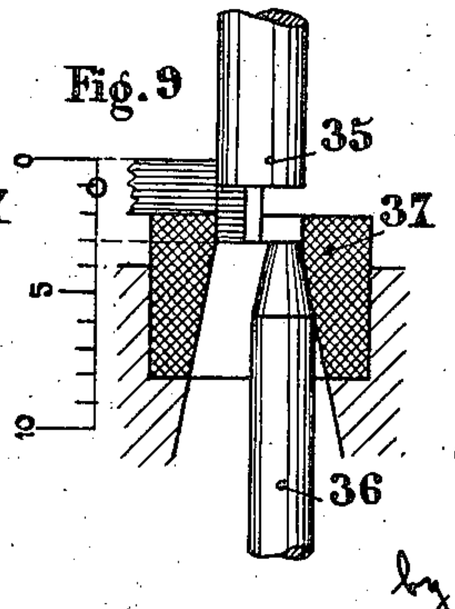


Fig. 9



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Patented June 19, 1923. 1,459,320

UNITED STATES PATENT OFFICE.

LUCIEN ALFRED MAURICE CORSET, OF PARIS, FRANCE.

PUNCHING MACHINE.

Application filed August 26, 1921. Serial No. 495,664.

To all whom it may concern:

Be it known that I, LUCIEN ALFRED MAURICE CORSET, a citizen of the French Republic, and resident of 29 Boulevard de Grenelle, Paris, France, have invented certain new and useful Improvements in Punching Machines, for which I have filed applications in France August 28th, 1920, and May 10th, 1921, of which the following is a specification.

Machines for cutting sheets of metal by successive punching require for the convenient operation of the machines the provision of a device adapted to limit the advance of the sheet after each cutting operation by the punch. The methods generally employed for this purpose are of two categories: A claw punch, said claw punch serving to limit the advance of the sheet; a punch traversed by a central pin for the same purpose.

These two systems present disadvantages. With the former, the sheet if it is desired to cut out an interior portion must be completely rotated on itself, which requires a groove of considerable depth. With the second the pin is very fragile and easily broken.

The present invention has for its subject a machine which obviates all these disadvantages. It is essentially characterized by the fact that the limitation of the advance of the sheet is obtained by means of a pin traversing the die and coming to rest upon the base of the punch. In this manner an excessive depth of groove is obviated and a special adjustable mounting of the die carrier permits the ready mounting of the die and carrier and the accurate centering of the die with respect to the pin.

In the accompanying drawings are shown diagrammatically by way of example various forms of construction according to the invention:—

In the form of construction shown in section in Figure 1 and in front elevation in Figure 2, the machine is principally constructed for the purpose of cutting thin sheets and may be mounted upon the framework of a drilling machine of usual type.

Figures 3 and 4 show a modification in section and plan respectively.

Figures 5 and 6 show two further modifications of the pin operating means shown in Figs. 3 and 4;

Figure 7 shows another form of construction having the general shape of a punching machine. The machines shown in Figs. 3 to 7 inclusive are principally constructed for the purpose of cutting thick plates.

Figs. 8 to 12 inclusive show the various operative positions of the punch and die in the modifications shown in Figs. 3 to 7 inclusive.

The machine shown in Figure 1 comprises:—

(1) A framework 1 having the general shape of the framework of a punching machine.

(2) A vertical shaft 6 supported in the framework 1 by a sleeve screwed into the framework and in which the shaft 6 can rotate with slight friction.

(3) A bearing 7.

(4) A cylindrical slide 2 for supporting the punch in which the bearing 7 is mounted.

(5) A punch 3 adjusted to the diameter of the die 4.

(6) A die 4.

(7) A die carrier 5 adjusted by a spherical casing in the lower part of the framework 1.

(8) A pin 10 continually held in contact with the punch 3 by means of a spring 12 which rests against the pin carrier 11.

As described above, the whole device can be mounted on the framework of a drilling machine shown in dotted lines, the upper arm being shown at 23 and the supporting plate at 18.

In order to mount the device on the machine, the tube 17 is unscrewed from the framework 1 and the punching machine is mounted on the framework of the drilling machine by adjusting the end of the shaft 6 in the member 22 of the drilling machine and the pin 28 is engaged in a hole provided for this purpose in the support 18.

The tube 17 is then slid into the hole of the support 18 and is screwed into the framework 1.

For connecting up the driving mechanism of the drilling machine the shaft 6 and the flywheel 9 which is secured thereto, are ro-

tated and communicate to the punch 3 a to-and-fro movement by means of the following mechanism:

The lower part of shaft 6 is provided with an enlarged head having its upper face engaging with the lower end of a flanged bushing 8 screwed into the framework, a steel washer 21 being interposed between the upper face of the enlarged head and the bushing to reduce the friction.

The lower face of the shaft 6 is formed by two helicoidal surfaces, one of which includes between its sides an angle of about four-fifths of the circumference. The other, whose pitch is much greater than that of the first, includes between its two extremities one-fifth of the circumference.

The development of the corresponding helices may thus be represented by a line rising slowly during four-fifths of its course and then rapidly descending to the same extent during one-fifth of the remainder of its course.

The member 7 is provided with correspondingly inclined surfaces but it is held stationary in the sleeve 2 by a pin.

The tool-carrying sleeve 2 is provided with a key seen from the front in the drawing, which prevents turning movement relatively to the framework 1. On the rotation of the shaft 6 the inclined surfaces at the lower end of the shaft 6 and on the member 7 are caused to run on one another during four-fifths of a revolution and as the shaft 6 is prevented from vertical movement the member 7, the sleeve 2 and the tool 3 are forced downwards in spite of the resistance afforded by the pin 10 under the action of the spring 12.

When the short and rapid inclined surfaces come into operation a reversed movement takes place and the sleeve 2 rises rapidly by reason of the pin 10 which pushes the tool 3 upwards.

This to-and-fro movement is produced by each revolution of the shaft 6.

The plate or sheet to be cut, provided with or without a template, is moved in any desired direction against the punch in movement. When the punch 3 is in its raised position the sheet passes underneath and comes to rest against the pin 10. The punch descending can only engage and cut the edge of the sheet. The burr of the cut sheet is thus effected in the form of a segment of a circle.

If the advancing movement of the sheet is continued in the same direction the same operation is reproduced but the burr of the cut sheet is then effected in the form of an arc as the base of the preceding cut in the sheet will come against the pin 10.

Before commencing the operations various adjustments must be effected.

The punch 3 is secured in the tool carrier 2 by any known method which does not require explanation here. As regards the die 4, it is held firmly in the die carrier 5 permitting of effecting accurate adjustment of the die relatively to the punch 3. For this purpose the die carrier rests on the lower part of the framework by means of a spherical knee joint which permits a slight oscillatory movement, and three screws (only one of which, 20, is shown in the drawings) are for the purpose of obtaining and securing the die in the required position.

According to the thickness of the sheet to be cut and the length of the punch 3, it is necessary to regulate the height of movement of the sleeve. This result may be obtained by means of the sleeve 8; this sleeve being screwed into the framework 1, thus causing the shaft 6 to be depressed and consequently also the tool holder 2; when it is unscrewed the reversed operation is obtained. Screws 30 (Figure 2) screw into the face of the framework and lock the sleeve 8 in the required position. As regards the bolt which presses the lugs of the framework 1 against the other face thereof, this serves to take up the wear of the tool holder and its casing.

The guide 24 is for the purpose of facilitating the separation of the punch from the sheet during its upward movement; it is adjusted upwardly by a milled screw 26 and is supported by a spring 25; a set screw is provided for locking the screw 26.

In the case where the cutting is to be effected along a closed circle in the interior of the surface of the sheet, it is necessary to pass this sheet between the punch 3 and the pin 10, then to effect the punching operation to produce the forward hole for starting.

It is then necessary to separate the punch from the pin so as to be able to pass the sheet and then to raise it still further so as to disengage the circular burr from the die 4.

In order to permit of this separation, the upper end of the spring 12 is attached and held in a handle 15 by means of a pin 14, whilst its other free end is secured upon a pin carrier 11 by nuts 19.

The handle 15 is provided with a projection 13 which engages in a groove of special form 16 (Figure 2) formed in the tube 17.

When the pin 10 is to be lowered for effecting the operation above described it is sufficient to turn the handle 15 towards the right and to cause the projection 13 to slide to the lower end of the groove 16. During this movement the spring 12 is depressed and carries with it the pin carrier 11 and the pin 10 is completely disengaged from the hole in the die, which thus permits the passage of the sheet and its being punched. In the case where the transmission is not sufficient to

insure the supplementary effort required for effecting the punching, a lever inserted into horizontal holes provided in the pulley 9 permits of obtaining the necessary result.

The pin is then raised by means of the handle 15 and engaged in the starting hole in the sheet, and then the drive takes place to continue the cutting, as hereinbefore described.

The pin 10 being sufficiently free to rest at any point of the internal circumference of the movement of the die, it will be seen that the sheet may be pushed in any direction and that it is not necessary to effect a complete rotation of the sheet, but simply a succession of translations in order to cut along an internal closed circuit. It is thus possible with a uniform depth of groove to effect the cutting of sheets of greater size than with machines provided with a claw tool, wherein the sheet must carry out a complete revolution in order to be cut along an internal closed circle.

The simple form of the punch which renders it less fragile when tempered, also permits the employment of harder steel, the formation of a better edge, and this in a more economical manner. This permits moreover of guiding the punch more easily.

Finally, the punch works very freely on the whole of its periphery and not only on one-half of its periphery, as is the case with claw punches wherein a part even of this half breaks away rather than cuts. These are the advantages which are obtained by the employment of the pin 10.

As will be seen hereinafter, these advantages are still further increased when cutting thick plates.

A modification of the machine is illustrated in Figures 3 and 4. This machine differs from the machine hereinbefore described in that certain details thereof render the operation more easy and permit of the machine being used not only for cutting thin sheets but also for cutting thicker sheets. In this modification:—

(*a*) The device for effecting the raising of the punch after the punching operation is modified. It is effected by a cam instead of by means of a spring.

Details of this device are shown in Figure 3. The bearing 7 is placed at the upper end of the tool holder 2 and carries, as described in the machine above, helicoidal surfaces which come into contact with inclined surfaces formed at the base 16 of the shaft 6. Below this base 16 is provided a cam 15 connected to the shaft 6 also formed with a helicoidal surface suitably arranged relatively to the first helicoidal surface and engaging with a pin 14 of the key 12. This key is immovably connected to the tool holder 2 by a projection 13 and the pin 14. The action of the cam 15 on the pin 14 therefore produces an upward movement of the punch.

(*b*) To the sleeve 8 adapted to control the height of the punch 3 is secured an adjustable wheel 17 which, when turned in one direction or the other, causes the sleeve 8 to rise or fall by means of a steep pitched thread on the sleeve and a corresponding thread in the framework or in a nut provided thereon in such a manner that a slight movement of the wheel produces a large movement of the punch.

The wheel 17 may also form a movable nut and the screw thread may be formed on a member 16 secured to the framework, this construction being shown in Figure 3.

(*c*) The locking of the sleeve 8 in its adjusting position is effected by means of a pin 20 engaging with one of a number of vertical holes 19 formed in the wheel 17; this pin engaging against a spring member 22 secured to the framework 46.

For raising the punch through a considerable distance it thus suffices to turn the wheel 17 through less than 360° without removing the pin 20.

The pin 20 may be replaced by a handle.

(*d*) The adjustment of the die carrier is effected by a vertical screw such as 18 acting upon a flange secured to the spherical member 5 which construction is preferred to that shown in Fig. 1 as the screw 18 will be instinctively turned in the proper direction to secure the desired adjustment.

(*e*) Finally, the pin 10 instead of resting constantly against the punch 2 under the action of a spring is separately controlled and is withdrawn from the punch at the moment when the cutting of the iron ring begins. This device facilitates the dropping of this ring and consequently prevents the engagement of the die carrier and the pin with the said ring.

For this purpose there is provided for example around the base of the shaft 6 an eccentric 51 of which the collar 50 is connected by a rod 49 and the member 48 to a bell crank lever 44, 47, hinged at 45 to the framework 46. The arm 44 is provided with a forked end which engages with two longitudinal grooves of the sleeve 39 carrying the pin carrier 11 and to which they are connected by a dashpot 40.

Two modifications of this device are shown in Figures 5 and 6. In these modifications the movement of the pin carrier is controlled by the rotation of a cam with helicoidal surfaces secured to the shaft 6 and transmitted thereto either by a curved lever 55 oscillating on the pivot 56 (Figure 5), or by the member 55 of which the vertical movement is produced by the slider 57 (Figure 6).

In the machine according to the second form of construction, provision has been

made for cutting thick sheets. This machine is stronger than the first machine and is provided with independent mechanism for controlling the pin carrier and, as has been described above, permits of facilitating the removal of the rings of cut material without affecting the pin carrier or the pin.

This machine, shown in Figure 7, is formed by the application to a punching machine of the usual type of suitable mechanism for controlling the pin 36.

The eccentric 51 with a collar 50 is mounted upon the shaft of the machine and transmits an oscillatory movement by means of the bell crank lever arms 47—49, pivoted at 48 to the bell crank lever 44 pivoted at 45, the arm 47 being slidable in a socket in the upper end of lever 44.

The lever 44 is provided at its end with a D 41 to which it is hinged by means of pins. Through this D passes a sleeve 39 secured thereto by a dashpot 40 resting upon the edge 54 of the said sleeve. Into this sleeve is screwed the pin carrier 38. The upward movement of the dashpot is limited by a nut 42.

The apparatus is regulated in such a manner that the vertical movement of the pin 36 is at least double or treble that of the punch 35 and the pin and the punch only come into contact with one another when both are at the upward end of their movement.

The operation of the machine is as follows:—The sheet is advanced under the punch 35 and comes to rest against the pin 36, and the cutting is effected as described in connection with the previous machines, but it may here be remarked that for thick sheets the cut-off portion presses the pin 36 against the inner wall of the die almost preventing any upward movement thereof, so that a very strong spring must be employed having a detrimental action.

According to the device now described, the pin is rapidly disengaged as soon as it has limited the advance of the sheet and the punch has commenced the punching operation so that the disadvantage disappears. At the end of the downward movement (Figure 12) it will be seen that the pin has moved through a distance about three times that of the punch and has moved laterally sufficiently to allow the disengagement of the piece cut from the sheet.

Figures 8, 9, 10, 11 and 12 show various phases of the operation.

The truncated cone indicated at the end of the pin has for its object to prevent the slight wedging which may be produced at the beginning of the cutting of the sheet.

To compensate for the play due to wear the collar of the eccentric 50, as also the member 48, can be tightened up.

For adjusting the pin 36 according to the length and path of the tool 35, the pin carrier 38 is screwed into a sleeve 39 until the end of the pin 36 is in contact with the end of the punch 35 which has been moved to the top of its path.

The lock nut 43 is then tightened and this prevents the pin carrier 38 from turning in the sleeve 39.

The dashpot 40 serves to prevent the rupture of the pin in the case of an obstruction in the hole of the die, preventing the pin from rising. In this case the lever 44 continues the upward movement compressing the dashpot.

The advantages enumerated for the first form of constructon also exist in the second form, which also presents the following advantages.

The punch used is much less fragile than that of tubular or concentric punching machines, which for this reason can only be used with difficulty for cutting thick sheets.

By reason of the arrangement of the pin it may have a much larger diameter for the same advance than in the case of a concentric machine and consequently it can more effectively resist shocks which it receives from the sheet at each advancing movement of the latter.

Finally, in consequence of the separate controlling system of the pin it is not subjected to the considerable lateral efforts due to the wedging of the cut ring during the punching operation.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:—

1. A machine for cutting metal plates by successive punching operations, comprising in combination a cylindrical punch, a die arranged opposite the punch, a pin passing through the opening in the die and adapted to come into contact with the punch during the whole movement or a portion of the movement of the punch, said pin limiting the advance of the sheet during each movement of the punch.

2. The combination with a drilling machine, of a punch, a die arranged opposite the punch, a pin passing through the opening in the die and adapted to come into contact with the punch during the whole movement or a portion of the movement of the punch, said pin limiting the advance of the sheet during each movement of the punch, and means for operating the punch and the pin in snychronism.

3. A machine for cutting metal plates by successive punching operations combined with a drilling machine, comprising in combination with the shaft of the drilling machine, of a cylindrical punch, a die arranged opposite the punch, a pin passing through the opening in the die and adapted to come into contact with the punch during a por-

tion of the movement of the punch, said pin limiting the advance of the sheet during each movement of the punch, means for driving said shaft, means for converting the rotary movement of the shaft into a reciprocating movement of the punch, said means consisting of inclined surfaces formed on the shaft and inclined surfaces connected to the punch, said inclined surfaces co-operating with one another and a spring normally pressing the pin towards the punch.

4. A machine for cutting metal plates by successive punching operations, comprising a tool carrier, a punch carried by said tool carrier, means for preventing rotary movement of the tool carrier, means for producing a reciprocating movement of the tool carrier, a die co-operating with the punch, a pin passing through the die and co-operating with the punch and a spring normally pressing the pin into contact with the punch.

5. A machine for cutting metal plates by successive punching operations, comprising in combination a cylindrical punch, a die arranged opposite the punch, a pin passing through the opening in the die and adapted to come into contact with the punch during a portion of the movement of the punch, said pin limiting the advance of the sheet during each movement of the punch, and means for adjusting the position of the punch, said means consisting of a screwed member and means co-operating with the screwed member for raising and lowering the screwed member relatively to the machine, and a lock nut for locking the screwed member in position.

6. A machine for cutting metal plates by successive punching operations, comprising in combination a cylindrical punch, a die arranged opposite the punch, a pin passing through the opening in the die and adapted to come into contact with the punch during a portion of the movement of the punch, said pin limiting the advance of the sheet during each movement of the punch, a tool carrier for said punch, a screwed sleeve co-operating with said carrier, a handwheel for raising and lowering said sleeve and means for locking the sleeve in position.

7. A machine for cutting metal sheets by successive punching operations, comprising a punch, a shaft for operating said punch, means between the shaft and the punch for converting the rotary movement of the shaft into a vertical movement of the punch, a die co-operating with the punch, a pin passing through the die and a spring normally pressing the pin against the die, said spring being adapted to be lowered so as to withdraw the pin from the punch so as to insert the sheet to be cut.

8. A machine for cutting metal sheets by successive punching operations, comprising a punch, a shaft for operating said punch, means between the shaft and the punch for converting the rotary movement of the shaft into a vertical movement of the punch, a die co-operating with the punch, a pin passing through the die, and means for imparting a larger vertical movement to the pin than to the punch, said means permitting the pin to come into contact with the punch when the punch is at the end of its upper movement.

9. A punching machine comprising a framework, a tool carrier mounted in said framework, a punch carried in said carrier, a shaft rotatably mounted in the framework, means for rotating said shaft, members having helicoidal surfaces disposed between the shaft and the tool carrier, said members being so arranged as to convert the rotary movement of the shaft into a vertical movement of the tool carrier, a die carrier mounted in the framework, a die in said carrier, said die co-operating with the punch, a pin passing through said die and adapted to be brought into contact with the punch, and means for imparting a larger vertical movement to the pin than to the punch, said means permitting the pin to come into contact with the punch when the punch is at the end of its upper movement.

10. A punch machine comprising a framework, a tool carrier mounted in said framework, a punch carried in said carrier, a shaft rotatably mounted in the framework, means for rotating said shaft, members having helicoidal surfaces disposed between the shaft and the tool carrier, said members being so arranged as to convert the rotary movement of the shaft into a vertical movement of the tool carrier, a die carrier mounted in the frame work, a die in said carrier, said die co-operating with the punch, and means for adjustably mounting the die carrier in the framework so that the die may be adjusted relatively to the punch.

11. A punching machine comprising a tool carrier, a punch carried in said carrier, a shaft rotatably mounted, means for rotating said shaft, members having helicoidal surfaces disposed between the shaft and the tool carrier, said members being so arranged as to convert the rotary movement of the shaft into a vertical movement of the tool carrier, a die carrier, a die mounted in said carrier, said die co-operating with the punch, a pin passing through said die and adapted to be brought into contact with the punch, a pin carrier to which the pin is connected, a sleeve into which the pin carrier is screwed, an eccentric on the shaft, and lever mechanism between the eccentric and the sleeve for controlling said sleeve.

LUCIEN ALFRED MAURICE CORSET.