

Aug. 5, 1924.

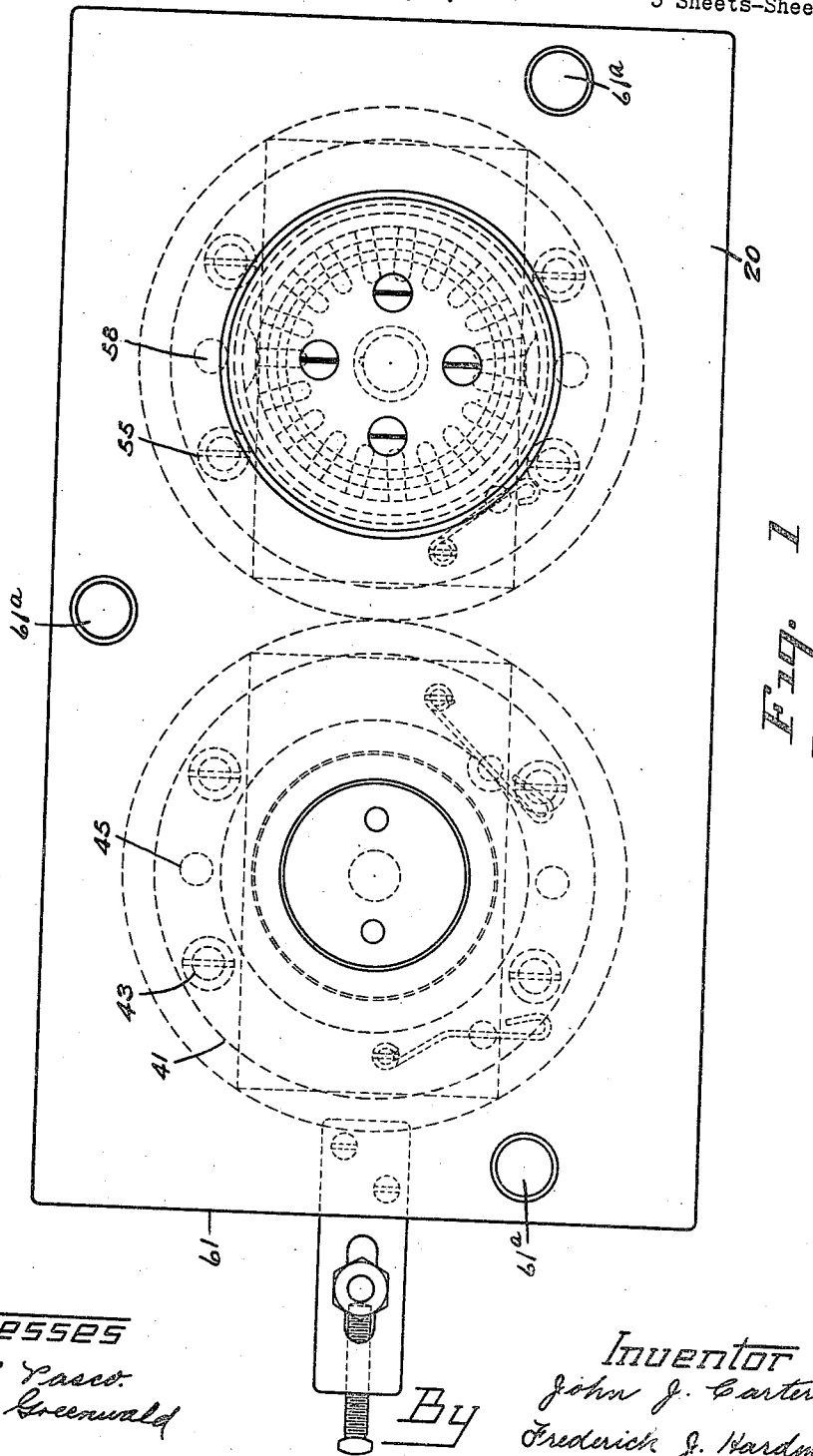
J. J. CARTER

1,504,182

PUNCH AND DIE

Filed May 6, 1922

5 Sheets-Sheet 1



Witnesses
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5 Sheets-Sheet 2

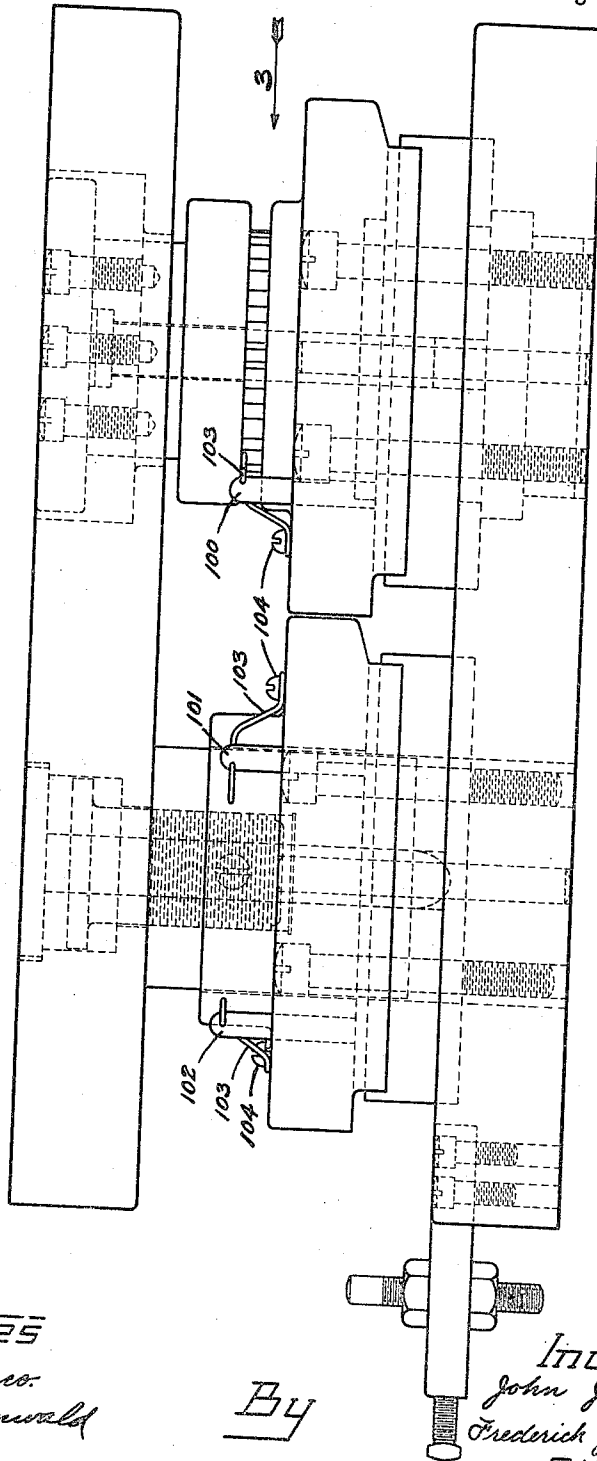


Fig. 2

Witnesses

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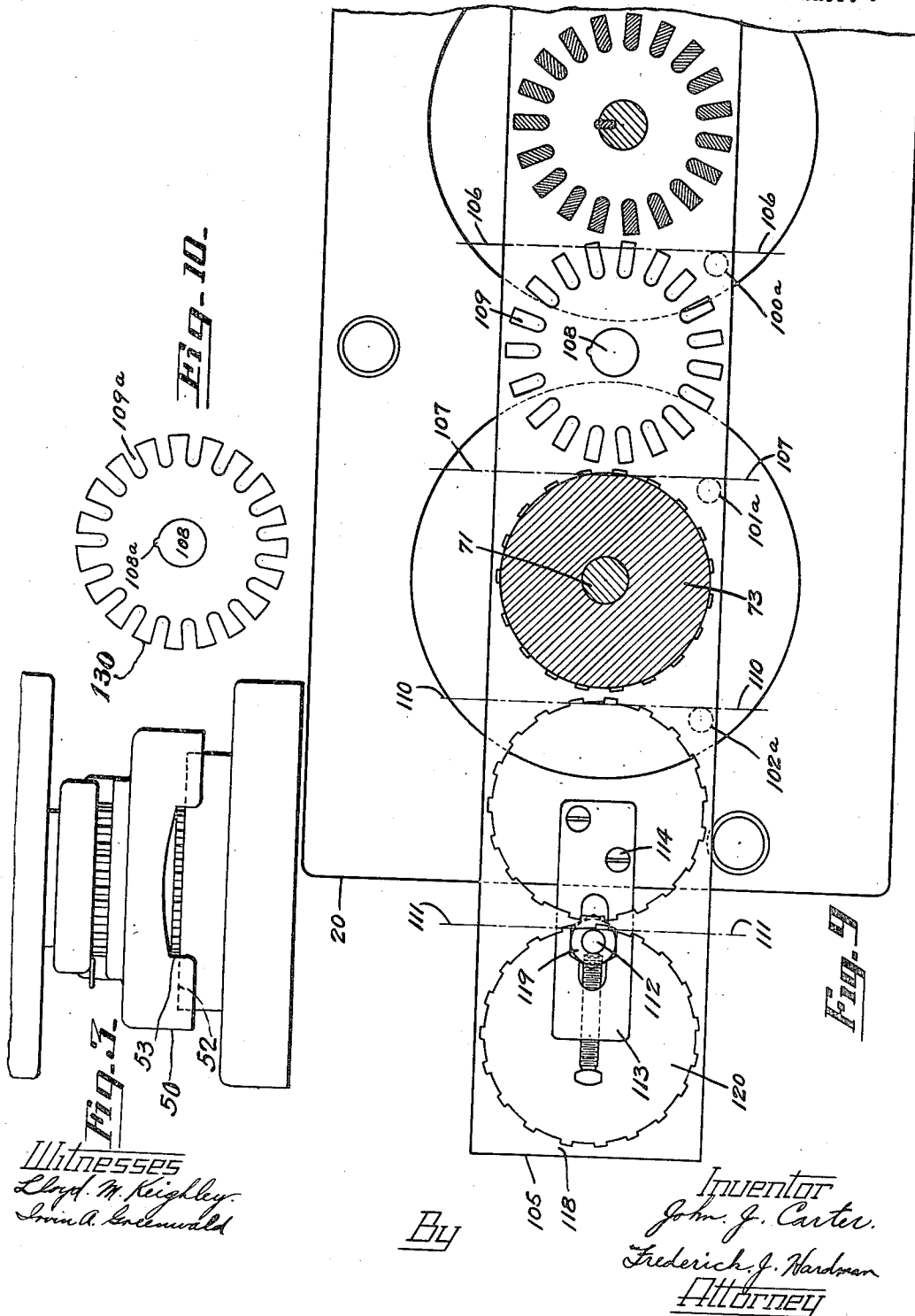
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PUNCH AND DIE

Filed May 6, 1922

5 Sheets-Sheet 3



Witnesses
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5 Sheets-Sheet 4

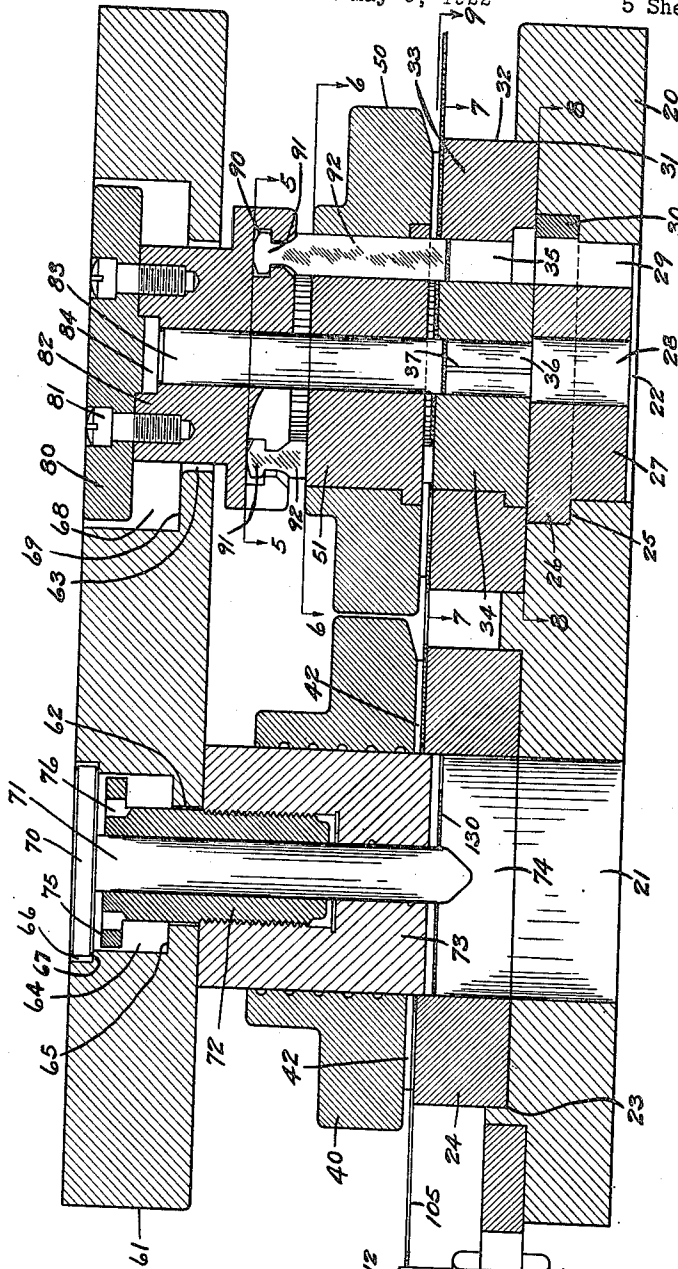


Fig. 4

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5 Sheets-Sheet 5

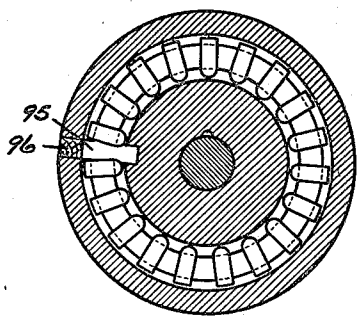


Fig. 5

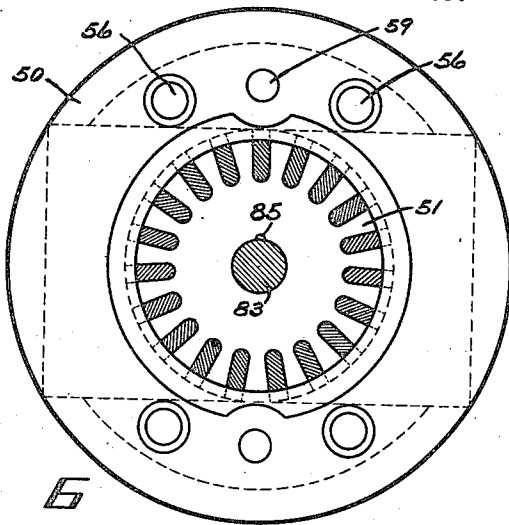


Fig. 6

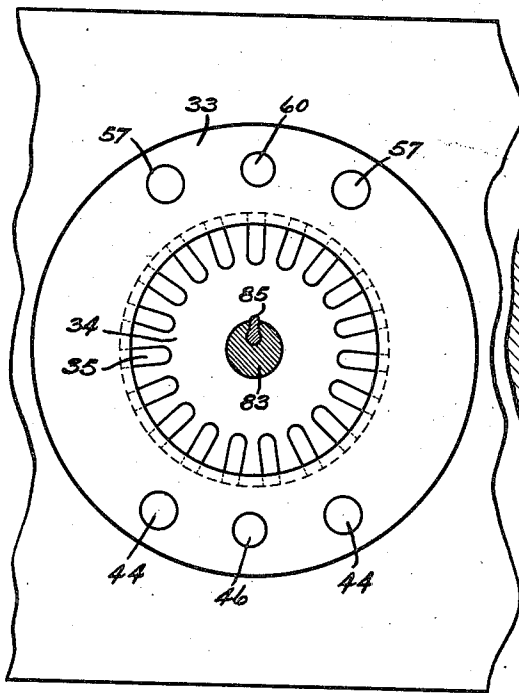


Fig. 7

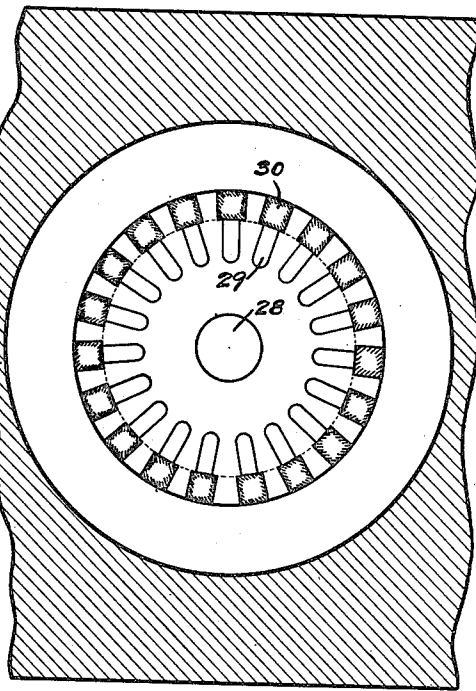


Fig. 8

Witnesses

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UNITED STATES PATENT OFFICE.

JOHN J. CARTER, OF ANDERSON, INDIANA, ASSIGNOR TO GENERAL MOTORS CORPORATION, A CORPORATION OF DELAWARE.

PUNCH AND DIE.

Application filed May 6, 1922. Serial No. 558,921.

To all whom it may concern:

Be it known that I, JOHN J. CARTER, a citizen of the United States of America, residing at Anderson, county of Madison, State of Indiana, have invented certain new and useful Improvements in Punches and Dies, of which the following is a full, clear, and exact description.

This invention relates to punches and dies for forming armature core laminations and has among its objects the provision of a punch and die capable of a large number of operations before regrinding is necessary. A further object is to provide a punch and die for punching out a plurality of holes in flat material in one operation, the individual punches being easily disassembled for grinding or replacement.

A further object of the present invention is to provide a compound punch and die adapted especially for punching out armature laminations in two operations from a strip of sheet material, and to provide means for readily locating the sheet material in proper relation to the punches and dies.

Other and further objects of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

Fig. 1 is a plan view of the punch and die constructed in accordance with the present invention;

Fig. 2 is a side view thereof;

Fig. 3 is an end view looking in the direction of the arrow 3 in Fig. 2;

Fig. 4 is a longitudinal sectional view;

Figs. 5, 6, 7, and 8 are sectional views taken respectively on the lines 5-5, 6-6, 7-7, 8-8, of Fig. 4;

Fig. 9 is a fragmentary sectional view taken on the line 9-9 of Fig. 4, showing the different operations performed upon a strip of flat material; and

Fig. 10 is a plan view of an armature core punching produced by the disclosed embodiment of the invention.

In the drawings 20 designates the die supporting block provided with slug holes 21 and 22. Hole 21 is counterbored at 23 to provide a recess for receiving the die 24.

Hole 22 is counterbored at 25 to provide a recess for receiving the flange 26 of slug block 27 which is provided with a central slug hole 28 and a plurality of radial slug notches 29, each notch being closed up by a block 30.

The hole 22 is also counterbored at 31 to provide a recess for receiving a die 32 which includes an outer member or shell 33 for receiving an inner member 34. Die member 34 is provided with a plurality of annularly located radial notches 35 and with a central hole 36 and a keyway groove 37. Both die members 33 and 34 are ground and when assembled together as shown in Figs. 4 and 7 these members provide a plurality of shearing edges which cooperate respectively with a plurality of punches to be described.

The die 24 supports a punch guide 40 the lower surface of which is provided with a circular recess 41 by means of which the punch 40 is adapted to fit over the die 24. The under surface of punch guide 40 is provided with a groove 42 so that when guide 40 is placed over the die 24, a portion of the under surface of the guide 40 which is wide enough to accommodate the desired width of flat stock to be punched out will be spaced from the upper surface of the die 24. The members 40 and 24 are secured together and upon the base 20 by means of screws 43 which pass through suitable holes in these members.

Die 32 supports punch guide shell 50 carrying punch guide 51. Guide shell 50 is provided with a circular recess 52 and with a groove 53 which corresponds respectively with the recess 41 and the groove 42 provided in the punch guide 40. By means of the circular recess 52, the guide shell 50 is adapted to fit over the die shell 33, and a portion of the under surface of the punch guide shell 50 will be spaced from the upper surface of the die 32 so as to provide for the passage therethrough of a strip of sheet material. The punch guide 51 is provided with a plurality of radially extending notches in alignment with the notches 35 of the die 34 and with a central hole and keyway groove, in alignment with hole 36 and groove 37 provided in the die 34. The punch guide 50 is secured in position upon the outer shell 33 of the die 32 by means of

screws 55 passing through suitable holes 56 and 57 provided in these members, respectively, and having threaded engagement with the base 20. In order to secure accurate location of these members with respect to each other, dowel pins 58 are provided, these pins passing through holes 59 and 60 provided in members 50 and 33 respectively and also extend into holes in the base 20 which are aligned with holes 59 and 60.

Thus far the stationary parts of the punching die have been described. The base 20 is adapted to be secured upon the bed of the punch press by means of screws passing through holes 20^a.

The movable parts of the punching die will now be described. A punch supporting block 61 is adapted to be secured to the plunger of the punch press by means of screws which pass through holes 61^a. Punch block 61 is provided with holes 62 and 63 which are aligned substantially with the slug holes 21 and 22, respectively. Hole 62 is counterbored at 64 to provide a ledge 65, and is counterbored again at 66 to provide a ledge 67. Hole 63 is counterbored at 68 to provide a ledge 69. A disc 70 is adapted to rest upon the ledge 67 and supports a pilot 71 which passes through a central aperture in screw 72 and through a central aperture in punch 73, the latter sliding within a central bore provided in the punch guide 40 which is accurately aligned with the central bore provided in the die 24. It is evident that the lower surface of the punch 73 and the upper surface of the die 24 provides shearing surfaces adapted to punch out a disc of flat material. The screw 72 is provided with a flange 75 carrying a plurality of spanner wrench holes 76. The flange 75 is adapted to rest upon the ledge 65. By adjusting the screw 72 with respect to the punch 73 the movement of the punch 73 with respect to the movement of the punch supporting block 61 may be varied. It will be understood that the upper surface of the punch block 61 will be located against the lower surface of the punch press plunger not shown. Therefore downward movement of the plunger will immediately cause a movement of the pilot 71 but there will be some lost motion before the punch 73 beings to move downwardly. In the upper position of the block 61 the lower surface of the flange 75 will rest upon the ledge 65 and the upper surface of the punch 73 will be spaced from the lower surface of the block 61, therefore before any movement of the punch takes place there must be a movement of the punch press plunger through a distance equal to the distance between the ledge 65 and the lower surface of the flange 75 as shown in Fig. 4. The reason for providing this lost

motion is that it is not necessary to have the punch 73 move through as great a distance as the pilot 71.

The counterbore 68 is adapted to receive a disc 80 attached by screw 81 to a punch head 82 which has a central bore for receiving the punch 83. Punch 83 is provided with a head 84 seated within a counterbored recess provided in the head 82, said punch head 84 being confined between the disc 80 and the head 82. The central bore and counterbored recesses provided in the punch head 82 may be slightly larger in diameter than the outside diameter of punch 83 and its head 84, so as to permit of a slight amount of sidewise movement between the punch 83 and the head 82. Punch 83 is provided with an insert 85 (see Fig. 6) for punching out a keyway or locating notch in an armature lamination. Punch 83 and its insert 85 are adapted to pass respectively through the central bore and groove in the punch guide 51 and through the bore 36 and groove 37 in the die 34.

The punch head 82 is provided with an annular groove 90 which is T-shaped in cross section and adapted to receive the T-shaped heads 91 of a plurality of punches 92. The dimensions of the groove are slightly greater than the dimensions of the T-shaped heads 91 so as to permit a play between the punches 92 and the punch head 82. The punches 92 are adapted to slide through radially extending notches provided in the punch guide 51 and through the notches 35 provided in the die 34. The head 82 is provided with a radially extending notch 95 (see Fig. 5) through which the heads of the punches 92 are introduced one by one. After all the punches have been assembled, as shown in Fig. 5, the notch 95 is closed by plug 96.

In the movement of the block 61 the lower surface of the disc 80 rests against the ledge 69 so that there will be a downward motion of the block 61 through a distance equal to the distance between the ledge 69 and the disc 80 before the punch head 82 will be moved. This lost motion is preferably the same as the lost motion described in connection with punch 73 so that the travel of the punches 83, 92 and 73 is the same, the travel of the pilot 71 being greater.

The part 50 carries a plunger 100, and part 40 carries plungers 101 and 102. These plungers are normally held in the position shown in Fig. 2 by means of springs 103 secured in position by means of screws 104. Referring to Fig. 9, to start a series of punching operations upon a strip of sheet material 105 this material is introduced through the notch 53 in member 50 while the plunger 100 is pressed downwardly so as to intercept the forward edge of the strip 105. This position of the plunger 100 is indicated

by the circle 100^a in Fig. 9, and for the first punch operation the forward edge of the material will be located at the line 106. After the punch press has performed one operation the plunger 100 is released and the plunger 101 is pushed down as shown in Fig. 9. The material 105 is moved to the left as viewed in Fig. 9 until its forward edge strikes against the plunger 101, this portion of the forward edge being indicated by the line 107 in Fig. 9. The central hole 108 and the radial holes 109 have been punched out by the previous punch operation. The second operation of the punch press is performed resulting in similar holes being punched out of the strip 105. The plunger 101 is released and the plunger 102 is pressed and its position is indicated at 102^a in Fig. 9. The strip 105 is moved to the left until its forward edge touches the plunger 102, this portion of the forward edge being indicated at the line 110 in Fig. 9. After the third punch operation begins the hole 108 will be substantially in alignment with the pilot 71. As the punch press plunger descends the pointed end of the pilot 71 will enter the hole 108 before the punch 73 moves downwardly, said punch being maintained in its upper position by virtue of friction between it and the guide 40. Before the punch commences to shear through the strip 105 the pilot 71 will have accurately located the hole 108 and the radial holes 109 so that the hole 108 is concentric with the punch 73. After the third operation has been performed the plungers 101, 102 and 100 are not used again until a new strip of material is introduced into the punch and die. Before the fourth punch operation is performed the strip 105 is moved until its forward edge occupies the position indicated by 111 in Fig. 9, this being the position when the forward edge of the strip touches a stop pin 112 adjustably secured in position upon a bracket 113 attached by screws 114 to the base 20. Set screws 115 assist in holding the stop pin 112 in position while the nuts 116 grip opposite surfaces of the bracket 113. After the fourth punching operation has been performed the operator will lift the left-hand end of the strip 105 so that its forward edge will clear the pin 112. The strip 105 is moved to the left, and, as soon as the narrow portion of material 118 has cleared the pin 112, the strip is permitted to fall into horizontal position as shown in Fig. 4 and the strip is moved to the left until the punched out edge of the material indicated at 119 (surrounding the first hole 120 to be punched out of the strip) touches the pin 112. Thereafter the pin 112 acts as the stop, limiting the travel of the strip 105 during the succeeding punching operations. Between each operation the operator lifts the left end of the strip 105 so that the material between adjacent

punched out holes clears the stop pin, then the material is allowed to drop so that the stop pin will project through the next hole and the movement is continued until the strip strikes the pin inside the hole.

The slugs punched out by the punch 73 become the armature core laminations 130, (see Fig. 10) each lamination having holes 108 and a notch 108^a for purpose of location on and driving by means of an armature shaft. The holes 109 punched out preceding the operation of the punch 73 become the notches 109^a of the armature core lamination.

In order to secure perfect alignment of the punch guide with the dies these members are assembled together before the finishing operations are performed upon the surfaces which are in contact with the punches. For example, the parts 24 and 40 are assembled and then the finishing of the central bore through these members is made while the members are still attached together. The members 20, 33, 34, 50 and 51 are assembled together and the central bore through members 34 and 51 is finished in one operation. Then these members are pressed on a mandrel and the notches for receiving the punches 92 are accurately finished while these members are held in substantially perfect alignment. The punch guides are made sufficiently rigid and the bearing of the guiding surfaces are of sufficient length to obtain perfect alignment at all times between the punches and the dies. The mechanisms for lifting the punches up and down in the guides are not rigidly attached to the punches but provision is made for a little side play. It is apparent therefore that it is not necessary accurately to align the members 20 and 61 in setting up the punch and die in a punch press, that is, the hole 62 need not be in perfect alignment with the hole 21 and the hole 63 with the hole 22. Therefore much time is saved in setting up a punch and die which is constructed in accordance with the present invention. Another object of the present invention is that relatively large punching operations may be performed before regrinding of the dies and punches is necessary. This is believed to be due to the fact that the punches are maintained in substantially perfect alignment with the dies, and the punch press plunger cannot operate to put any side or bending strains into the punches, even though the block 61 should be out of alignment with the block 20. It has been found that the present invention, as compared with a punch and die constructed to perform the same operations and having its punches rigidly connected to the punch press plunger, will perform at least five times as many operations before regrinding is necessary and the liability

of breaking punches has been reduced to the minimum.

While the form of mechanism herein shown and described constitutes a preferred form of embodiment of the invention, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

I claim:

- 10 1. In a punch and die, the combination of the die member having a punch receiving orifice; a punch guide attached to said die and having punch guiding orifice in alignment with the die orifice; a punch
15 guided by the punch guide; and means for moving the punch into and out of the die, said means including a punch block adapted to be attached to a punch press plunger and having a floating connection with the punch.
- 20 2. In a punch and die, the combination with a die member having a central punch receiving orifice and a plurality of radial punch receiving orifices; of a punch guide attached to said die and having corresponding punch
25 guiding orifices in alignment with the orifices of the die; a plurality of punches guided by said punch guide; and a punch head having a floating connection with said punches.
- 30 3. In a punch and die, the combination with a die member having a central punch re-

ceiving orifice and a plurality of radial punch receiving orifices; of a punch guide attached to said die and having corresponding punch
35 guiding orifices in alignment with the orifices of the die; a plurality of punches having T-shaped heads; a punch head having an annular groove of T cross section adapted to receive the T-shaped heads of the
40 punches, the dimensions of the annular groove being such as to permit of side motion of the punch head with respect to the punches; and means adapted to be attached to a punch press plunger for moving the
45 punch head.

4. In a punch and die, the combination with a die member; of a punch cooperating therewith; a pilot for aligning the work with the punch and die; a member supporting the pilot and adapted to be attached to
50 the plunger of a punch press; and means for transmitting motion from the last mentioned member to the punch and including a lost motion connection whereby the travel of the punch will be less than the travel
55 of the pilot.

In testimony whereof I hereto affix my signature.

JOHN J. CARTER.

Witnesses:

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