

S. D. HARTOG.
 PROCESS OF MAKING PUNCHES AND DIES.
 APPLICATION FILED JULY 3, 1912.

1,070,889.

Patented Aug. 19, 1913.

3 SHEETS—SHEET 1.

Fig. 1.

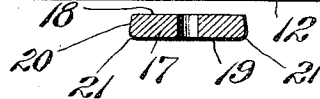
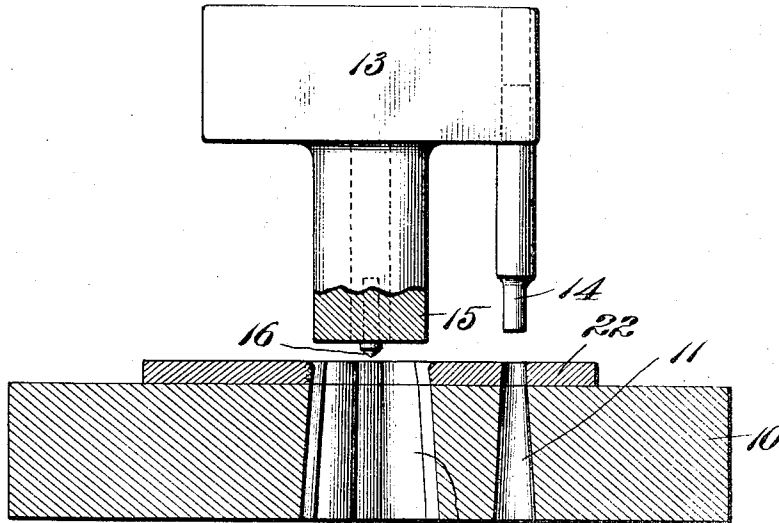


Fig. 4.

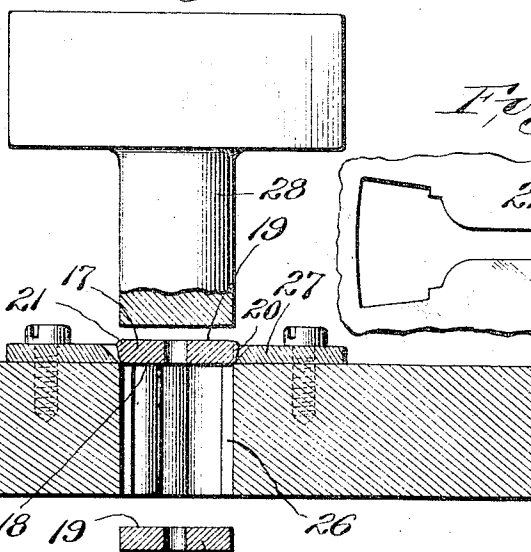


Fig. 5.

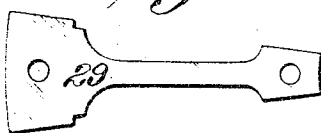
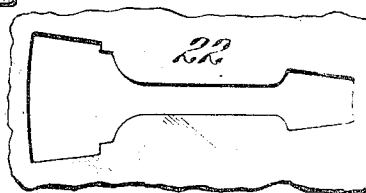


Fig. 3.



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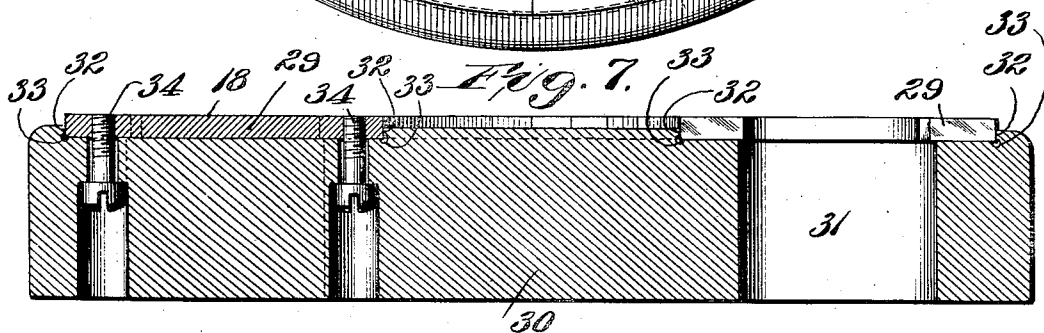
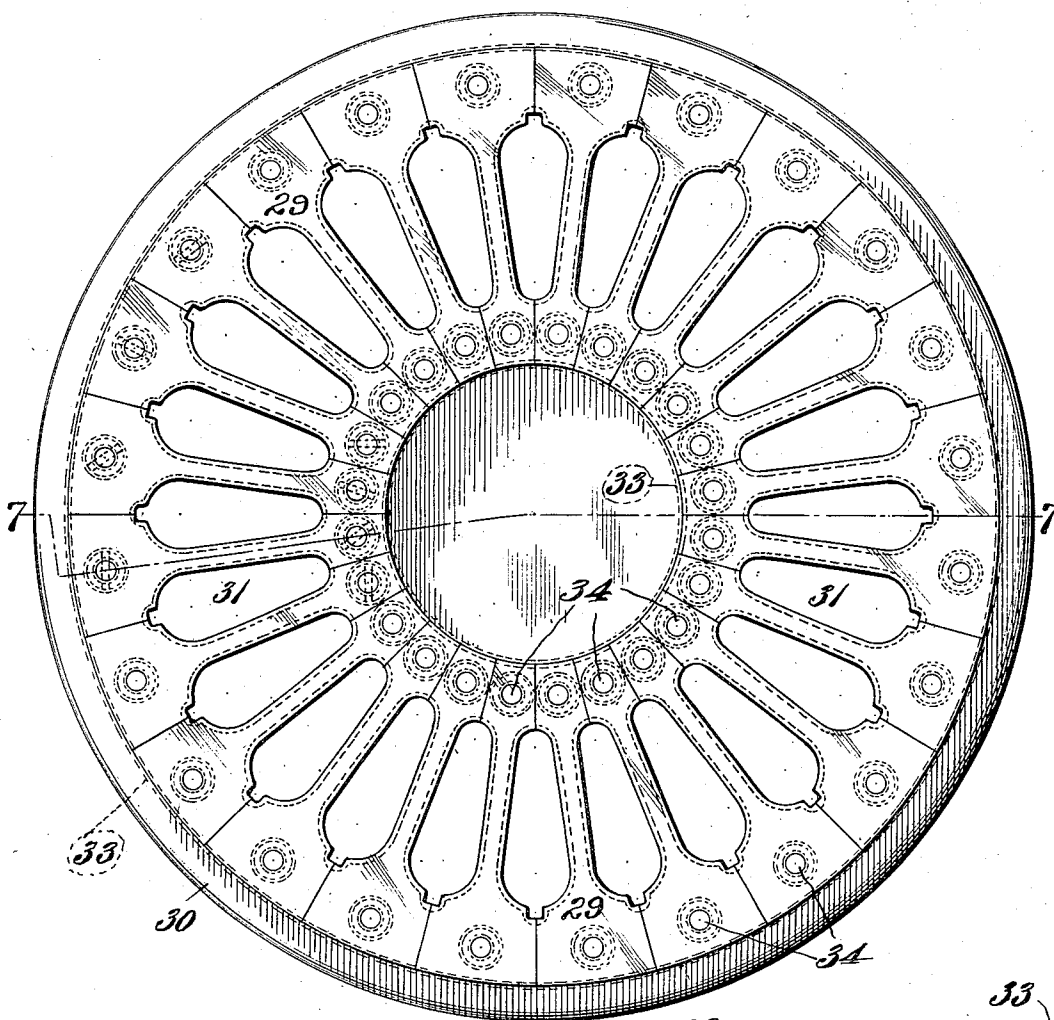
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3 SHEETS—SHEET 2.

Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 8.

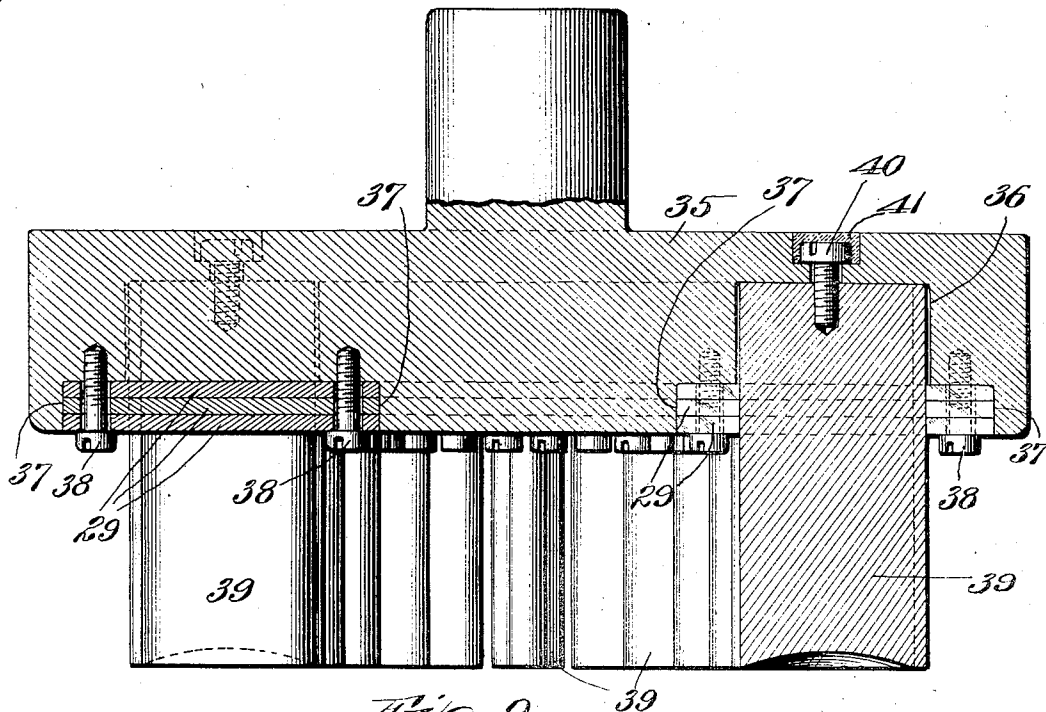
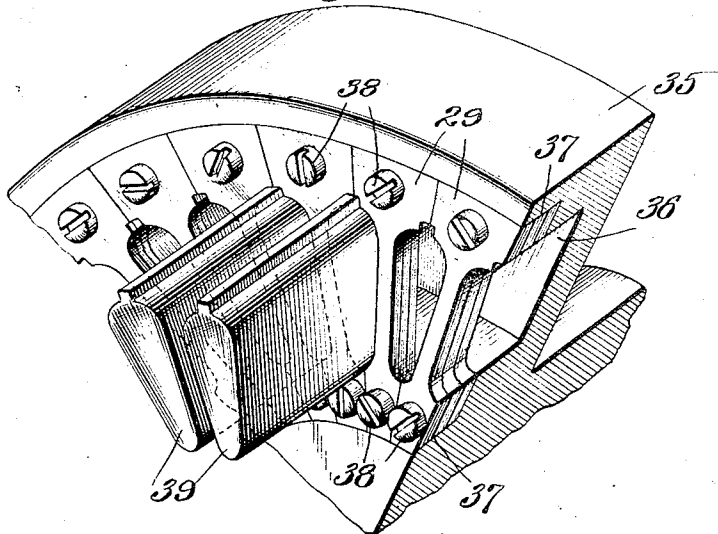


Fig. 9.



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UNITED STATES PATENT OFFICE.

STEPHEN D. HARTOG, OF ST. LOUIS, MISSOURI.

PROCESS OF MAKING PUNCHES AND DIES.

1,070,889.

Specification of Letters Patent.

Patented Aug. 19, 1913.

Application filed July 3, 1912. Serial No. 707,603.

To all whom it may concern:

Be it known that I, STEPHEN D. HARTOG, a citizen of the United States, and residing at St. Louis, in the State of Missouri, have
5 invented certain new and useful Improvements in Processes of Making Punches and Dies, of which the following is a specification.

This invention relates to punches and dies,
10 and more particularly to punches and dies of the multiple or compound type.

In the prior art, more particularly where a multiple punch and die was used for punching thin sheets such as laminæ for
15 electrical machinery, the die was made of a solid block of steel. It is necessary to make such a die of comparatively great depth so as to permit considerable grinding to compensate for wear. It is difficult to make
20 such a die accurate, and it therefore requires for its making exceptionally skilled mechanics. One of the difficulties encountered is due to the fact that in the hardening and tempering of these dies, (having comparatively large bulk) great internal strains are
25 set up during cooling, causing not only cracking, but also warping and deformation. It is therefore necessary to handle the die with extreme care to keep an even temperature. In the use of solid or block dies, especially where thin material is operated upon, the die aperture is liable to become worn or bell-mouthed. This not only results in an enlargement of the punched hole
30 and the formation of burs and therefore inaccuracy of the work, but also results in the punchings becoming wadded, thereby throwing undue stresses on the punches. It is therefore necessary to grind the die down
40 until the bell-mouthed part is ground out, which not only requires excessive grinding at a great cost, but also reduces the life of the die. Moreover when a solid or block die becomes broken or defective, even though
45 this defect extends only to one die aperture, the whole die must be discarded.

A multiple punch as now constructed consists of a punch holder comprising a solid block into which the punches are set. The
50 manufacture of such punches requires careful fitting in order that the punches and the punch holder may be properly alined with respect to the die apertures in the die. As the punches must be comparatively long to
55 permit grinding, the difficulty of fitting is increased in view of the fact that a slight

displacement or error (more especially one of inclination) at the root of the punch, will cause this error to be multiplied at the punch point. It is therefore necessary, after the
60 punches are set in the holder, to properly aline these punches by staking or bending them over. This operation does not only weaken the punches, but positions them at an acute angle to the die, thereby increasing the tendency of the punches to bind in the die.
65

One of the objects of this invention therefore is to develop a process whereby punches and dies may be made with great accuracy,
70 at a small cost, and by unskilled labor.

Another object is to develop a process whereby those parts or elements of the punches and dies which require accuracy in their making, are duplicated to a large extent, and whereby accuracy of duplication and indefinite reproduction of those parts or elements can be obtained at a small cost.
75

Another object is to develop a process whereby those parts or elements are produced by punching operations.
80

Further objects will appear from the detail description taken in connection with the accompanying drawings in which:

Figure 1 is an elevation partly in section
85 of a punch and die illustrating one of the steps of the process, Fig. 2 is a plan of the element as formed in the first step of the process, Fig. 3 is a view of a sheet of material from which the element shown in Fig. 2 has been punched, Fig. 4 is an elevation partly in section of a finishing or shaving punch and die illustrating another step in the process, Fig. 5 is a view of the completed element as formed by the second step,
90 Fig. 6 is a plan view of an assembled die made in accordance with the process forming the subject matter of this invention, Fig. 7 is a section on the line 7—7 Fig. 6, Fig. 8 is a vertical section through an assembled punch made in accordance with the process forming the subject matter of this invention, and Fig. 9 is a perspective view of a part of the punch.
95
100

In accordance with this invention the die
105 face is built up of a series of duplicate and interchangeable plates positioned and located one by the other in assembled relation to form the die apertures of a multiple or compound die. A series of these duplicate
110 plates are also mounted on the punch block or holder in the same coöperative relation as

on the die block, and these plates form together a series of spaced punch receiving apertures in which the punches are positioned and located in assembled relation.

5 The plates for both the punch and die are duplicate and interchangeable, and are so shaped as to form parts of two adjacent apertures. These plates are produced wholly by punching operations, and the process of
10 forming these plates will now be described.

Referring more particularly to Figs. 1 to 5 inclusive, 10 designates a die block of ordinary construction provided with die apertures 11 and 12, which die apertures are
15 given considerable draft as shown. A punch block or holder 13 is provided with punches 14 and 15 cooperating with the die apertures 11 and 12, and the punch 15 is provided with the usual centering pins 16. The punch and
20 die will punch the aperture forming plates or elements 17 from the sheet 22 and also form the screw receiving holes therein.

The aperture forming plates are made of comparatively thick stock (one-eighth of an
25 inch or over). This requires, as is well known to those skilled in the art, that the punch be smaller than the cooperating die aperture, the clearance increasing with the thickness of the stock. The punching 17 as
30 punched from the sheet will therefore have the face 18, which was engaged by the punch, smaller than the face 19, which engaged the die, so that the edge 20 will be inclined instead of square, while the lower
35 corner of the edge will be rounded as shown at 21 Fig. 1 (on an exaggerated scale). The inside edge of the punched sheet will also be inclined and rounded, but reversely from the punching 17. This is a characteristic of
40 punched material, especially where the stock is heavy.

The punching 17 formed as above will be entirely unsuitable in its present state. The face 18 cannot be used either as a punch or
45 as a die face, as the edge 20 tapers in the wrong direction, while the rounded corners 21 will render the face 19 unsuitable for cutting. For the same reason the punched plate 22 is entirely unsuitable in its present state,
50 as neither the face which engaged the die, nor the face which engaged the punch can be used as a cutting face. In accordance with this invention the process is performed in two steps. In the first step the plate or
55 punching is punched roughly to a size large enough to permit trimming. This is indicated in Fig. 2 where the dotted lines show the finished size of the punching. In the second step the rough punching is trimmed
60 to finished size by a finishing punch and die.

The finishing or shaving punch and die consist of a die block 25 having a die aperture 26 and a nest 27, and a punch 28 cooperating with the die aperture 26. This
65 finishing punch and die are formed accu-

70 rately and the clearance between the punch and die is very small, as it is only necessary to take a small shaving from the edge of the punched plate 17. In practice the size of the punch and die are practically the same and only very slightly smaller than the size of the face 18. In the punching operation the punching 17 is positioned in the nest with the face 18 engaging the die. The
75 product resulting from this operation will be the finished plate 29 having its edges practically square as shown in Fig. 4. It will therefore be seen that in accordance with this process a series of duplicate interchangeable plates 29 are formed wholly by
80 punching operations. These plates are accurately finished to size with their edges square to form a good cutting edge, and are so shaped that each plate will form a half of two adjacent apertures as hereinafter described. It will be noted that the plates so
85 formed are those parts punched out from the sheet.

The process of assembling a die will now be described. Referring to Figs. 6 and 7,
90 30 designates a die block or support. This die block has formed therein apertures 31 which may be cast in the block. A channel is cut in the upper face of the die to provide positioning shoulders 32, which shoulders are undercut as shown at 33. The width of
95 this channel as measured between the shoulders is made accurately to correspond to the length of the plates 29. The plates are positioned in the channel formed in the die
100 block with the side edges of these plates engaging one another and with the ends of the plates engaging the shoulders 32. The plates are secured in position by means of screws 34 passing through the die block and tapped
105 into the plates. The holes in the die block receiving the screws are of larger diameter than the screws, and the apertures 31 are larger than the die apertures formed by the plates. The die thus formed will have its
110 die face made up of a series of mutually engaging plates positioned one by the other in cooperative relation to form a series of spaced die apertures.

Referring now to Figs. 8 and 9, 35 designates a punch block or holder which is
115 formed with an annular recess 36 and with a larger annular recess forming shoulders 37. A series of the plates 29 are mounted in the annular recess and are secured in position
120 by means of screws 38 passing through the apertures in the plates 29. The screws are of slightly smaller diameter than the apertures in the plates. The plates 29 will thus be positioned by their mutual engagement
125 with one another and by the engagement of the ends of the plates with the shoulders 37, and these plates form together a plurality of apertures identical with the die apertures and spaced in identically the same relation. 130

These apertures receive the punches 39 as shown in the drawings. The channel 36 is slightly wider than the punches as shown in Fig. 8, and the punches are therefore located and positioned wholly by the aperture forming plates. Preferably these plates are mounted in layers as shown so as to provide more extended bearings for the punches. After the punches are in position they are secured as positioned by means of screws 40 extending through enlarged countersunk holes in the punch block and tapped into the punches, and the countersunk holes are then filled up with babbitt 41. This method of securing the punches, by only filling the countersunk fastener receiving holes, is preferable over the old method in which the punches were secured by a large mass of babbitt, as the shrinking of a large mass will often displace the punches.

It will be noted that the face 18 of the punching which originally engaged the roughing punch, and is therefore the more accurate and clean cut face, forms the upper face of the die and the lower face on the punch block.

It will thus be seen that the invention accomplishes its objects. The plates forming the die face as well as the means for accurately locating and positioning the punches, are duplicate and interchangeable. They therefore require for their manufacture only the accurate production of the master punches and dies, and one set of these master punches and dies can be used for manufacturing an indefinite number of plates and therefore an indefinite number of punches and dies. The plates are small and comparatively thin; the required heating and cooling for hardening and tempering will therefore not cause distortion and cracking as is the case in the manufacture of block dies. This invention therefore results in a process which has a low cost of production, a low cost of apparatus installation and maintenance, and has the capacity of accurate duplication and indefinite reproduction.

In accordance with this process the edges of a series of aperture forming plates are

formed in duplicate by punching, so that each plate will have a die-cut contour providing duplicate, interchangeable edge locating means, and the plates so formed are assembled in mutual contour engagement on a holder or block to form in mutual assembly a plurality of accurately spaced punch-receiving apertures. The expression "punch-receiving apertures" as used in the specification and claims is used in its broad sense, so as to include the die-apertures formed by the plates on the die block and which receive the punches in the operation of punching, as well as the apertures formed by the plates on the punch holder and which receive and permanently position the punches thereon.

While this invention is particularly adapted for manufacturing multiple or compound punches and dies for producing laminæ of electrical machinery, it is by no means limited to this specific use, but its application may be general. It is further obvious that various changes may be made in the details of the process, within the scope of the claims, without departing from the spirit of this invention, and it is therefore to be understood that this invention is not to be limited to the specific details described and shown.

Having thus described the invention what is claimed is:

The process of making multiple punches and dies which comprises forming the edges of a series of aperture forming plates in duplicate by punching so that each plate will have a die-cut contour providing duplicate interchangeable edge locating means, and assembling the plates so formed in mutual contour engagement on a holder or block to form in mutual assembly a plurality of accurately spaced punch receiving apertures.

In testimony whereof I affix my signature in presence of two witnesses.

STEPHEN D. HARTOG.

Witnesses:

A. F. BEYER,
FRANKLIN MILLER.