

(No Model.)

4 Sheets—Sheet 1.

G. F. CHAMPNEY.
APPARATUS FOR MAKING DIES.

No. 499,821.

Patented June 20, 1893.

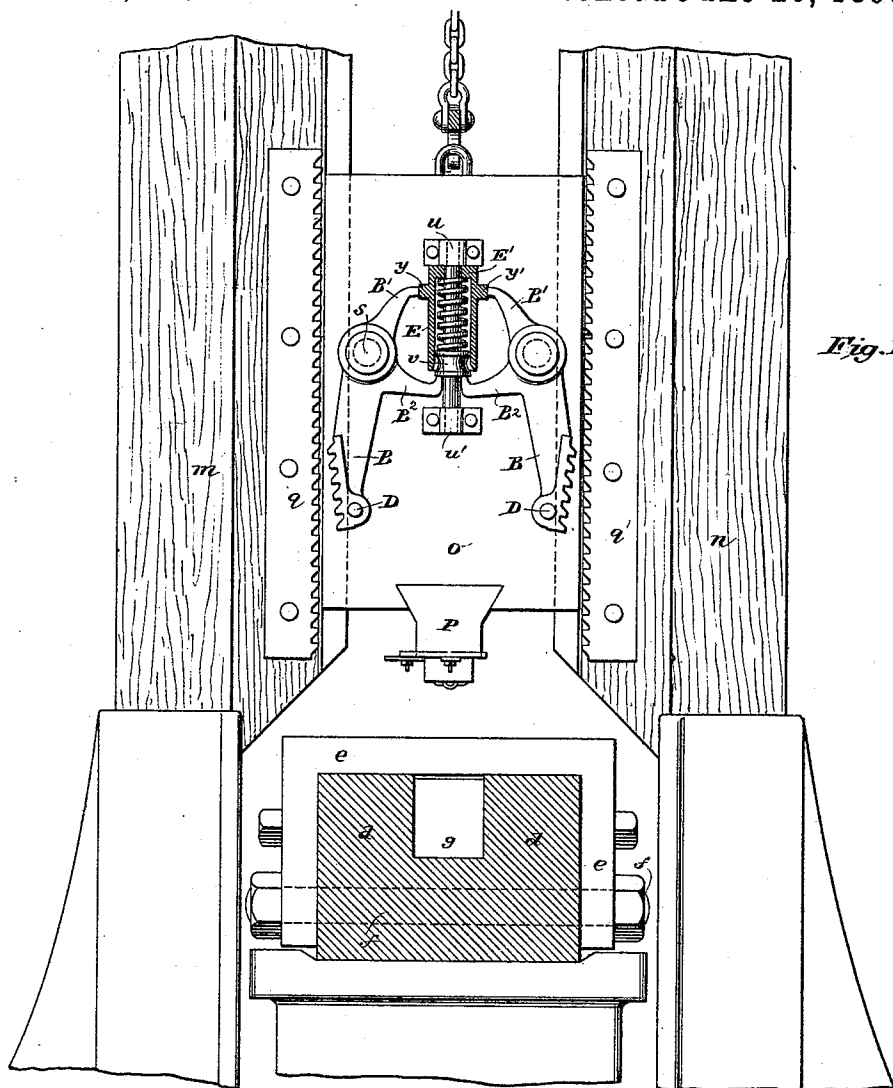


Fig. 1.

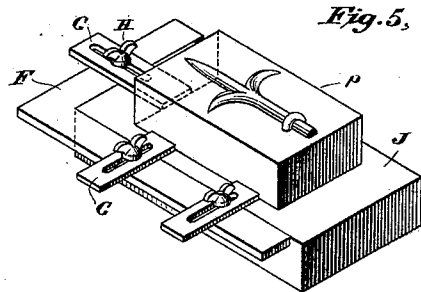


Fig. 5.

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Philip Phelps & Honey

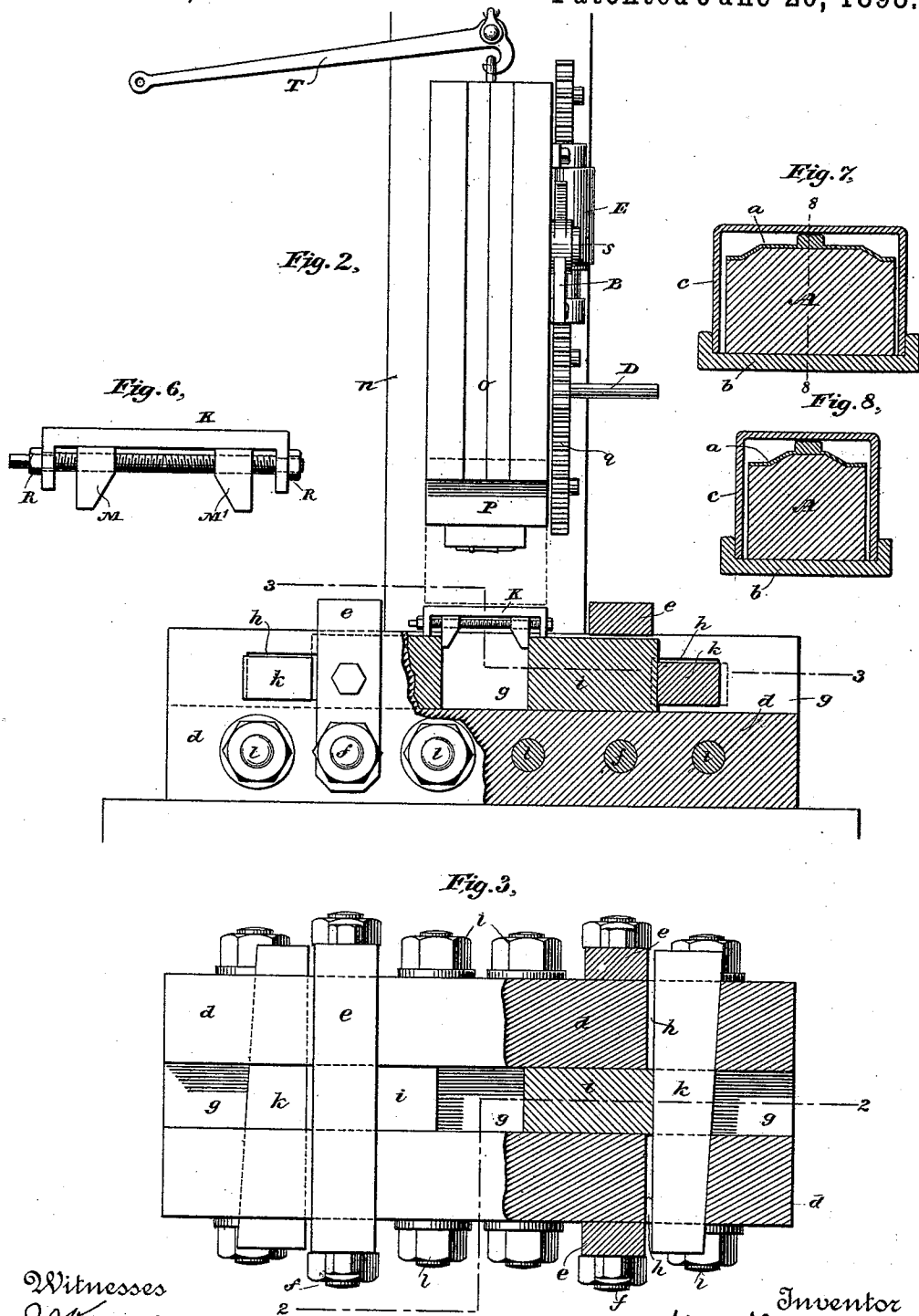
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4 Sheets—Sheet 2.

G. F. CHAMPNEY.
APPARATUS FOR MAKING DIES.

No. 499,821.

Patented June 20, 1893.



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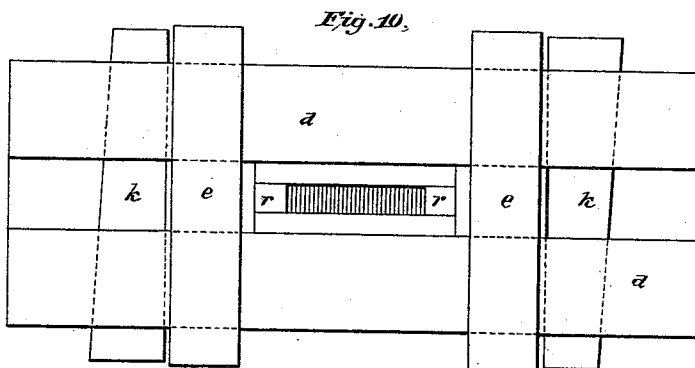
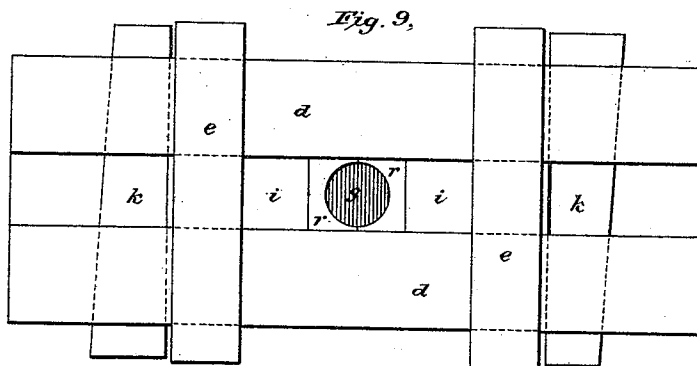
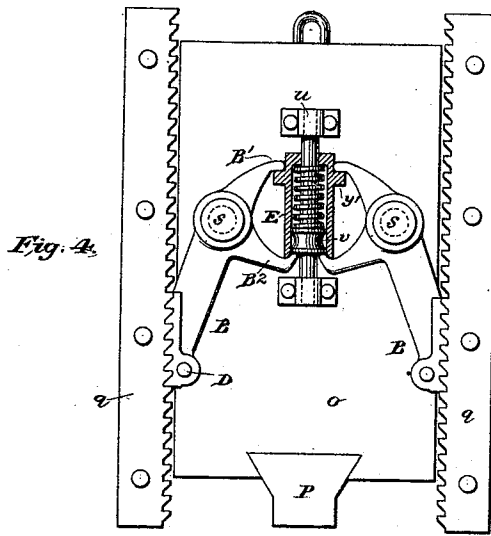
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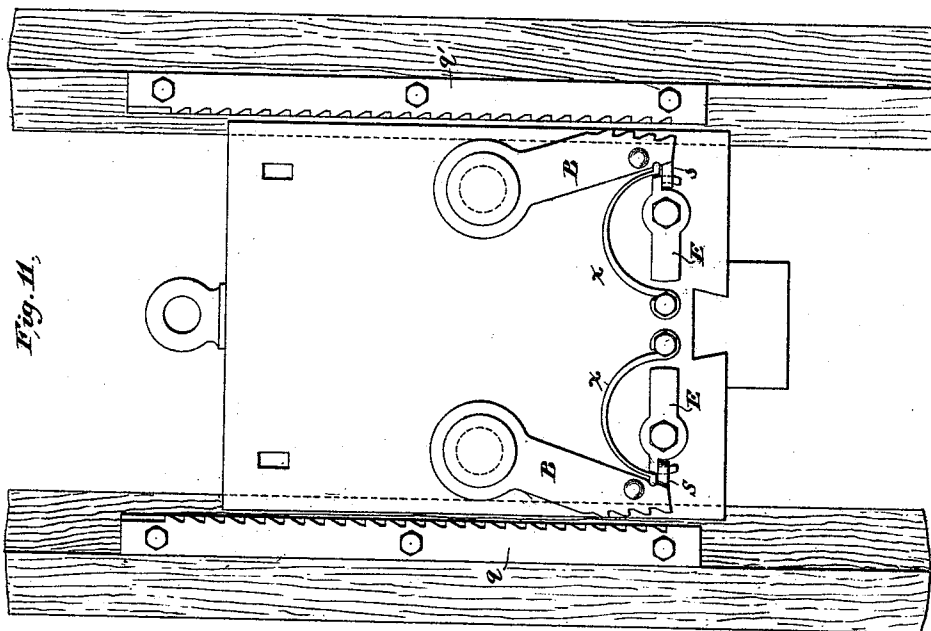
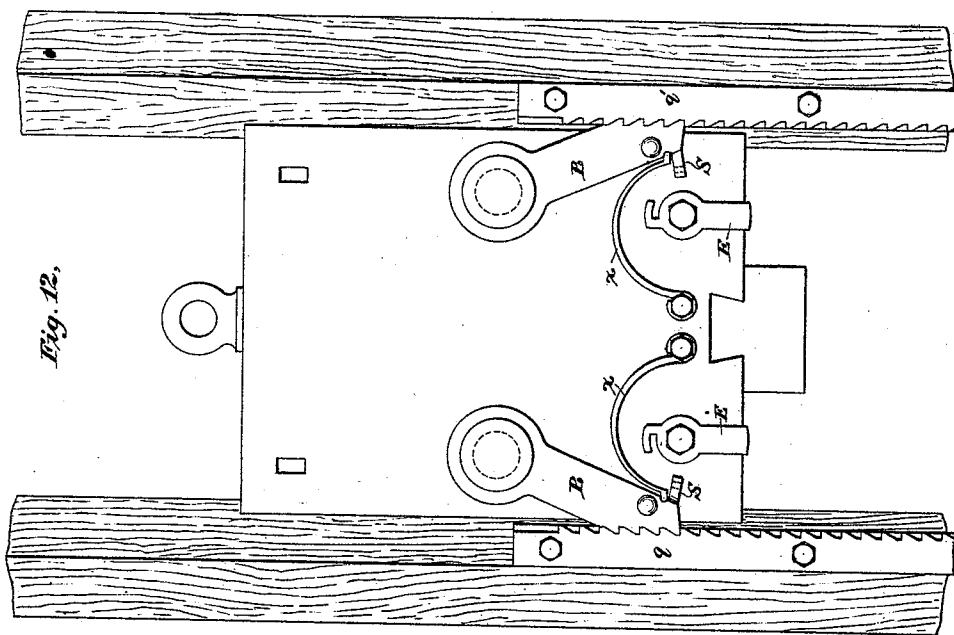
(No Model.)

4 Sheets—Sheet 4.

G. F. CHAMPNEY.
APPARATUS FOR MAKING DIES.

No. 499,821.

Patented June 20, 1893.



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UNITED STATES PATENT OFFICE.

GEORGE F. CHAMPNEY, OF TAUNTON, MASSACHUSETTS, ASSIGNOR OF
THREE-FIFTHS TO ALFRED H. HARRISON, OF LONDON, ENGLAND.

APPARATUS FOR MAKING DIES.

SPECIFICATION forming part of Letters Patent No. 499,821, dated June 20, 1893.

Application filed December 11, 1889. Serial No. 333,357. (No model.) Patented in France June 11, 1888, No. 191,144; in Germany September 21, 1888, No. 39,069, and in England February 18, 1889, No. 2,822.

To all whom it may concern:

Be it known that I, GEORGE F. CHAMPNEY, a citizen of the United States, residing at Taunton, Bristol county, State of Massachusetts, have invented certain new and useful Improvements in Apparatus for Making Dies, (portions of the said improvements having been patented in the following countries: France, dated June 11, 1888, No. 191,144; Germany, dated September 21, 1888, No. 39,069, and Great Britain, dated February 18, 1889, No. 2,822,) fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

My invention relates to the process of die making in which a die block is formed into a die by the impact of a patrice driven into it by a blow from a powerful hammer, and consists in part of improvements upon the methods of practicing that art and in part in specially designed apparatus for use therein. In this art as I prefer to practice it, a die block preferably of steel, or iron faced with steel, is heated, being preferably incased or protected during the process of heating so that oxidation of its surface is prevented, and while hot is placed under the hammer carrying the patrice and there secured in a proper swage or die holder. The hammer is then caused to descend with sufficient velocity and momentum to drive the patrice into the die block. I have found that in practicing this process it is of importance to make the impression in the die block by a single blow from the hammer. If the hammer is permitted to strike the die block, rebound, and then fall back, striking the die block a second blow, it will frequently happen that the impressions produced by the two blows are not exactly coincident with each other, so that the die may lose the distinctness which it had prior to the second blow, or the two impressions may be so confused as to render the die worthless. I propose to overcome this liability to destruction of the die by arresting the descent of the hammer after its rebound, and my present invention consists in part in improvements in apparatus for practicing such improvement. In practicing this art I have found it a matter of difficulty to attach and adjust the patrice to the hammer. Many patrices must of course be used and it is therefore desirable that the means of attachment to the hammer should be such that one patrice can be readily replaced by another. Moreover, as the patrices are frequently of different sizes, the means used for attaching them should be such that a variation in the size of the patrice will not interfere with its proper attachment and adjustment. I also find it desirable that the fastening of the patrice to the hammer should be such that its connection may be broken by the shock of the impact with the die block and the patrice left resting on or in the die block as the hammer recedes after the blow. In view of these several considerations I have found it best to attach the patrice by cement to the plain face of the hammer. When so attached one patrice can of course be readily substituted for another on the hammer. Moreover the cement may, if preferred, be of such a character as to be broken by the shock of the blow upon the die block and the patrice left upon the die block as the hammer rebounds. In cementing the patrice to the face of the hammer I have, however, encountered a difficulty. It is of course necessary that the patrice and the die block should be so aligned that when the hammer descends the patrice shall strike the die block centrally. That this may be insured it is necessary that the die block when placed in the die holder, and the patrice when attached to the hammer, should be properly centered with reference to each other. I find it most convenient to do this by centering both the patrice and the die block with reference to the hammer, and to this end I provide the hammer with a hammer block, preferably of hardened steel, which has a face preferably rectangular and of a size suitable to enter the recess or channel in the swage for the reception of the die block. The patrice may of course be centered upon this hammer block by making necessary measurements at the time when the patrice is applied; but this method is open to the difficulty above referred to that the cement by which the attachment is effected is likely to become set before the proper location of the patrice is determined. To avoid this difficulty I have devised an ad-

justing tool applicable to the hammer block, which I first set with reference to the particular patrice to be attached, so that it shall, when applied with the patrice to the hammer block, accurately indicate the proper position of the patrice. I then apply the cement either to the face of the hammer block or to the patrice, and then, applying the tool and the patrice simultaneously to the hammer block, I am able to obtain the proper position of the patrice at once and before the cement sets. To facilitate the adjustment of the tool used in this process I prefer to provide upon the work table a block of the same size as the face of the hammer block, which I use for setting the tool instead of the hammer block itself. The placing of the die block in the die holder is rendered difficult by the fact that it is usually hot when placed therein and further that it is necessary to effect the proper centering of the die block with great expedition that sufficient time may not intervene for the oxidation of the surface of the hot block. I have devised a method for centering the die block which has advantages over any other known to me and which consists in adjusting the die-holder in advance so that it shall present a recess or die space of the size of the die block, accurately centered with reference to the hammer, so that it is only necessary to drop the hot block into this die space in order to center it. As the die blocks, however, are of various sizes, it is desirable to provide means for varying the size of the die space in the die holder, and for so locating the die space that it shall be centered with reference to the hammer. The die holder which I prefer to use is of the general character shown in my prior Patent No. 281,970, having a central groove or channel, and I provide a number of packing pieces of various sizes by the use of which in connection with the adjustable locking keys the size of the recess for the die block may be indefinitely varied. The centering of the recess, however, I have found to be a matter of some difficulty. To facilitate it I have devised a tool which I first set with reference to the length of the die block and then employ for determining the length of the die space and centering it in the manner hereinafter specifically described.

My invention further consists in certain features and details of construction which will be hereinafter fully described and specifically called pointed out in the claims.

In the drawings annexed and forming a part of this specification—Figure 1 shows in section the die holder and the channel in which the die is placed and in elevation the hammer carrying the patrice, the guides between which it moves, and the mechanism for arresting the hammer upon its rebound. Fig. 2 is a side view partly in section on the line 2—2 of Fig. 3. Fig. 3 is a plan view of the die holder partly in section on line 3—3 of Fig. 2. Fig. 4 is an elevation partly in section of the mechanism for catching the hammer on the re-

bound, the clutches being shown in a different position from that in which they are shown in Fig. 1. Fig. 5 is an elevation of the tool for adjusting the patrice to the hammer block, showing the manner of its use. Fig. 6 represents the tool for centering the die space in the die holder. Fig. 7 is a vertical section of a die block and the coverings used to protect it while hot. Fig. 8 is a vertical section on line 8—8 of Fig. 7. Figs. 9 and 10 show the method of adapting the die holder to die blocks of different sizes and shapes. Figs. 11 and 12 show a modification of the mechanism for catching the hammer on the rebound.

The die holder in the preferred form, which I have shown herein, consists of a solid block of steel *d* of suitable size, for instance three and one-half feet long by twelve or thirteen inches wide and eight or nine inches high, in which is planed a channel *g* about four inches wide and half the depth of the block, to receive the die block. Steel reinforcing strips *e* embracing the sides of the block are shrunk on and fastened by steel bolts *f* passing through the body of the block. Other large bolts *l*, four of which are shown, pass through the lower part of the block at internals of its length for the purpose of strengthening it against the tendency to split longitudinally under the stress of the blow of the hammer. At each end of the block and just above the level of the bottom of the channel are cut two slightly tapering key-ways *h* adapted to receive the tapering keys *k* which are longer than the width of the block and which form end bearings for the die block or for packing pieces between the die block and the keys and which are driven in to wedge the die block in place. These key-ways *h* are bored through the block *d* and are therefore closed on top, which I find to be an improvement upon the open key-ways shown in my prior Patent No. 281,970. This construction of die holder is superior to any heretofore devised, in that the bolts passing through the body of the block and the strips passing across the top of the channel reinforce the block effectually against the tendency to split longitudinally under the tremendous force exerted by the falling hammer. Other forms of die holder are found to be too weak for durability. It is highly desirable that the die block should be normally secured in the die holder so that no spreading action may be possible under the blow of the hammer, but that the block may be firmly held so that it may take a perfect impression from the patrice. I find that the construction of die holder herein described is much more effective to this end than any other which I have previously used or known of. The fact that the keyways are bored through the block instead of being in the form of open channels in its top also adds to the firmness and solidity of the die-block when wedged in place in the holder.

My experience in using die-holders made as shown in my Patent No. 281,970, has proved

to me the very great importance, in fact the necessity, of employing the re-inforcing strips or bands and bolts above described. Before employing these devices I found that the enormous spreading strain of the blow, acting on the hot metal of the die-block at the top of the channel, wedged the sides of the die-block apart at the top and produced a strong tendency to cause splits or cracks in the die-holder ranging diagonally down and outward from the bottom corners of the channel. These cracks did not always immediately appear upon the first use of the die-holder but did invariably occur after the holder had been used for the manufacture of a number of dies. I endeavored to meet this difficulty by increasing the size of the die-holder and the thickness of its sides. I found, however, that I could not overcome the difficulty in this way, for the reason that the increase of the mass of the die-holder lessened its elasticity and spring and thus increased, rather than decreased, the tendency to split. I finally hit upon the device of shrinking on the heavy steel bands above referred to, planing them out so as to be slightly, say a sixteenth of an inch, smaller than the exterior of the die-holder, and, as stated, putting them in place preferably while hot, thus causing a constant grip transverse of the die-holder tending to always neutralize the spreading force exerted by the hammer. The bolts passing through the side depending portions of the bands serve to prevent the spreading of the said depending portions during the cooling of the band and also to substantially strengthen the grip of the band upon the holder. The lower bolt may, however, if preferred, be placed in after the strip is cooled. The upper bolts are sufficient to prevent the spreading of the depending sides of the band while cooling. The principal function of the lower bolt is to re-inforce the pressure of the band and to prevent the breaking off of the heads of the small upper bolts under the jar and stress of the blows. I, however, found that these bands and the bolts through them alone were insufficient to secure satisfactory durability in the die-holder and that it was also necessary to employ the heavy steel bolts above described passing directly through the die-holder. I have found that even where a die-holder had started to crack, as above indicated, the application of the bands and bolts stopped the cracking and made the die-holder permanently useful.

With reference to the comparative location of the keys and character of packing pieces respectively shown in my former Patent No. 281,970 and my present application, I may say that I encountered in the use of my former device the difficulty that the key, being placed high enough to permit a part of the slide or packing piece to pass between it and the bottom of the channel, I found that as a consequence the key was raised above the point of maximum outward pressure caused

by the blow upon the die-block, the result of which was a tendency to force the slide outward beneath the key and wedge the key upward and bend it. The keys in this way became so badly bent and distorted that it was frequently impossible to remove them from the body of the die-holder. This difficulty is obviated in my present construction by boring or mortising the key-ways through the block nearly on a level with the bottom of the channel and by substituting for the slides of my former patent packing pieces of variable size, having no lateral portions passing under the keys. This form of packing pieces has the further advantage that several of different sizes may be used in conjunction to vary the size of the die-space. I also found that the cutting of the sides of the die-holder as shown in my said former patent was a disadvantage for the reason that the resistance of the sides of the die-holder to the spreading strain was thereby materially weakened since the length of that portion of the die-holder which resisted this strain was reduced to the distance between the open key-ways.

The packing pieces *i* are used for the purpose of adapting the die holder to dies of different lengths. A suitable number of them of different sizes are provided. If preferred the space between the die space and the keys may be filled with several narrower packing pieces instead of a single large one as shown in the figures, and thus a smaller number of packing pieces will be required in order to secure the requisite degree of adjustability of the die space. Packing pieces may also be inserted lengthwise of the dies, as shown in Fig. 10, to permit the die holder to be used for die blocks of different widths.

In order to avoid the necessity of providing an assortment of the lateral packing pieces of different lengths it is convenient to provide short narrow packing pieces *r* which can be used to vary the length of the narrow die space, as shown in Fig. 10. In Fig. 9, the packing pieces are shown of a shape to receive a circular die block. The block *d* stands upon a suitable foundation between two upright guides *m*, *n*, between which the hammer *o* slides up and down, suitable power mechanism being provided for raising the hammer and a suitable trip *T* operated from below for permitting it to fall. As already stated, the hammer preferably carries a hardened steel hammer block *P* which is preferably of rectangular form. The striking face of this hammer block is preferably made of a width which will enter the channel *g*, just clearing the inner edges of the channel, and its length is that of the largest die block likely to be operated upon.

Mechanism for arresting the hammer on its rebound and preventing a second blow consists of two ratchet bars *q*, *q'*, one attached to each of the uprights, and two clutches *B* pivoted upon bolts *s*, *s'*, fixed in the hammer, and having on their lower ends teeth adapted

to mesh with the ratchets. Centrally of the hammer is fixed a vertical mandrel t , the ends of which are held by clips u, u' . About the mandrel is a catch E , cylindrical in form as herein shown, made of considerable thickness and weight, the head E' of which has in it a hole through which the mandrel passes. The lower end of the cylindrical catch E fits loosely about a collar v free to slide up and down the mandrel. About the mandrel is a small spring x , held under a slight pressure between the head of the catch E and the collar. Near the top of the catch E and on opposite sides are two external lugs y, y' . Each of the clutches B is provided with a pair of arms $B' B^2$. The arms B' are so shaped that when their upper ends rest against the lugs y, y' as shown in Fig. 1, the arms B^2 support the collar v and compress the spring. The operation of these devices is as follows: The clutches normally rest with their arms B' against the lugs y, y' in which position the teeth on their lower ends are held in such position that they cannot engage with the teeth on the ratchets q, q' , as shown in Fig. 1. When the hammer descends and strikes the die block the momentum of the catch E carries it downward against the pressure of the spring x until the lugs y, y' release the arms B' and permit the clutches to spring outward under the pressure of the spring x acting through the collar v and the arms B^2 until the parts assume the position shown in Fig. 4. The lugs y, y' are now caught under the upper hooked ends of arms B' and the cylinder is thus retained in its depressed position and the clutches are forced outward and drag along the teeth of the ratchets q, q' as the hammer rises on its rebound. As soon as the hammer ceases to ascend the teeth of the clutches engage with the teeth of the ratchets and prevent a second descent. When the hammer is to be again raised the lower ends of the clutches B are pressed together and the catch E immediately returns to its normal place and locks the clutches B in the position shown in Fig. 1. The handles D , inserted in the lower ends of the clutches, are provided for use in pressing the clutches together. I do not of course confine myself to the particular construction of the several parts of this mechanism which I have shown.

An indefinite variety of forms of weighted catches and springs might be devised for operating the clutches and the form and construction of the clutches themselves may be indefinitely varied without departing from my invention. This mechanism may be applied to a fall or drop hammer of any type and used for any purpose where it is desirable to prevent a second blow.

In Figs. 11 and 12 I have shown one of the many possible modified forms of the mechanism last described. The clutches B are provided with springs x , which tend to force them outward, and catches E , each of the catches

being adapted to take into eyes S forming part of the clutch arms. The catches E are preferably pivoted and are weighted. When they are in engagement with the eyes S they hold the clutches B against the pressure of the springs x out of possible engagement with ratchets q, q' . When, however, the hammer strikes the die block, the weights of the catches cause them to tilt as shown in Fig. 12, releasing the arms B , which are then pushed outward by the springs and assume a position in which they may engage with the ratchets q, q' . When the hammer is to be raised the clutches B are drawn inward and secured by the catches E .

The tool which I use for adjusting the patrice to the hammer-block consists of a block F of the shape of a carpenter's square provided with adjustable lugs G held in place by thumb screws or other appropriate device H . In use the patrice is first centered upon the hammer block or preferably upon a form J provided for the purpose and of the same size in horizontal section as the hammer block. The block F is then applied to the hammer block or form and the lugs G are adjusted so that their inner ends rest against the patrice. The cement is then spread either upon the face of the hammer block or upon the back of the patrice.

The tool is applied to the hammer block as shown in Fig. 1 and the patrice is placed with its edges against the ends of the lugs G so that it assumes a position relative to the hammer block corresponding to the set previously given to the lugs on the tool.

The tool for adjusting the die space to the size of the die and centering the die space consists of a frame K in which is journaled a shaft L screw-threaded from the center to each of its bearings in the frame K , the screw threads on the two sides of the center being reversely cut. The shaft L carries between its bearings and equi-distant from the ends of the frame K , two screw-threaded lugs M, M' . These lugs have a flat bearing against the frame K so that as the shaft is revolved they are prevented from turning and hence caused to travel according to the direction in which the shaft is revolved to or from the center of the shaft. The length of the frame K is made equal to the face of the hammer block.

The end of the shaft L is squared to receive a wrench and is provided with set nuts R . This tool is used in the following manner: The set nuts are loosened and the shaft is turned in the proper direction until the outer faces of the lugs M, M' are separated from each other by a distance equal to the length of the die block which it is desired to impress, and the set nuts are then tightened. As the lugs M, M' are always moved equally it will be observed that they always remain respectively equi-distant from their respective ends of frame K . The hammer is lowered toward the die holder until it takes the posi-

tion shown in broken lines in Fig. 2. The frame K is then placed with its back against the face of the hammer block and so fitted thereto that the ends of the frame are coincident with the ends of the hammer block. The lugs M, M', will now project downward into the channel and their outer faces will indicate the proper positions for the sides of the die space. Packing pieces are now placed in the channel until the spaces between each of the lugs M, M' and the corresponding key *k* are filled, as shown in Fig. 2, the positions of the keys *k*, *k*, in their key-ways being shifted, if necessary, to obtain the proper adjustment of the packing pieces.

In practice it is necessary, since the adjusting tool is usually set to a cold die block, to allow for the expansion of the die block in heating, and for this purpose the tool should be set for a space an eighth of an inch or thereabout greater than the length of the die block when cold.

It is obvious that any device or marks which will enable the operator to always so place the tool upon the hammer block that the lugs M, M', shall be respectively equi-distant from the edges of the hammer block would be an equivalent of making the frame K equal in length to the hammer block.

In making dies with my improved apparatus, die block A of steel or other suitable material, (Figs. 7 and 8,) is suitably protected from oxidation by a close fitting cap *a* of metal and casing *b*, *c*, preferably of refractory material, such as plumbago, and is then heated. The die space in the die holder is centered to the hammer block and the patrice is attached to the face of the hammer block preferably in the manner above described. The hammer is then raised, the die block, heated preferably to a white or welding heat, is removed from the furnace, the casing *b*, *c*, is taken off, and the die block is dropped into the die space in the die holder.

It may be here remarked that it is desirable, in order to facilitate the introduction of the die block into the die space, to first loosen one of the keys *k* and push back the packing slightly so as to enlarge the die space. The die block is then dropped in, the key is driven home tightly, wedging the die block. The cap *a* is now removed, the hammer is tripped, and the patrice driven into the die block. The hammer rebounds and is caught by the clutches, and remains suspended until it is again raised.

The die block is preferably provided with a fullness on its upper surface, as shown, in order to secure a greater adaptability of the metal to the patrice.

The weight of the hammer and the distance from which it is caused to fall should be adjusted according to the size of the patrice and the distance to which it is to be driven into the die block. I find that it is desirable to cause the patrice to move at a considerable rate of speed when it strikes the die block

since a more clearly defined impression will be obtained than where the speed is small, even though the momentum be very great. Thus the best results are obtained when the patrice has at the moment of impact a velocity of from twenty-five feet per second upward, which is attained by a clear fall of the hammer of from ten feet upward. I do not, however, confine myself in the present application to any particular velocity of movement of the patrice or distance of fall of the hammer. For ordinary light work, such as for cutting dies for fence picket heads, scissors, hammer heads and other small articles, I find a drop of fifteen feet with a hammer weighing one thousand pounds to give the best results.

Under the term hammer block as used herein I intend to include any sort of a striking face with which a hammer may be provided.

The best cement I have found for attaching the patrice to the hammer block is plaster of paris. The shock of the blow of the hammer upon the die block breaks this cement, detaching the patrice from the hammer. I do not, however, limit myself to the use of plaster of paris or of a cement which is broken by the blow of the hammer upon the die block.

Certain features disclosed in the present application are claimed in my pending applications, Serial Nos. 332,533 and 435,478, and consequently are not claimed herein.

Having described my invention, what I claim, and desire to protect by Letters Patent, is—

1. The combination with the hammer and die block, of the clutch mechanism consisting of the ratchet, the clutch arms, the catch for holding the clutches out of engagement with the ratchet during the descent of the hammer and adapted to be operated to release said clutches by the shock of the hammer upon the die block, and the spring for forcing the clutches into engagement with the ratchets when thus released, substantially as described.

2. The combination with the hammer and die block, of the ratchets *q*, *q'*, clutches B and the vertically movable catch E for holding the clutches out of engagement with the ratchets during the descent of the hammer and adapted to be moved longitudinally to release said clutches by the shock of the hammer upon the die block, and the spring *x* for forcing the clutches into engagement with the ratchets when thus released, substantially as described.

3. The combination with the hammer and die block and ratchets *q*, *q'*, of the clutches B provided with arms B', B², collar *v* engaging arms B², catch E provided with projections engaging arms B' and spring *x* engaging said catch and collar, substantially as described.

4. The block *d* provided with a channel *g*, the tapering keys *k*, and key ways therefor, and packing pieces adapted to be dropped

into the channel *g* between the keys *k*; whereby the die space may be adjusted and the die wedged in position, substantially as set forth.

5 5. The combination of the block *d*, having
the channel *g*, and key ways *h* bored through
the block *d*, the tapering keys *k* and packing
pieces whereby the die space may be adjusted
and the die block wedged in position, sub-
stantially as set forth.

10 6. The die holder, consisting of a channeled
block provided with reinforcing straps cross-
ing the channel and bolts passing through the
block beneath the channel, substantially as
set forth.

15 7. The channeled block *d* provided with
straps *e* and bolts *f*, *l*, substantially as set
forth.

20 8. As a means for impressing a die block,
a hammer, a patrice attached to the hammer
by cement, and mechanism for causing the
hammer to drop and drive the patrice into
the die block, substantially as described.

9. As a means for impressing a die block,
a hammer, a patrice attached to the hammer
by plaster of paris, and mechanism for caus- 25
ing the hammer to drop and drive the patrice
into the die block, substantially as described.

10. In combination with means for operat-
ing a drop hammer, a die block, a drop ham-
mer, and a patrice detachably connected to 30
said hammer, so that at the moment when the
patrice is driven by the fall of the hammer
into the die block, the patrice shall be sev-
ered from the hammer by the shock of the
impact, substantially as set forth and de- 35
scribed.

In testimony whereof I have hereunto set
my hand in the presence of two subscribing
witnesses.

GEORGE F. CHAMPNEY.

Witnesses:

J. J. KENNEDY,
EDWARD R. WOOD.