

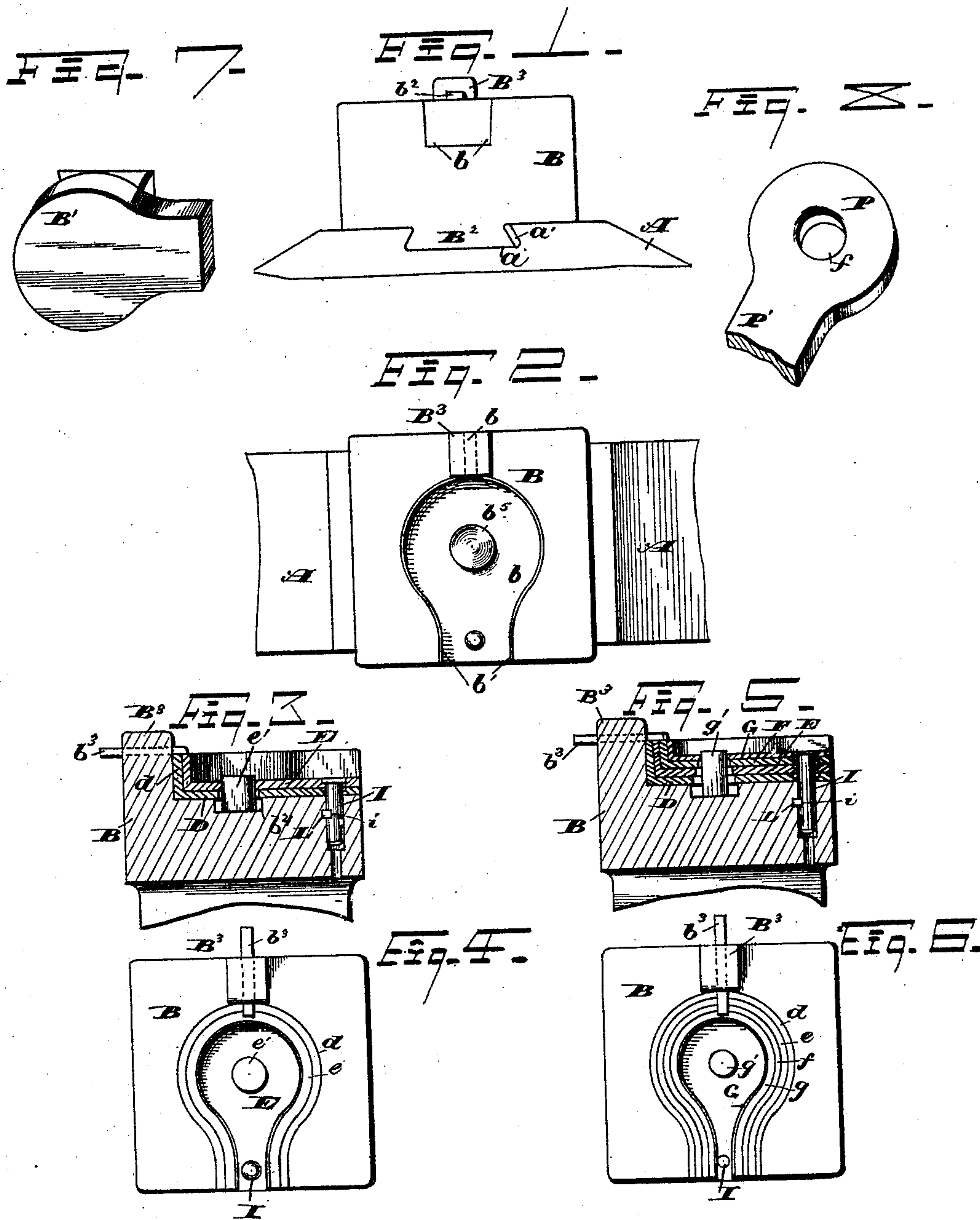
(No Model.)

H. P. PHIPPS.

FORGING DIES.

No. 327,309.

Patented Sept. 29, 1885.



WITNESSES

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# UNITED STATES PATENT OFFICE.

HENRY P. PHIPPS, OF CLEVELAND, OHIO.

## FORGING-DIES.

SPECIFICATION forming part of Letters Patent No. 327,309, dated September 29, 1885.

Application filed July 23, 1885. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY P. PHIPPS, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and  
5 useful Improvements in Forging-Dies; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

10 My invention relates to improvements in forging - dies designed more especially for forging chord-heads on bridge-chords or eye-bars and other similar work, in which a nest of dies are forged and used, the one within  
15 another, and all of the forged dies held in a larger or foundation die in such a manner that the outer die supports the inner die or dies, and so arranged that any or all of the dies constituting the nest are detachable, to the end  
20 that a great saving is effected in the metal of which the dies are constructed, and that the dies are more easily handled and more durable and less expensive than the ordinary dies used for such purposes. With these objects in view  
25 my invention consists in certain features of construction and in combination of parts hereinafter described, and pointed out in the claims.

In the construction of modern iron bridges  
30 usually a large number of bridge-chords or eye-bars are used, consisting each of a flat bar of iron with enlarged ends, called "chord-heads," the heads having lateral holes extending flatwise through the bar, the holes being bored  
35 to fit chord pins or bolts. Formerly these heads were forged and then welded to the ends of the chord-bar. A more modern way is to build a pile or fagot on the end of the chord-bar and weld and shape the head at one  
40 operation by means of a steam-hammer and suitable forging-dies. These chord-heads range in size, usually, from perhaps two or three inches to eighteen or twenty inches in diameter, and consequently a large number of dies  
45 of corresponding sizes are required. Such dies are usually of cast-iron, and are necessarily made very heavy to give the required strength. Otherwise they would not withstand the heavy blows and lateral strain to which

they are subjected. The larger dies weigh 50 perhaps two tons or more, and this great weight is a serious hinderance in handling the dies.

In addition to the great weight and consequent cost of material, each lower or female 55 die has to be fitted to the anvil and brought in position to receive the male die that is attached to the plunger. Notwithstanding their great weight and unwieldy proportions the dies are frequently fractured and rendered 60 worthless, and have to be replaced with new ones, by reason of which, in large establishments, a monthly expense is incurred, usually of several hundred dollars, in "keeping up" a set of these dies. The upper or male die, 65 being a solid block of metal, is seldom broken or injured.

In view of the aforesaid difficulties I have devised a nest of dies forged, the smaller within the next larger in size. The outer or 70 foundation die is of cast-iron and fitted to the anvil, and is of suitable size to serve as the largest of the series of dies, and is of sufficient strength to insure it against breakage. The forged dies are thin and lighter to handle, 75 and by reason of their support from the foundation-die are rendered durable.

In the accompanying drawings, Figure 1 is a side elevation of the outer or foundation die, showing also the upper portion of the 80 anvil of a steam-hammer to which the dies are attached. Fig. 2 is a plan view of the same. Fig. 3 is an elevation in section, and Fig. 4 a plan view of the foundation-die, showing two forged dies in position therein. 85 Figs. 5 and 6 are respectively an elevation in section and a plan showing four dies in position in the foundation-die. Fig. 7 is a view in perspective of the upper or male die that fits the foundation-die. Fig. 8 is a view in 90 perspective of a chord-head and a portion of the chord.

A represents the upper portion of an anvil, such as are commonly used with steam-hammers, drop-presses, &c. The anvil has a recess, *a*, across the upper face, the side walls 95 of which are usually undercut, as shown in Fig. 1.



B' and B are respectively the male and female dies. The former is secured to the plunger or cross-head of the hammer or drop-press, as the case may be, and the latter rests upon the anvil. The die B has a tongue, B<sup>2</sup>, that is secured by one or more keys, a', in the recess a, in position for the die B to receive the die B' when the latter is being operated by the hammer or drop-press. The die B is the largest of the series of female dies, and may therefore be called the "foundation-die." The depression or chamber b in this die corresponds in size and shape with the die B' and with the chord-head P, that is supposed to have been forged thereon. A heavy upwardly-projecting lug, B<sup>3</sup>, is cast on the rear wall of the die B, and has a keyway, b<sup>2</sup>, for the purpose hereinafter shown. The lateral opening b' of the chamber b corresponds in width with the chord P'. The chamber b is necessarily of considerable depth to accommodate the fagots, that for a large chord-head are usually quite bulky, not much pains being taken to arrange the fagot in a compact form or shape to fit the die. When several dies constituting a nest are to be forged, the chamber b should be ten or twelve inches (more or less) in depth, and the die should be made very heavy and strong to prevent the possibility of its breaking. Suppose the chord-heads to be forged are respectively eighteen, sixteen, and fourteen inches in diameter, and so on in the descending series. Male dies of sizes corresponding with the different chord-heads are provided, and each male die is fitted to the plunger. With the old system a series of heavy female dies corresponding, respectively, to the different sizes of the chords is provided, and each female die is fitted to the anvil. With my improved system the second die in size is forged in the foundation-die, and the third in size is forged in the second, and so on through the descending series, and in the following manner, designating the dies according to the size of the chord-head, which we have supposed to be eighteen, sixteen, and fourteen inches, &c. A fagot of suitable size is placed in the die B (eighteen-inch) and given a few strokes of the hammer, using the male eighteen-inch die to flatten and weld the fagot. The eighteen-inch male die is then removed, and the sixteen-inch male die is substituted, after which the hammer is worked vigorously. The strokes of the sixteen-inch die break down the central portion of the fagot and force a large amount of the metal to the outside and form the rim d of the die D. (See Figs. 3 and 5.) The blows are continued until the rim is forced up about flush with the top of the die B, after which lighter blows are given, while water is freely applied to the newly-forged die. The side walls of the die D in the supposed case would of course be an inch thick, and an inch would be a suitable thickness for the bottom of this die; but when the side walls have been forced up flush with the die B the bot-

tom would be thicker or thinner, according to the amount of metal that was in the fagot, and if it was found that the bottom of the forging was so thick that it would interfere with forging of the next die the hammering might be continued to reduce the bottom of the fagot to a suitable thickness, and if in so doing the side walls were carried above the die B it would do no harm, as the protruding portions of the rim would not be in the way in operating the die or in forging the next die. The die D is next removed and the inside dressed a trifle to smooth the surface, about the same amount of labor being necessary for this purpose as with the cast-iron dies. A hole is drilled to fit the pin I, and countersunk to bring the head of the pin flush with the die. This pin extends some distance into the die B, and is secured therein by a lateral key, L, that engages a notch, i, in the pin. The other end of the die D is held down by the key b<sup>3</sup>. Other dies, E F G, &c., with, respectively, rims e, f, and g, may be forged in a similar manner. The key b<sup>3</sup> is made to extend over the rim of the inner die, by means of which all of the forged dies are secured at this end, and pins I are made for each forged die, or several notches for engaging the key L may be made on the same pin. Of course various other means might be employed for holding down the forged dies.

In Figs. 3 and 4 two forged dies, D and E, are shown, and in Figs. 5 and 6 four dies, D, E, F, and G, are shown in position. These forged dies in the supposed case are so thin that they would be internally worthless to use singly, but when in position in the next larger die and supported by the foundation-die are found to be sufficiently strong and durable. The limit of the durability is yet to be tested, as in a trial of four months of such usage as would usually have broken several cast dies the entire nest of forged dies up to the present time is intact, and shows no signs of giving out. The die B has a shallow bore, b<sup>4</sup>, in which is set a steel plug, b<sup>5</sup>, for making the hole p in the chord-head P. Each of the forged dies is provided with a similar but smaller hole, according to the size of the die, and a plug is made for each die, and of such length that when the lower end of the plug rests on the bottom of the bore b<sup>4</sup> the upper end thereof will extend above the face of the die about half the distance of the thickness of the chord-head. In Figs. 3 and 4 is shown a plug, e', for the die E, and in Figs. 5 and 6 is shown the plug g' for the die G. As a chord-head is reversed from time to time in the process of forging, the said plug breaks a core from the head and forms the hole. These holes are afterward bored accurately to fit the chord-pins. In forging the die D the hole b<sup>4</sup> is filled with a plug that comes about even with the face of the die, and the same may be done with each successive forged die, or these holes may be bored after all of the dies are forged.



When once the die B is in position and keyed to the anvil, it or any or all of the forged dies may be used in forging the various-sized chord-heads without disturbing the foundation-die, and as each of the forged dies is comparably light and fits in its place without any adjustment the labor of changing the dies is greatly reduced as compared with the old system of dies aforesaid.

10 What I claim is—

1. A nest or series of forging-dies arranged the one within another, substantially as set forth.

2. A nest or series of forging-dies consisting, essentially, of a base or foundation die and a series of smaller dies arranged within the foundation-die, substantially as set forth. 15

In testimony whereof I sign this specification, in the presence of two witnesses, this 11th day of June, 1885.

HENRY P. PHIPPS.

Witnesses:

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CHAS. H. DORER.