(No Model.) 3 Sheets—Sheet 1.

W. R. HINSDALE.

APPARATUS FOR BREAKING STEEL INGOT BARS.

No. 384,846. Patented June 19, 1888.

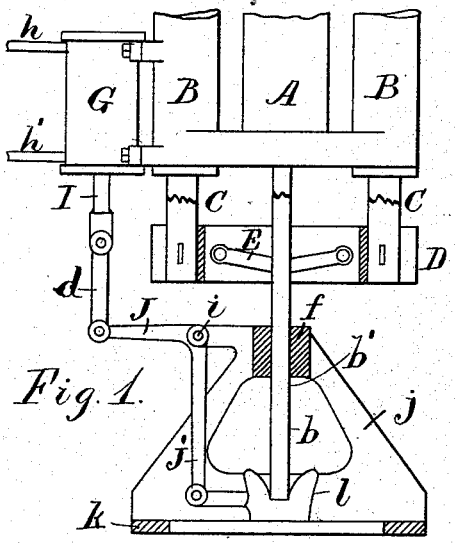

Fig. 1.

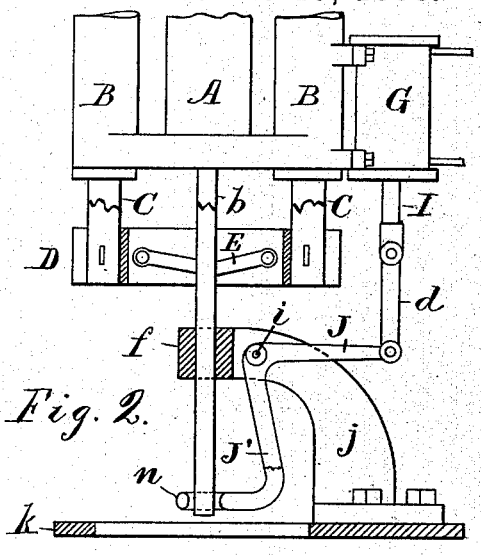

Fig. 2.

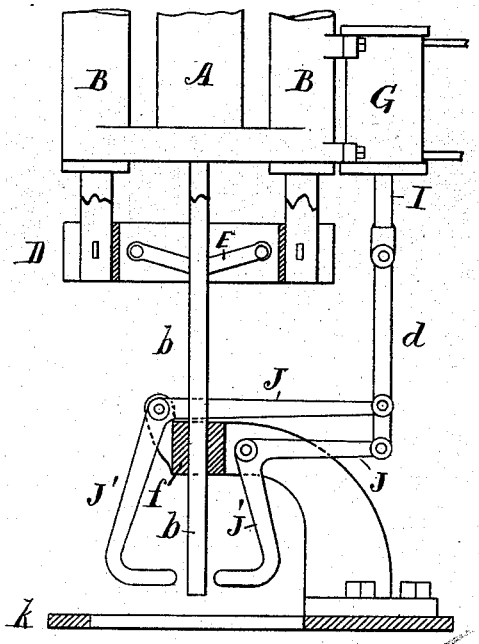

Fig. 3.

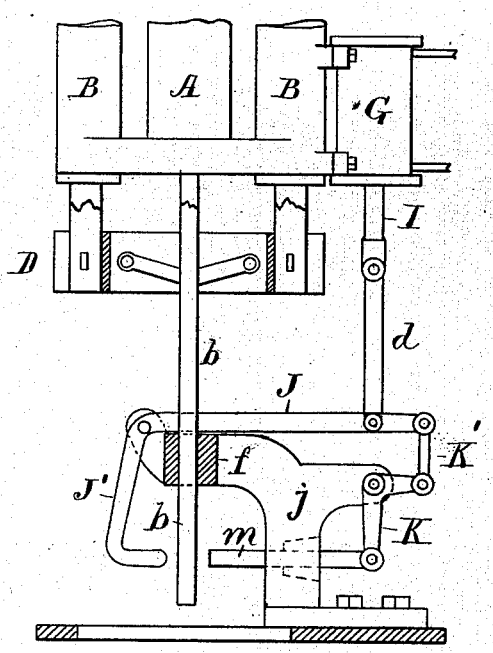

Fig. 4.

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Fig. 5

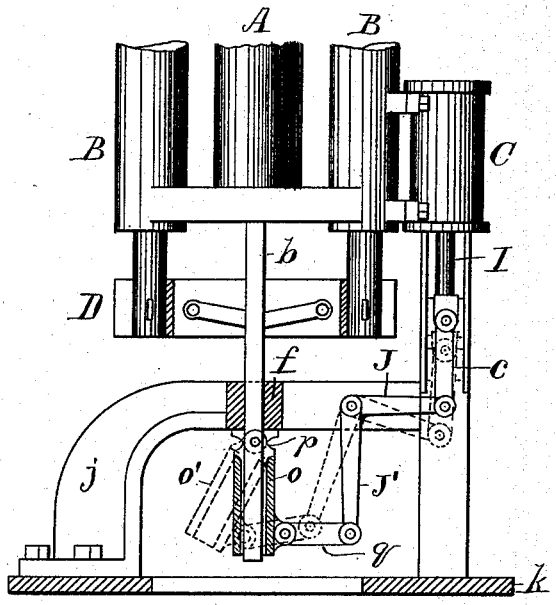
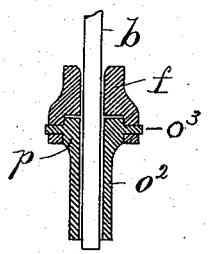


Fig. 6



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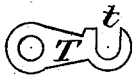
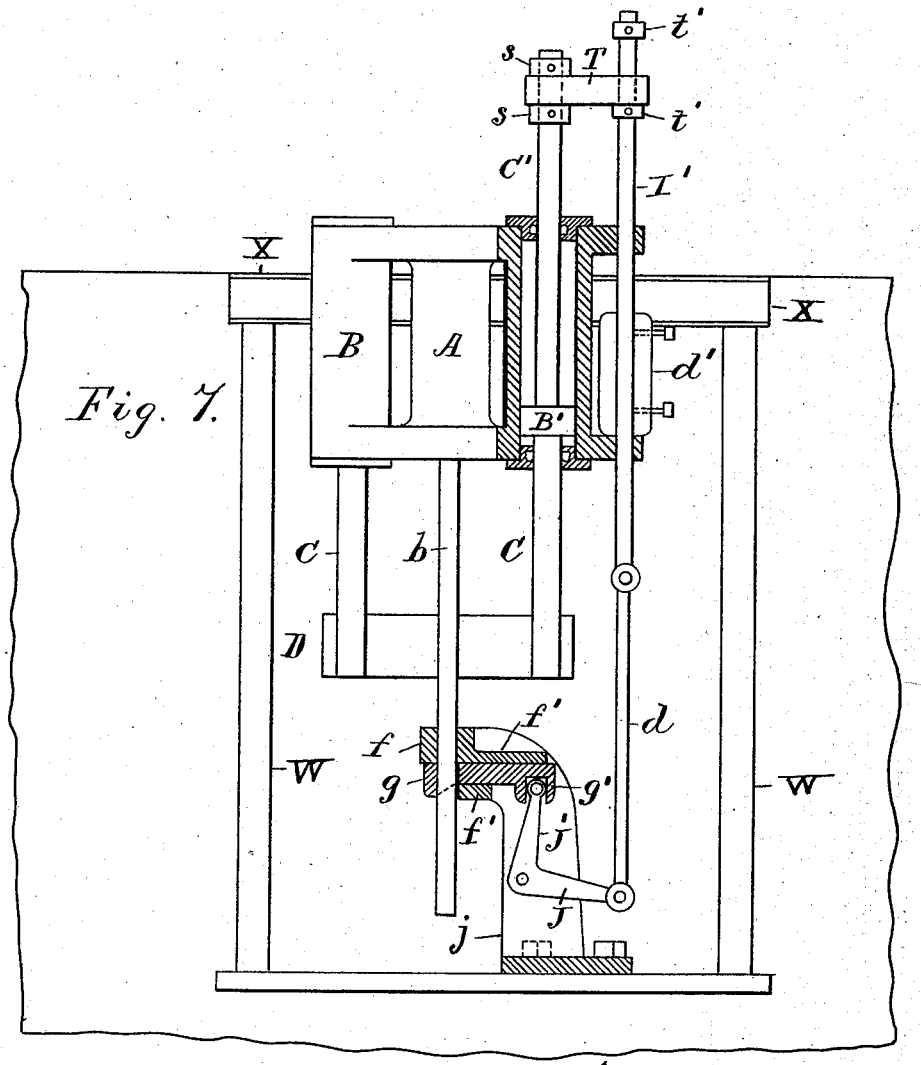


Fig. 8.

Fig. 7.



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UNITED STATES PATENT OFFICE.

WILLIAM R. HINSDALE, OF HOBOKEN, NEW JERSEY.

APPARATUS FOR BREAKING STEEL INGOT-BARS.

SPECIFICATION forming part of Letters Patent No. 384,846, dated June 19, 1888.

Application filed March 7, 1888. Serial No. 266,460. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM R. HINSDALE, a citizen of the United States, residing at Hoboken, Hudson county, New Jersey, have invented certain new and useful Improvements in Apparatus for Breaking Steel Ingot-Bars, fully described and represented in the following specification, and the accompanying drawings, forming a part of the same.

The object of this invention is partly to furnish a more compact and economical construction for breaking a continuous bar of cast-steel into ingots and partly to hold the separate section in a straight piece and free it from lateral curvature during the breaking operation to avoid injury to the ingots when ruptured in a heated and soft condition.

The invention consists, partly, in the combination, with a vertical ingot-bar or a mold in which the same is produced, of a breaking device operated horizontally, a cylinder arranged vertically with a piston to operate the bending device, and a bell-crank connecting the vertically-moving piston with the horizontally-moving breaker.

The invention also includes a tubular holder hinged at one end and adapted to receive the ingot-bar and to hold the same in a straight piece during the bending operation.

My invention will be understood by reference to the annexed drawings, in which I have illustrated by diagram a number of constructions adapted to carry out my invention, the ingot-bar being shown extended from the lower end of a mold through a cross-head, which is adapted to draw the ingot from the mold by connections with hydraulic cylinders, as in my patent application No. 222,948, filed December 29, 1886.

The mold and hydraulic cylinders are only partly shown in the drawings, as they form no part of my present invention, which consists only in the means for breaking the ingot-bar after it is formed.

Figure 1 shows in diagram a fixed socket with a reciprocating socket arranged in the path of the bar and connected with the actuating-cylinder by a bell-crank. Fig. 2 shows the same elements, excepting that the bar is bent by an open eye attached to the bell-crank. Fig. 3 shows two bell-cranks attached to the rod of the actuating or bending cylinder and provided each with a presser to operate upon opposite sides of the ingot-bar. Fig. 4 shows one bell-crank provided with a presser to operate upon one side of the ingot-bar, and a reciprocating pusher adapted to operate upon the opposite side of the ingot-bar, the pusher being connected with one arm of the first bell-crank by a secondary bell-crank and connecting-link. Fig. 5 shows an oscillating holder hinged below the fixed socket, which sustains the thrust of the ingots during the breaking operation, the free end of the holder being oscillated by a bell-crank linked to the same and to the piston of the actuating or breaking cylinder. Fig. 6 is a vertical section of holder *o*, and Fig. 7 an alternative construction in section where hatched; Fig. 8, a plan of arm T.

A represents the lower end of the ingot-mold in which the ingot-bar *b* is cast; B, the cross-head cylinders; C, their piston-rods; D, the cross-head, and E the feeding-pawls which clamp the rod when drawing it downward from the cylinder A and automatically release it on their upward movement.

f is a fixed socket, through which the ingot is projected to sustain it during the breaking operation, the breaking being effected by bending the ingot back and forth beneath such socket.

G is the vertical bending or breaking cylinder, which is arranged parallel with the mold A, and therefore at right angles with the breaking devices which operate transversely to the bar *b*.

The piston of the bending or breaking cylinder would be actuated by water, steam, compressed air, or any other suitable agent introduced through pipes *h h'*, or by other convenient means, and the rod I would be connected with such piston and its vertical motion converted into the horizantal movement of the breaker or bender by a bell-crank, J J'.

The fixed socket *f* is shown mounted upon a bracket or standard, *j*, which would be affixed to any suitable foundation or bed, *k*, below the mold A, and the bell-crank is preferably pivoted upon such bracket, as by the pin *i*, to confine the strain wholly to such bracket.

In Fig. 1 the lower end of the bell-crank is linked to a moving socket, *l*, adapted to receive

the lower end of the ingot-bar *b*, and to move such end of the bar back and forth sidewise when the piston-rod I is reciprocated up and down. As the bar is held by the fixed socket *f*, such bending back and forth operates to rupture the bar close beneath the fixed socket, as at the point *b'*, and to thus separate an ingot from the bar.

In the figures the arm J of the bell-crank is connected by link *d* with the piston-rod I, and the arm J' operates the bender, whatever its form.

In Fig. 2 an open eye, *n*, is shown attached to the arm J' and adapted to admit the bar *b* when the piston-rod I is adjusted at the middle of its stroke. The reciprocation of the piston-rod then operates to bend the bar back and forth laterally to rupture it, as before described.

In Fig. 3 two bell-cranks, having each one arm lettered J and the other arm lettered J', are pivoted upon the bracket *j* at opposite sides of the socket *f*, with their lower ends bent toward the ingot-bar to push the same back and forth, one of them operating upon one side of the bar when the piston-rod I is moved in one direction, and the other operating upon the opposite side of the bar when the motion of the piston-rod is reversed.

In Fig. 4 a somewhat similar arrangement is shown, except that one of the bell-cranks is replaced by a straight horizontal bar, *m*, which is arranged to operate opposite the bent end of the arm J', the bar *m* being connected with the arm J by an auxiliary bell-crank, K, connected to the outer end of the arm J by a link, K'. In the constructions thus far shown the pressure is applied only to a single point upon the ingot-bar near its lower free end, thus subjecting the substance of the bar between such point and the socket *j* to more or less lateral strain in producing the desired rupture; but in Fig. 5 is shown an oscillating holder adapted to sustain that portion of the bar which is intended to be severed to form a single ingot, the holder *o* being arranged in line with the socket *f* beneath the same and adapted to receive the bar and to contain substantially the amount required to form an ingot.

The holder is furnished with ears *p*, which would be pinned to the bracket *j* at opposite sides of the ingot-bar, as shown in Fig. 6, and the lower end of the holder is shown connected with the arm J' of the bell-crank by a link, *q*.

The reciprocation of the piston in the bending-cylinder then operates to oscillate the bell-crank and the lower end of the holder, as indicated by the dotted lines *o'* in Fig. 5, and moves a section of the ingot-bar into an angle with that portion inside the socket *f* without subjecting the metal of the bar below the socket to any bending strain, except the portion between the top of the holder and the bottom of the socket.

The holder is shown in Fig. 5 with two sides in section fitted loosely to the bar *b* and flared outwardly at their upper ends to readily admit the latter; but such sides may be fitted as closely to the bar as is possible for the bar to move between the same, and would thus hold the same from curvature more perfectly during the breaking operation.

It is obvious that the sides *o* (shown in section in Fig. 5) are the chief operative parts of the holder which act upon the ingot-bar, and that the sides o^2 (shown in section in Fig. 6) serve only to hold the operative sides together and to connect them to the pivots o^3.

It is immaterial how the operative sides *o* are connected together and to the pivot, or whether ties of some form are connected with the sides *o*, instead of the continuous flat plate shown in Fig. 6.

In Fig. 7 is shown the means for utilizing the piston-rod of one of the cross-head cylinders B to actuate the bell-crank in the desired manner. In this view the cylinders B and mold A are shown entire, while their lower ends only are shown in the other figures. The rods C and the ingot-bar *b* are also represented as broken at *e* in Figs. 1, 2, 3, 4, to avoid showing the entire space required for the movement of the cross-head in the drawings of Figs. 1 to 4, inclusive.

In Fig. 7, B' is the piston attached to one of the rods C, and a rod, C', is shown extended through the upper end of the cylinder from piston B', for the express purpose of actuating a rod, I', connected with the bell-crank J J' in place of the rod I. (Shown in Figs. 1 to 5.) An arm, T, is shown applied to the tops of the rods C' and I', the arm being adapted to turn upon the rod C', between collars *s*, and formed with an open socket, *t*, at its outer end, adapted to hook upon the rod I', between collars *t'*. By this construction the arm T may be detached from the rod I' when operating the cross-head D prior to the breaking operation, the rod C' then being moved into a suitable position for the outer end of the arm I to engage the arm I', between collars *t'*, after which the reciprocation of the piston B' would actuate the rod I' and the breaking devices, the same as the rod I shown in the other constructions.

The arm J' of the bell-crank is shown in Fig. 7 connected with a plain slide, *g*, fitted to a guide, *f'*, beneath the socket *f*, and adapted when moved across the lower end of such socket to sever the ingot-bar by pushing the same bodily sidewise. To prevent the bar from bending during such operation the slide is furnished with a vertical cheek-piece upon its outer end, and the ingot-bar is thus held approximately parallel with its original position during the entire breaking operation. This construction for the breaking device is especially adapted to ingot-bars in which a cold-shut is formed at intervals in the process of casting, by which the bar is weakened at given points, and thus adapted to readily rupture when pushed laterally by the slide.

To facilitate the connection of the rod C' with the rod I', and to permit the reciproca-

tion of the cross-head D, without affecting the bar *b* already drawn from the mold A, it would be necessary to disengage the pawls E from the ingot-bar during the breaking operation, which may be effected by any convenient means, but which are not shown herein, as they form no part of my present invention.

The rod I′, the bell-crank and the slide *g*, are shown at one extremity of their movement, with the ingot-bar extended through the socket *f*, ready to be broken, and a weight, *d*′, is affixed to the rod I′, to hold the parts normally in this position, so that the slide may not interfere with the movement of the ingot-bar when propelled through the socket *f* by the movement of the cross-head.

The cross-head is shown at the lower end of its stroke as it appears after moving the ingot-bar into position for breaking, and the arm T may then, by a previous arrangement of the collars *s* and *t*′, be immediately fitted to the rod I′ and serve to actuate the breaking mechanism by its reverse movement upward.

In Fig. 7 is shown a pit, W, in which such an apparatus would be erected in most cases, in order to bring the mouth of the mold A about ten inches above the ground or floor level, for the convenience of pouring the fluid metal therein.

Beams X are represented resting upon the walls of the pit, and the entire apparatus (excepting the bracket *j* or other support provided for the socket *f*) would be suspended from such beams.

By arranging the breaking or bending cylinder vertically it may be connected with the breaking devices by a bell-crank or other equivalent means for transforming the vertical into a horizontal movement, and the connections to and from such cylinder may be made with great facility, and the valve mechanism for operating the same may be conveniently connected and operated. By such a bell-crank connection I am also enabled to utilize the movement of any hydraulic piston that may be used to reciprocate the cross-head D, and am able to convey the water or other operating-fluid to and from the breaking-cylinder with much greater economy and convenience than when located beneath the level of the fixed socket *f*.

I have made no specific claim herein to a movable holder adapted, like that shown in Fig. 5, to sever the ingot-bar by shifting a portion transversely to the bar at the desired point of rupture, as I have filed on April 2, 1888, a division of this application, No. 269,219, to claim such subject-matter.

Having thus set forth the nature of my invention, what I claim herein is—

1. In an apparatus for breaking ingot-bars, the combination, with a vertical mold and a vertical cylinder sustained adjacent to the same, of a fixed socket beneath the mold to sustain the ingot-bar during the breaking operation, and a bell-crank with a vertical arm connected to such ingot-bar below the fixed socket, and having a horizontal arm connected with the piston of the vertical cylinder, as and for the purpose set forth.

2. In an apparatus for breaking ingot-bars, the combination, with a vertical mold and a vertical cylinder sustained adjacent to the same, of a fixed socket beneath the mold, an oscillating holder pivoted in the path of the ingot-bar below the fixed socket, and a bell-crank having its vertical arm connected with such holder, and its horizontal arm connected with the piston of the vertical cylinder, as and for the purpose set forth.

3. In an apparatus for breaking ingot-bars, the combination, with a vertical mold and a vertical cylinder sustained adjacent to the same, of a fixed socket beneath the mold, mechanism operating between the bottom of the mold and the fixed socket for drawing the ingot-bar from the mold, and a bell-crank with a vertical arm connected to such ingot-bar below the fixed socket, and having a horizontal arm connected with the piston of such vertical cylinder, as and for the purpose set forth.

4. In an apparatus for breaking ingot-bars, the combination, with the vertical ingot-mold and vertical cylinder, of a fixed socket beneath the mold, a holder arranged to receive the ingot-bar below the fixed socket and operating by pushing transversely against such bar, and a bell-crank with a vertical arm connected to such transversely-moving holder, and having a horizontal arm connected with the piston of such vertical cylinder, as and for the purpose set forth.

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

WILLIAM R. HINSDALE.

Witnesses:
THOS. S. CRANE,
L. LEE.