July 25, 1944. LE ROY LAYTON 2,354,323

BILLET BAR BREAKER

Filed May 6, 1941 2 Sheets-Sheet 1

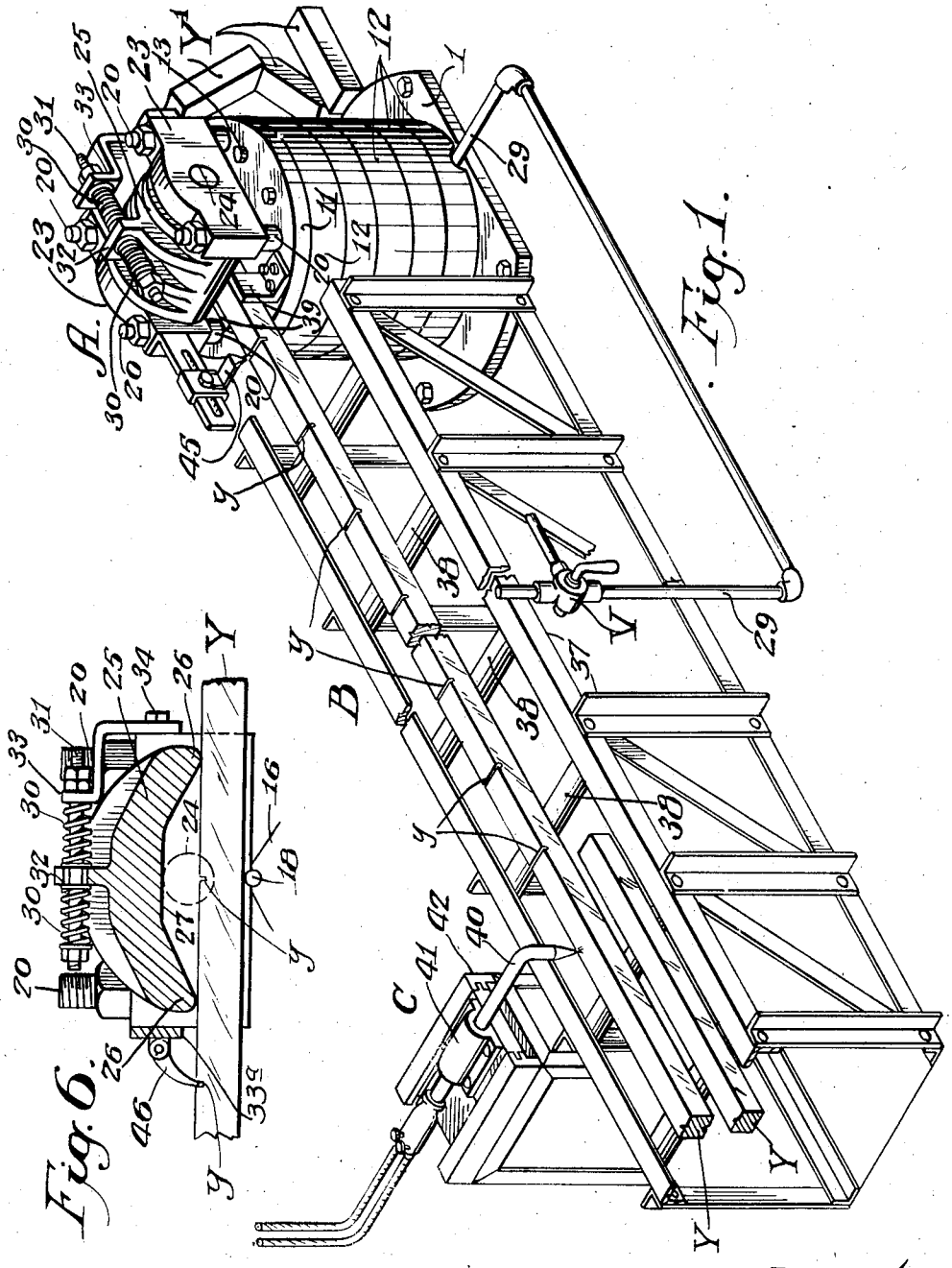


Fig. 1.

Fig. 6.

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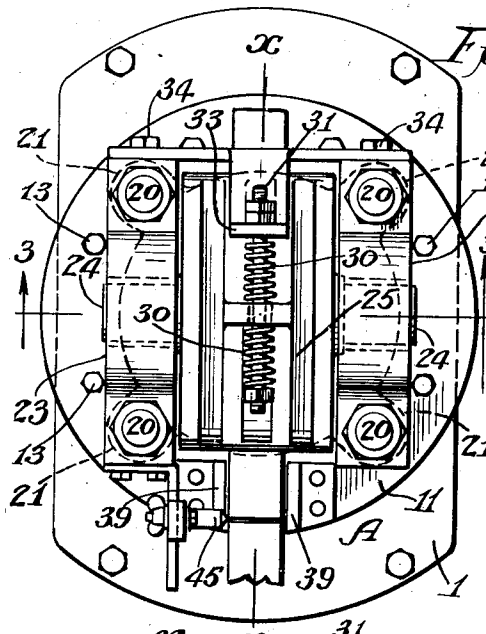


Fig. 2.

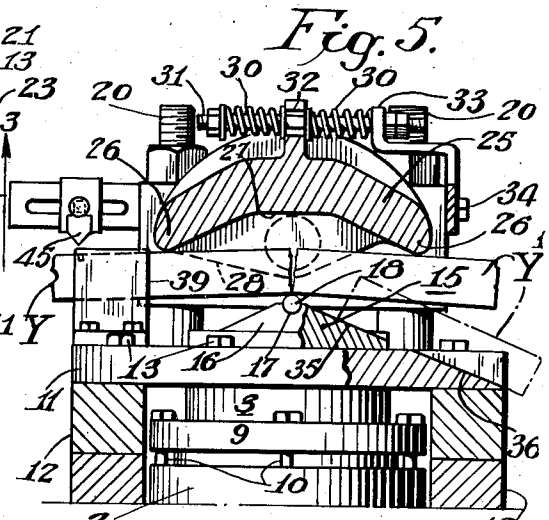


Fig. 5.

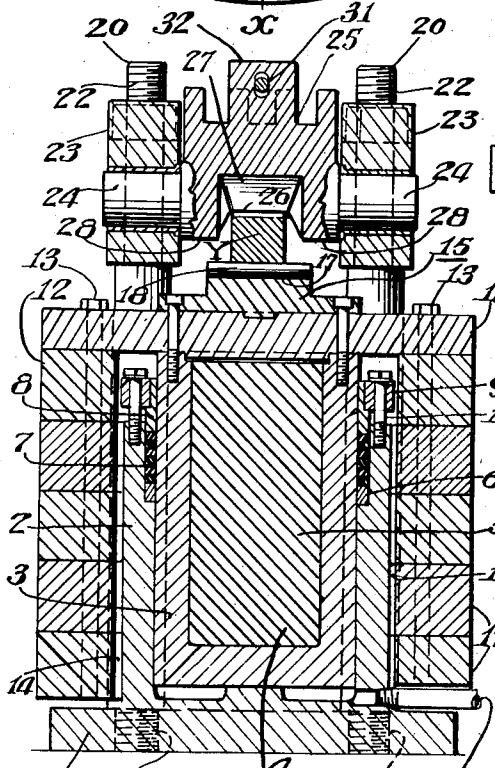


Fig. 3.

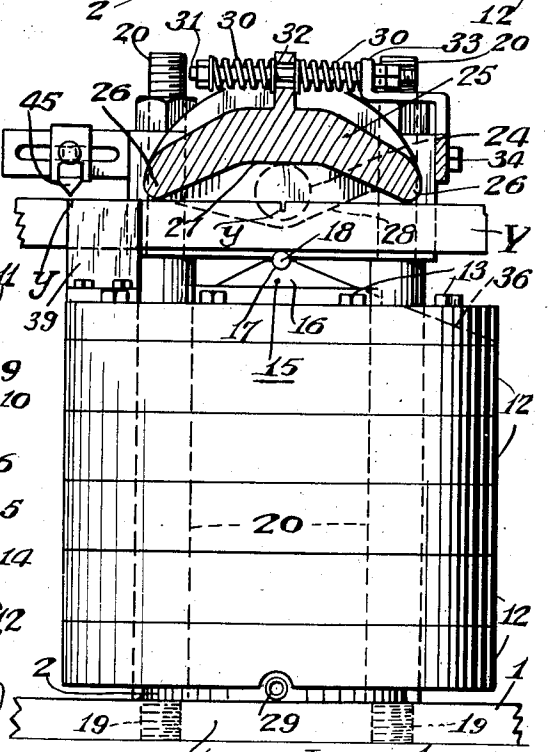


Fig. 4.

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2,354,323

BILLET BAR BREAKER

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Application May 6, 1941, Serial No. 392,187

15 Claims. (Cl. 29—66)

This invention relates to apparatus for cold-breaking steel billet bars into separate units of predetermined lengths, suitable, for example, for use in the forging processes disclosed in my prior United States Letters Patent No. 2,057,530, dated October 13, 1936, and No. 2,059,124, dated October 27, 1936, and in my copending applications Serial No. 234,713, filed October 12, 1938, now Patent No. 2,278,325, issued March 31, 1942, and Serial No. 271,570, filed May 3, 1939, now Patent No. 2,248,002, issued July 1, 1941; as well as for any other purpose for which it may be desirable to break relatively long bars of normally brittle metal into a number of pieces of relatively shorter lengths, respectively.

The object of the present invention is to provide a highly efficient hydraulically operated billet breaker of rigid compact construction, devoid of all overhead equipment such as the rams, return cylinders, piping, valves, etc., normally employed in hydraulically operated devices of this general character.

Another object of the invention is to provide improved means for supporting the spaced normally fixed pair of breaker elements against which the single breaker element operated by the ram presses the bar, whereby the spaced breaker elements can move relatively during simultaneous application of pressure to the bar in opposite directions by the three breaker elements collectively, to equalize the pressure applied to the bar at all three points engaged by the respective breaker elements, whereby undue strains on the apparatus are eliminated, and whereby the billet broken from the bar is prevented from being hurled through the air when the bar snaps.

In the accompanying drawings:

Fig. 1 is a perspective view of a complete apparatus, including a breaker, a feed table, and a prescoring apparatus constructed and assembled in accordance with the principles of the present invention;

Fig. 2 is a plan view of the breaker;

Fig. 3 is a sectional elevation taken on the line 3—3, Fig. 2;

Fig. 4 is a side elevation, partly in section, with the bar in position for breaking;

Fig. 5 is a fragmentary view similar to Fig. 4 with the bar in the act of being broken; and

Fig. 6 illustrates a modified form of apparatus for registering the prescorings of the bar successively over the anvil of the breaker.

As shown most clearly in Fig. 3, the breaker A comprises a base 1, which is adapted to rest on and preferably be rigidly secured to a suitable concrete or other solid foundation, floor, etc. Formed integrally, in the present instance, with the base 1, is a vertical hydraulic cylinder 2, of full circular cross-section. Mounted in and axially aligned with the cylinder 2 is a vertically reciprocable ram, plunger, or piston 3.

Preferably, the ram 3 is composed of cast iron or steel and is provided with a central cavity 4, which is adapted to be filled with a suitable material 5 of greater specific gravity, per cubic inch, than the material of which the ram 3 is composed, in order to provide the greatest possible weight within the ram 3, which, for the purposes of this invention, is of minimum dimensions for the work required of it. In the present instance, the cavity 4 is filled with lead.

In the present instance, the upper end of the cylinder 2 is counterbored, as indicated at 6, for the reception of suitable packing material 7, and a packing ring 8. The ring 8 is provided with an enlarged flange 9 for the reception of pressure screws 10, 10, which pass through said annular flange and are tapped into the upper end surface of the cylinder 2.

The ram 3 is provided with a diametrically-enlarged head 11 of circular form, as shown in Figs. 2 and 3, and which extends outwardly beyond and overhangs the peripheral edges of the ring 9 and cylinder 2. Rigidly secured to the overhanging portion of the ram-head 11, is a series of weight rings or segments 12, 12, said weight rings being secured to the head 11 by bolts 13. The inner diameter of the weight rings 12, 12 is sufficiently greater than the outside diameter of the cylinder 2 and packing ring flange 9 to provide working clearance 14 therebetween, as the ram 3 and weights 12, 12 rise and fall in a manner hereinafter described.

Resting on top of and rigidly secured to the ram-head 11 and centered about the vertical axis of the ram 3, is a breaker element or anvil 15, which, as clearly shown in Figs. 4 and 5, includes a supporting base member 16 of cast steel or other tough construction. The supporting base 16 is provided with a semicircular groove 17, in the present instance, for reception of a hardened steel round bar 18, which makes actual contact with the bar being broken.

Symmetrically disposed around the axis of the cylinder 2, radially beyond the cylinder 2, is a series of vertical posts or standards 20, 20, the lower ends 19 of which are reduced in diameter, threaded, and screwed into the corresponding tapped openings in the base 1. The posts 20, 20 project upwardly through openings 21,

21 formed in the weight 12 and ram-head 11, to a height above said ram-head where said posts support a superstructure hereinafter described. The openings 21 are sufficiently greater in diameter than the posts 20 to provide for free relative movement therebetween, during raising and lowering of the ram 3, the head 11, and the weights 12, 12 secured thereto.

The superstructure above noted includes a pair of cross-heads 23, 23 mounted on the upper diametrically reduced ends 22, 22 of the posts 20, 20. The cross-heads 23, 23 extend in parallel relation to the central vertical longitudinal plane x—x of the breaker A above the maximum height attained by the ram-head 11. The cross-heads 23, 23 are transversely bored and bushed to receive trunnions 24, 24 of a compensating or equalizing rocker 25.

As shown in Figs. 4 and 5, the rocker 25 is provided with a pair of spaced breaker elements in the form of parallel downwardly projecting rounded edges 26, 26, which are adapted to engage one side of a billet bar Y to either side of the single breaker element 18 carried by the ram 3, and which is adapted to engage the opposite side of the bar Y intermediate the breaker elements 26, 26.

In accordance with the principles of the present invention, the billet bar Y is scored transversely across one surface thereof, from edge to edge thereof, at relatively spaced points along the length of the bar, as indicated at y, y in Figs. 1, 4 and 5.

The bar Y is adapted to be fed to the breaker A in a plane intermediate that of the upper surface of the breaker element 18 and lower surfaces of the breaker elements 26, 26 carried by the rocker 25. One of the scorings y is adapted to be centered directly above the axis of the intermediate breaker element. Hydraulic pressure is then admitted to the lower end of the cylinder 2, to force the ram 3 and intermediate breaker element 18 upwardly, until the latter makes contact with the lower surface of the bar Y and moves the bar Y upwardly until the upper surface thereof engages the spaced breaker elements 26, 26 on the rocker 25.

The rocker 25 is permitted to adjust itself about the aligned axes of its trunnions 24, 24 and relative to the bar Y, to equalize the pressure exerted against the upper surface of the bar Y by the breaker elements 26, 26 at opposite sides, respectively, of the vertical plane of the scoring y, in which the single intermediate breaker element 18 engages the under surface of the bar Y. Continued upward movement of the ram 3 applies sufficient pressure simultaneously at the three relatively spaced points 18, 26, 26 collectively to cause the bar Y to be snapped along the line of the aligned scoring y and completely through the bar in a plane substantially at right angles to the longitudinal axis of the bar Y, as clearly shown in Fig. 5.

In order to provide sufficient clearance in the under side of the rocker 25, to permit snapping of the bar Y, in the manner noted, a cavity 27 is provided intermediate the breaker elements 26, 26 and the side arms 28, 28 of the rocker 25 from which the trunnions 24, 24 extend.

The hydraulic fluid pressure for raising the ram 3 is admitted to the lower end of the cylinder 2 through pipe 29, in the present instance, from any suitable source of hydraulic pressure, under control of any suitable reversible valve V, see Fig. 1, by which the flow of fluid pressure through the pipe 29 into the lower end of the cylinder 2 may be subsequently cut off and exhaust of the fluid from the lower end of the cylinder effected.

The combined weight of the ram 3 with its loaded center, the ram-head 11, and the weight rings 12, 12 secured to the ram-head 11, returns this assemblage and the breaker element 18 to their normal low position when the valve V is actuated to exhaust the hydraulic fluid pressure from the lower end of the cylinder 2.

In order to maintain the rocker 25 in position to receive the bar Y thereunder, the rocker is maintained resiliently in a normal central position by a pair of springs 30, 30, which encircle a rod 31 at opposite sides respectively of a central lug or bracket 32 formed on or secured to the upper side of the rocker 25. One end of the equalizing rod 31 is connected to a bracket 33, which, in the present instance, spans the space between the two cross-heads 23, 23 and is secured at its opposite ends respectively to said cross-heads by screws 34, 34. The springs 30, 30 yield freely during pressure-equalizing rocking motion of the rocker 25.

As the bar Y snaps under the equalized pressure exerted by the three-point contacts 26, 18, 26, collectively, the billet Y^1 which is thereby broken from the remainder of the bar, drops onto and slides down a chute composed of a pair of aligned inclined surfaces 35 and 36 formed on the anvil support 16 and ram-head 11, respectively, as shown in Fig. 5, the broken-off billets Y^1, Y^1 falling on the floor or into any suitable receptacle, as shown in Fig. 1.

When the bar Y snaps, the end underlying the left hand breaker element 26, as viewed in Fig. 5, is forced upwardly by the rise of the ram 3 and rocks the rocker 25 to force the right hand breaker element 26 downwardly which slaps the broken-off billet Y^1 downwardly against the chute 35—36, thus preventing the billet from being hurled in the air as a result of the sudden snapping of the billet bar.

As shown in Fig. 1, the billet bars Y are adapted to be fed to the breaker A by and along a feed table B, which includes a suitable framework 37 for supporting a series of rollers 38, 38, on which the bars Y, Y rest for longitudinal movement into the breaker A between a pair of suitable guides 39, 39, which are secured to the ram-head 11.

While resting on the roller 38, 38, the scorings y, y are formed in the uppermost surface of the bar Y, by any suitable form of transversely reciprocable means, such as a milling cutter, or, as shown in the present instance, by an acetylene torch 40. Preferably, the torch or other cutter 40 of the scoring device C is rigidly mounted on a slide 41. The slide 41, in turn, is slidably mounted in suitable guideways 42 located at one side of the feed table B.

In order to center the scorings y, y, successively above the lower, intermediate breaker element 18, an adjustable gauge 45 is secured to one of the cross-heads 23, at a distance from the axis of the breaker element 18 equal to the interval between each two scorings y, y, so that when one of the scorings is in registry with the gauge 45, the next preceding scoring will be in registry with the breaker element 18.

If desired, the gauge 45 may also be employed in producing the scorings at equal distances apart, as shown in Fig. 1. Obviously, by producing one scoring y in the bar Y, while another of said scorings is in registry with the gauge 45, and sub-

sequently moving the bar Y longitudinally on the feed table B until the next successive scoring *y* is in registry with the gauge **45**, the bar Y will be set up with respect to the scoring tool **40** in a position to produce a new scoring *y* in the bar Y in proper relation to the preceding scoring formed therein.

If desired, the gauge **45** may be replaced by a pawl **46** pivoted to a cross bar **33***a* spanning the space between the cross-heads **23**, in a manner for the tip of the pawl to drop into the scorings *y*, *y* successively, for registering the scoring successively with the breaker element **18**, as shown in Fig. 6.

I claim:

1. A billet bar breaker comprising two spaced rigidly connected breaker elements operable against one side of the bar, a single intermediate breaker element solely operable against the opposite side of the bar, and means affording relative movement between said two elements about a common pivotal axis intermediate said rigidly connected elements during simultaneous application of pressure to the bar in opposite directions by all three elements collectively.

2. A billet bar breaker comprising two spaced breaker elements operable against one side of the bar, a single intermediate breaker element solely operable against the opposite side of the bar, and rocker means rigidly connecting said two elements and affording relative movement between said two elements about a common pivotal axis intermediate said rigidly connected elements during simultaneous application of pressure to the bar in opposite directions by all three elements collectively.

3. A billet bar breaker comprising two spaced breaker elements operable against one side of the bar, a single intermediate breaker element solely operable against the opposite side of the bar, rocker means rigidly connecting said two elements and affording relative movement between said two elements about a common pivotal axis intermediate said rigidly connected elements during simultaneous application of pressure to the bar in opposite directions by all three elements collectively, a pivot for said rocker, a support for said pivot, a support for said single breaker element, means securing one of said supports in a fixed position, and means for effecting movement of the other support relative to the first support to effect said simultaneous application of pressure to the bar by said three elements.

4. A billet bar breaker comprising two spaced breaker elements operable against one side of the bar, a single intermediate breaker element solely operable against the opposite side of the bar, rocker means rigidly connecting said two elements and affording relative movement between said two elements about a common pivotal axis intermediate said rigidly connected elements during simultaneous application of pressure to the bar in opposite directions by all three elements collectively, a pivot for said rocker, a support for said pivot, a support for said single breaker element, means securing one of said supports in a fixed position, and hydraulic means for effecting movement of the other support relative to the first support to effect said simultaneous application of pressure to the bar by said three elements.

5. A billet bar breaker comprising a vertical cylinder, a ram operable axially in said cylinder, vertically movable single breaker means carried by the upper end of the ram and adapted to exert an upward pressure on the underside of the bar, cooperating breaker means spaced above and laterally at opposite sides solely of the first said breaker means, means for anchoring said cooperating breaker means against bodily upward movement to exert a counteracting downward pressure against the opposite side of the bar, means for admitting fluid pressure to said cylinder to raise said ram therein to effect breaking of a bar by and between said breaker means and for exhausting said fluid pressure from said cylinder to permit said ram to descend in said cylinder, and means attached to the upper end of said ram and depending therefrom outside said cylinder for effecting said descent.

6. A billet bar breaker comprising a vertical cylinder, a ram operable axially in said cylinder, vertically movable single breaker means carried by the upper end of the ram and adapted to exert an upward pressure on the underside of the bar, cooperating breaker means spaced above and laterally at opposite sides solely of the first said breaker means, means for anchoring said cooperating breaker means against bodily upward movement to exert a counteracting downward pressure against the opposite side of the bar, means for admitting fluid pressure to said cylinder to raise said ram therein to effect breaking of a bar by and between said breaker means and for exhausting said fluid pressure from said cylinder to permit said ram to descend in said cylinder, and gravitational weight means attached to the upper end of said ram and depending therefrom outside said cylinder for effecting said descent.

7. A billet bar breaker comprising a vertical cylinder, a ram operable in said cylinder, a head on said ram extending outwardly beyond the periphery of said cylinder, means for admitting fluid pressure to and exhausting the same from the lower end of the cylinder, and weight means encircling said cylinder and secured to said ram-head for solely effecting descent of said ram in said cylinder upon release of said fluid pressure.

8. A billet bar breaker comprising a vertical cylinder, a ram operable in said cylinder, a head on said ram extending outwardly beyond the periphery of said cylinder, means for admitting fluid pressure to and exhausting the same from the lower end of the cylinder, weight means encircling said cylinder and secured to said ram-head for solely effecting descent of said ram in said cylinder upon release of said fluid pressure, a superstructure spaced above said ram-head, upper breaker means carried by said superstructure, and lower breaker means carried by said ram-head for cooperation in breaking a billet bar inserted between said upper and lower breaker means prior to the rise of said ram.

9. A billet bar breaker comprising a rigid base structure, a vertical cylinder secured to said base structure, a ram operable in said cylinder, a head on said ram extending outwardly beyond the periphery of said cylinder, means for admitting fluid pressure to and exhausting the same from the lower end of the cylinder, weight means encircling said cylinder and secured to said ram-head for effecting descent of said ram in said cylinder upon release of said fluid pressure, a superstructure spaced above said ram-head, posts secured to and projecting upwardly from said base structure outside said cylinder through apertures in said ram-head and weight means for supporting said superstructure, upper breaker means carried by said superstructure, and lower breaker means carried by said ram-head for cooperation in breaking a billet bar inserted be-

tween said upper and lower breaker means prior to the rise of said ram.

10. A billet bar breaker comprising a rigid base structure, a vertical cylinder secured to said base structure, a ram operable in said cylinder, a head on said ram extending outwardly beyond the periphery of said cylinder, means for admitting fluid pressure to and exhausting the same from the lower end of the cylinder, weight means encircling said cylinder and secured to said ram-head for effecting descent of said ram in said cylinder upon release of said fluid pressure, a superstructure spaced above said ram-head, posts secured to and projecting upwardly from said base structure outside said cylinder through apertures in said ram-head and weight means for supporting said superstructure, upper breaker means carried by said superstructure and comprising a pair of breaker elements spaced apart and located at opposite sides respectively of the vertical axis of the ram, and lower breaker means carried by said ram-head for cooperation in breaking a billet bar inserted between said upper and lower breaker means prior to the rise of said ram.

11. A billet bar breaker comprising a rigid base structure, a vertical cylinder secured to said base structure, a ram operable in said cylinder, a head on said ram extending outwardly beyond the periphery of said cylinder, means for admitting fluid pressure to and exhausting the same from the lower end of the cylinder, weight means encircling said cylinder and secured to said ram-head for effecting descent of said ram in said cylinder upon release of said fluid pressure, a superstructure spaced above said ram-head, posts secured to and projecting upwardly from said base structure outside said cylinder through apertures in said ram-head and weight means for supporting said superstructure, upper breaker means carried by said superstructure and comprising a pair of breaker elements spaced apart and located at opposite sides respectively of the vertical axis of the ram, a rocker pivoted in said superstructure in the plane of the vertical axis of the ram and carrying said pair of breaker elements in said spaced relation, and lower breaker means carried by said ram-head for cooperation in breaking a billet bar inserted between said upper and lower breaker means prior to the rise of said ram.

12. A billet bar breaker comprising a rigid base structure, a vertical cylinder secured to said base structure, a ram operable in said cylinder, a head on said ram extending outwardly beyond the periphery of said cylinder, means for admitting fluid pressure to and exhausting the same from the lower end of the cylinder, weight means encircling said cylinder and secured to said ram-head for effecting descent of said ram in said cylinder upon release of said fluid pressure, a superstructure spaced above said ram-head, posts secured to and projecting upwardly from said base structure outside said cylinder through apertures in said ram-head and weight means for supporting said superstructure, upper breaker means carried by said superstructure and comprising a pair of breaker elements spaced apart and located at opposite sides respectively of the vertical axis of the ram, a rocker pivoted in said superstructure in the plane of the vertical axis of the ram and carrying said pair of breaker elements in said spaced relation, and lower breaker means carried by said ram-head for cooperation in breaking a billet bar inserted between said upper and lower breaker means prior to the rise of said ram, and resilient means carried by said superstructure for maintaining said rocker in a normal position with said spaced breaker elements substantially horizontal above said lower breaker means to receive the billet bar between said upper and lower breaker means.

13. A billet bar breaker comprising upper and lower breaker elements spaced apart vertically to receive the bar therebetween, a feed table extending laterally from said breaker for supporting the bar in a plane to pass between said upper and lower breaker elements, said bar being prescored transversely at spaced intervals longitudinally where the breaks in the bar are to be made, and a gauge carried by the breaker for registry with one of said scorings of a bar resting on said feed table to effect registration of another of said scorings with one of said breaker elements said gauge being arranged in advance of and in fixed horizontally spaced relation to the last said breaker element.

14. A billet bar breaker comprising upper and lower breaker elements spaced apart vertically to receive the bar therebetween, a feed table extending laterally from said breaker for supporting the bar in a plane to pass between said upper and lower breaker elements, said bar being prescored transversely at spaced intervals longitudinally where the breaks in the bar are to be made, means along said feed table in advance of said breaker for producing said scorings on the bar prior to feeding the bar into the breaker, and a gauge carried by the breaker for registry with one of said scorings of a bar resting on said feed table to effect registration of another of said scorings with one of said breaker elements.

15. A billet bar breaker comprising a pivoted rocker, a pair of breaker elements formed integrally with said rocker at opposite sides respectively of the rocker pivot for operation in one direction against one surface of the bar, and a single intermediate breaker element solely operable in the opposite direction against the opposite surface of the bar in the plane of the rocker pivot.

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