Oct. 25, 1932. E. T. PETERSON 1,884,196

PRESS

Filed May 29, 1930 3 Sheets-Sheet 1

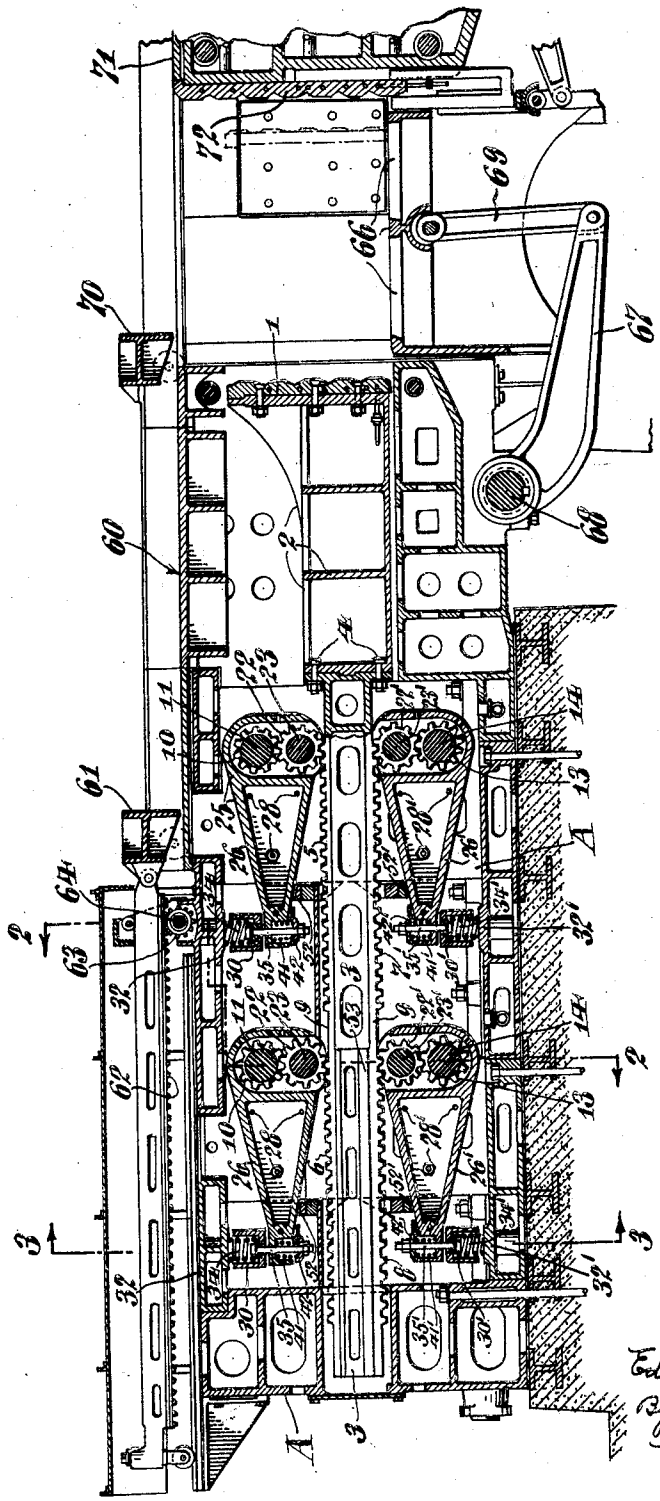


Fig. 1.

INVENTOR.
Edward T. Peterson
By Cyrus N. Anderson
Attorney

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PRESS

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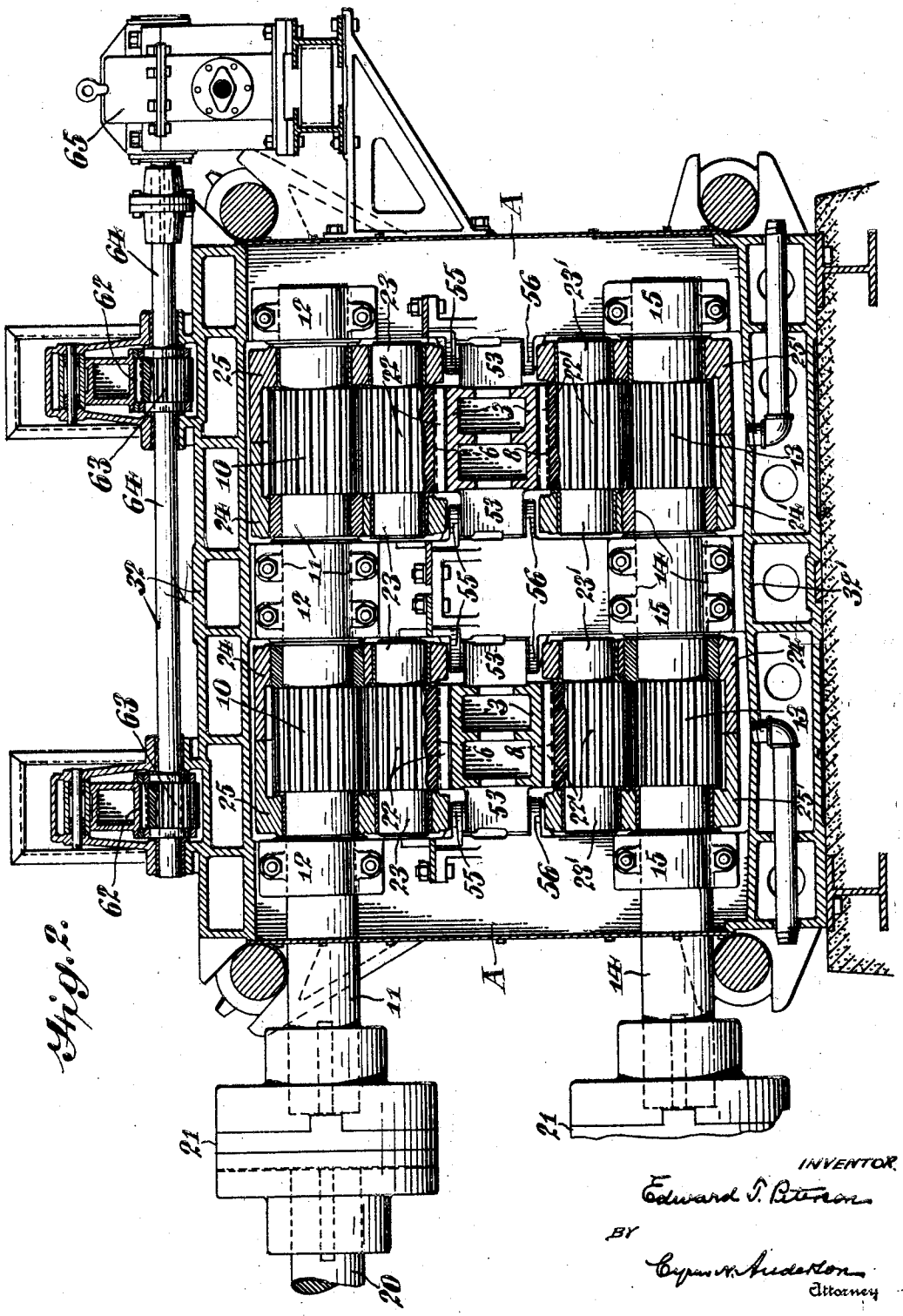


Fig. 2.

INVENTOR.
Edward T. Peterson
BY
Cyrus N. Anderson
Attorney

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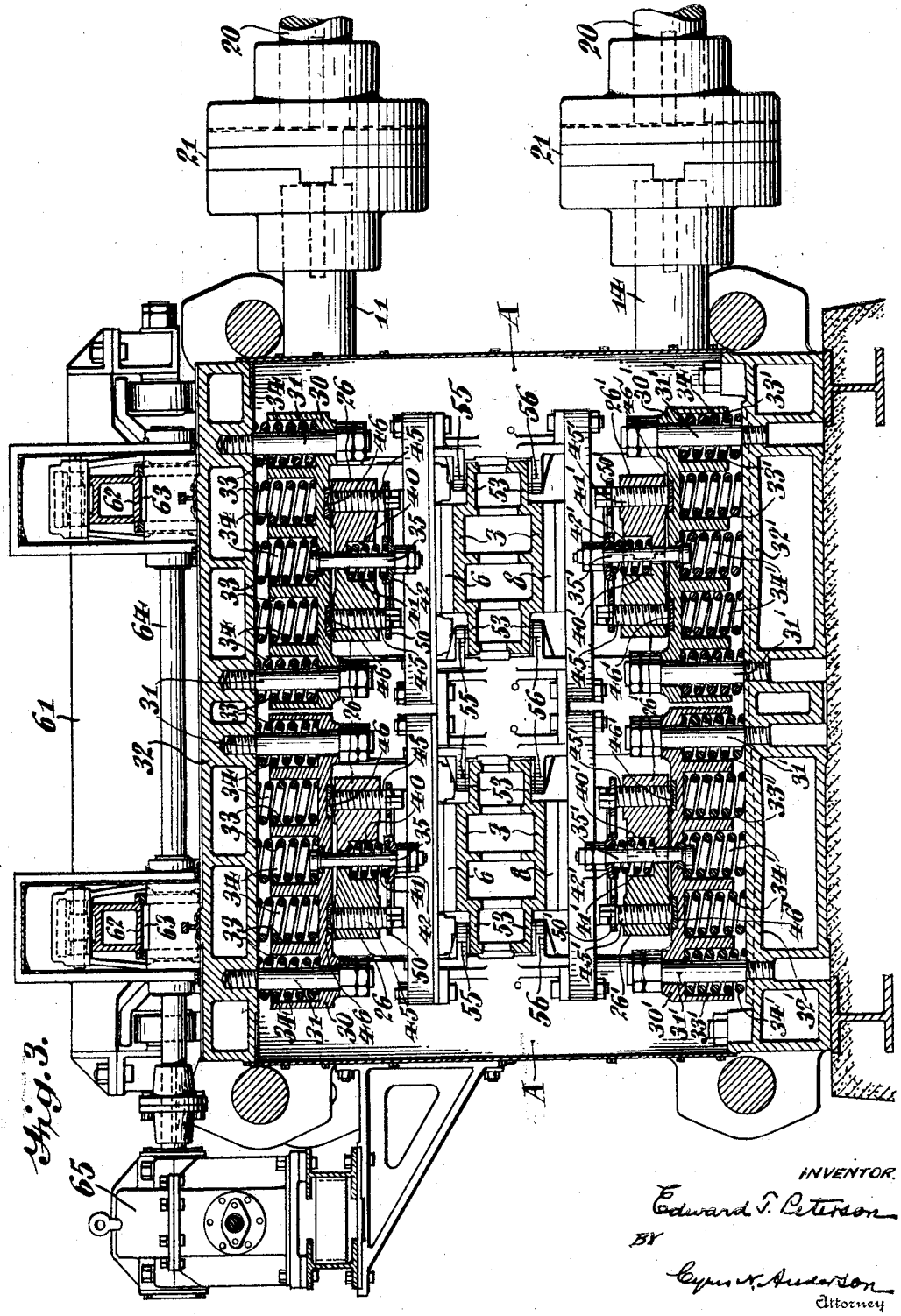


Fig. 3.

INVENTOR.
Edward T. Peterson
BY
Cyrus N. Anderson
Attorney

Patented Oct. 25, 1932 1,884,196

UNITED STATES PATENT OFFICE

EDWARD T. PETERSON, OF READING, PENNSYLVANIA, ASSIGNOR TO BIRDSBORO STEEL FOUNDRY AND MACHINE COMPANY, OF BIRDSBORO, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

PRESS

Application filed May 29, 1930. Serial No. 456,901.

My invention relates to presses in the operation of which forces for exerting great pressures are employed; for example, in the pressing and squeezing of ingots of iron where very high pressures are required. It is obvious that the co-action of a single gear with a single rack for the exertion of great pressure would require a gear and rack of large dimensions which would involve not only relatively great expense of construction but also would involve difficulty in the handling of the parts of the press.

It is an object of my invention to provide a press embodying a novel construction including means of such character that great forces may be applied to the compressing ram of the press without the necessity of employing parts or elements of a size such that they may not be handled readily and also of a size such that the cost of the manufacture and installation of a press would be greatly enhanced.

It also is an object of my invention to provide means of novel construction including a plurality of ram driving units in combination with means whereby the respective driving units for actuating the ram are yieldingly related to the ram, each driving element yielding independently of every other driving element.

It is a further object of my invention to provide a construction in which each driving unit for actuating the ram of the press comprises a driving and a driven gear, the latter being supported by a yielding frame or support and engaging a rack having connection with the ram of the press.

A further object of the invention is to provide a plurality of driving units in combination with means whereby the pressures or forces exerted by the said units may be automatically equalized.

Other objects and advantages of the invention will be pointed out in the detailed description thereof which follows or else will be apparent from such description.

In order that the invention may be readily understood and its practical advantages fully appreciated reference should be had to the accompanying drawings wherein I have illustrated an embodiment of the invention in the form which at present is preferred by me.

In the drawings:

Fig. 1 is a view in longitudinal sectional elevation of a portion of an ingot press containing the means embodying my invention;

Fig. 2 is a transverse sectional view taken in part in the two planes indicated by the line 2—2 of Fig. 1; and

Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 1.

As has been indicated already, the invention relates to improvements in what are known as ingot presses and in order that the invention may be more readily understood and its purpose and function more fully appreciated I have shown in addition to the mechanism or means embodying the invention other portions of such a press in order that the operation of the means of the invention may be described satisfactorily.

In the drawings I have shown a suitable framework designated as a whole by the letter A within and upon which other parts of the operating mechanism of the press including the means of my invention are supported.

In the drawings I have shown a ram comprising a head 1 mounted upon the front end of a supporting frame portion 2 which is connected at its rear end to the front ends of two racks bars 3. Each of these rack bars is provided with flanges at its front end through which fastening bolts 4 extend for fastening the same to the rear end of the frame 2. Each of the rack bars is provided with two groups of teeth 5 and 6 upon its upper side and two groups of teeth 7 and 8 upon its lower side. The two groups of teeth upon the upper and lower sides of the rack bars are separated or spaced from each other as indicated at 9. For the purpose of reciprocating the rack bars to cause movement of the compressing head 1 inwardly and outwardly I have provided a plurality of actuating units having parts which engage respectively with the groups of teeth 5, 6, 7 and 8 of the rack bars 3. In the construction as illustrated there are two of these rack bars arranged in spaced parallel relation to each other as is indicated in Figs. 2 and 3 of the

drawings, but if desired a single rack bar may be employed. The construction of all of these units is the same. The actuating units for causing reciprocation of the rack bars 3 and 4 to operate the compressing means are located in adjoining relation to the top and bottom sides of the said bars. Each of the units which is provided with means for engaging the teeth upon the top sides of the rack bars 3 is provided with upper gears 10 which are supported upon shafts 11 which extend across the frame A and are supported in bearings 12. The bearings for only one of the shafts 11 are shown but the other of said shafts 11 is supported in similar bearings. The actuating units having means in engagement with the groups of teeth 7 and 8 upon the bottom sides of the racks 3 are provided with gears 13, similar to the gears 1, which are mounted upon shafts 14 which also extend crosswise of the frame A and are supported in bearings 15. The gears 10 and 13 and the shafts 11 and 14 are identical in every respect except that they occupy different relative positions with respect to the rack bars 3. The several shafts 11 and 14 are driven by any suitable power means, not shown. The driving shafts 20 which are connected to and are driven by the power means are connected respectively to the ends of the shafts 11 and 14 by coupling means 21.

The gears 10 upon the shafts 11 are rotated in clockwise direction when it is desired to cause inward movement of the rack bars 3 to effect a compressive movement of the compressing head 1 of the ram. When it is desired to retract or withdraw the said head the said gears 10 and the shafts upon which they are mounted are rotated in anti-clockwise direction.

The gears 10 are in engagement respectively with gears 22 which respectively engage the groups of teeth 5 and 6 upon the top sides of the rack bars 3. These gears 22 are mounted upon short shafts 23 the opposite ends of which are journaled in the opposite sides of a casing or frame made up of two parts 24 and 25, as indicated in Fig. 2 of the drawings. The parts 24 and 25 of these casings are provided with rearwardly extending arms 26 which are fastened together in any suitable manner as by bolts 28. The casings made up of the parts 24 and 25 are pivotally mounted upon the shafts 11 and are adapted to swing thereon about a horizontal axis co-incidental with the axes of the said shaft 11. The lower ends of the said casings are open in order that the gears 22 may project therefrom and engage with the series of rack teeth 5 and 6. The driving of the shafts 11 causes rotation of the gears 10 to cause rotation of the gears 22.

It will be apparent that upon the application of force through the gears 10 and 22 to drive the rack bars 3 to effect an inward or forward movement of the said rack bars a force of reaction is imposed upon the arms 26, which, being fastened together, act as a single arm tending to cause upward movement of the rear ends thereof. For the purpose of resisting upward swinging movement of the said arms I have provided blocks 30 which are located above and extend crosswise of the rear end of the said arms 26. These blocks are slidably supported upon bolts 31 which depend from a stationary support 32, which is a part of the frame structure of the machine. The blocks 30 are each provided with pockets 33 in the upper sides thereof within which coiled springs 34 are located. The lower ends of these springs are seated upon the bottoms of the pockets 33 while the upper ends thereof are seated against the under side of the support 32 from which the block 30 is suspended by means of the bolts 31. The springs 34 are under compression and their tendency is to expand. The blocks 30 are yieldingly connected to the rear ends of the arms 26 by means of bolts 35 which extend through holes provided at the middle parts of the blocks 30 and through holes which include the dividing line between the arms 26. The holes through which the bolts 35 extend terminate at their lower ends in enlarged pockets 40 within which springs 41 are located, the said springs being compressed and having a tendency to expand. The upper ends of the said springs are seated against the bottoms of the pockets 40 while the lower ends thereof are seated against washers 42 which are retained upon the lower ends of the said bolts. The tendency of the said springs 40 to expand assists in holding the blocks 30 and the arms 26 in contact with each other. The blocks 30 are supported against the upper ends of screw-threaded pins or bolts 45 which upper ends engage wearing plates of hard metal 46 provided in seats upon the under sides of the said blocks. The supporting pins or bolts 45 are adjustable relatively to the arms 26 and after having been adjusted to the positions desired are held in such positions by means of the plates 50 which are provided with squared openings in their opposite ends through which openings the squared lower ends of the bolts or pins 45 extend. The plates 50 are retained in position upon the bolts or pins 45 by means of cotter pins. It will be apparent that the bars 30 are yieldingly held in relation to the arms 26. As previously indicated, each couple of arms 26 constitutes in effect a single arm.

The construction of the actuating units which are located below the bottom sides of the rack bars 3 is substantially identical with that of the units located above the said rack bars which have been described. The actuating units which are located below the rack bars comprise in addition to the gears 13 previously referred to, which are mounted on

the shafts 14, gears 22′ which are mounted upon short shafts 23′ the opposite ends of which are journaled in the opposite sides of a casing or frame comprising two parts 24′ and 25′. These parts 24′ and 25′ are provided with rearwardly extending arms 26′ which are connected together by any suitable means as by bolts 28′. Blocks 30′ are located underneath the rear ends of the pairs of arms 26′. These blocks are mounted upon vertical bolts or posts 31′ which are mounted at their lower ends in an abutment 32′ which is a part of the frame of the structure. The blocks are retained upon these bolts or posts by nuts upon the upper ends of the said bolts or posts as shown. Each of the said blocks is provided in its bottom sides with holes or pockets 33′ within which are located coiled springs 34′ the upper ends of which are seated against the bottoms of the said holes or pockets 33′ while the lower ends thereof are seated upon and are supported by the abutment 32′. These springs are normally under compression and hold the blocks 30′ in their uppermost position against the under sides of the nuts upon the tops of the bolts or posts 31′. Bolts 35′ extend through holes midway of the opposite ends of the blocks 30′ and also through holes provided in the arms 26′. The last named holes open into enlarged openings or pockets 40′ within which are located springs 41′ the upper ends of which are seated against washers 42′ while the lower ends thereof are seated against the bottoms of the enlarged openings 40′. The washers 42′ are held in place by nuts upon the upper ends of the said bolts 35′. The springs 41′ are under compression and assist in holding the rear ends of the arms 26′ and the blocks 30′ in contactual relation with respect to each other. The arms 26′ are provided at their rear ends with screw-threaded bolts or pins 45′ the lower ends of which contact with wear plates or blocks 46′ provided in shallow depressions constituting seats in the upper sides of the block 30′. The screw-threaded bolts or pins 45′ are adjustable and after having been adjusted to the positions desired are held in such positions by plates 50′ the opposite ends of which are provided with polygonal openings with which the polygonal shaped upper ends of the adjustable bolts or pins 45′ are in engagement.

Upon reference to Fig. 1 of the drawings it will be apparent that when the rack bars 3 are to be driven toward the right in said figure to effect compression or squeezing of an ingot of iron or other metal or other substance the gears 13 and the shafts 14 are rotated in anti-clockwise direction to cause rotation of the gears 22′ in clockwise direction. These gears 22′ are in engagement with the groups of rack teeth 7 and 8.

Any suitable means may be employed for effecting rotation of the gears 10 and 13 first in one direction and then in another to effect reciprocating movements of the rack bars 3 to in turn actuate the head 1 by which the compression or squeezing of the ingot of iron or other substance is effected. Although not shown a reversible motor or motors may be employed for that purpose. Swinging movement of the arms 26 toward the rack bars 3 is limited by the stationary stops 52 while similar stops 52′ limit the swinging movement of the arms 26′ toward the said rack bars.

For the purpose of supporting and guiding the rack bars 3 I have provided upon opposite sides of the said bars elongated projections 53 which extend lengthwise thereof and which are held and guided between upper and lower guides 55 and 56. These guides are arranged in pairs, as shown in Fig. 2 of the drawings, one guide of one pair being located upon the upper side of a projection 53 and the other guide of the same pair being located upon the lower side thereof.

In the operation of the apparatus the spongy material to be compressed or squeezed may be placed upon a table 60 whereupon a pusher head 61 is actuated and moved toward the right, having reference to Fig. 1 of the drawings, over the said table 60 to move the said material from the said table. The pusher head 61 is mounted upon the front ends of rack bars 62 which are actuated by means of gears 63 mounted upon the shaft 64 rotation of which is effected by any suitable means, as by gearing, not shown, located within a casing or housing 65. The material is delivered from the table 60 onto a platform or support 66 which is adapted to be moved up and down in the chamber of the press within which the compressing and squeezing of the spongy material of iron or other substances takes place. Vertical up and down movements of the support 66 are effected by means of levers 67 (only one of which is shown) which are supported above and upon a rock shaft 68. Links 69 (only one of which is shown) have connection at their lower ends with the front swinging ends of the levers 67 and at their upper ends to the support 66. The swinging movements of the levers 67 acting through the links 69 cause vertical movements of the support 66 so as to move the latter into position in the plane of the table 60 to receive the material which may be discharged from the said table. The support 66 should arrive in its uppermost position before movement of the pusher bar 61 pushes material from the table 60 in order that a pusher bar 70 may remove from the support 66 any ingot which may be thereon and which may have been compressed or squeezed. The bar 70 removes any ingot which may be upon the support 66 onto a table 71 which preferably should occupy the same plane as that in which the said table 60 is located.

The pusher bars 61 and 70, the mechanism for operating the same and the means including the arms 67, rock shaft 68 and links 69 for raising and lowering the support 66 are of known construction and constitute parts of machines for pressing ingots of iron, steel or any other substance. Hence it is deemed to be unnecessary to illustrate the construction as it pertains to these parts in greater detail or to describe the same more at length.

It may be noted that in addition to the compressing head 1 other compressing means may be employed in presses of this character for effecting a compressing and squeezing action in directions substantially at right angles to that in which the compression of the head 1 is effected.

The head 1 presses any ingot which may be present upon the support 66 against the opposing side 72 of the compression chamber.

It will be seen that by my invention I have provided a plurality of mechanical units which are adapted to operate and apply force simultaneously to the rack bars for moving the same forward to actuate the plunger of the press to effect a squeezing or compressing action upon an ingot or block of iron, steel or other substance. By thus providing a plurality of units I am enabled to apply a resultant force of the required magnitude to the plunger for compressing metal ingots without the necessity of employing driving means for the plungers of relatively large dimensions. The employment of a plurality of units or means for engaging and driving the respective rack bars for actuating the ram of the press necessitates the employment or use of means to prevent an excessive stress upon the force applying means of any one of the units. To that end the element or part of each unit which is in engagement with a rack bar and by and through which force is transmitted to the said bar is movably supported, the said movement being a swinging one in the construction illustrated. Any such movement during the application of force to effect a compressing action of the plunger is effected in opposition to the resistance of the springs 34 or 34′ as the case may be. But for the presence of some such protective and safety means it might happen that under certain conditions an unusual and excessive force generated by the power means for operating the press might be applied through a single unit, due to the presence of an unusual and excessive resistance encountered. Such an occurrence might and probably would result in a breaking of some part of the said unit or other part of the press. For example, assume that there should be an irregularity in the formation of the teeth of the gears of a unit or of the teeth of a group of teeth upon a rack bar, such irregularity might, except for the presence of the means for providing a yielding of the gear of that unit in engagement with the teeth of the rack bar, impose an extraordinary and excessive force upon such unit. However, under the conditions stated the springs 34 or 34′ as the case might be, which are associated with such unit, will yield so that such unit will not exert more than its proper proportion of the whole force applied to the plunger to effect a compression movement thereof. In other words, the embodiment of the yielding means in association with the respective units for actuating the plunger of the press operates to cause an equalization of the forces exerted by the said units, in case an extraordinary and excessive resistance is encountered, so that no unit is required to perform more work or to exert any greater force in the operation of the press than any other unit. By the means of my invention an equalization of the forces applied by the several units is maintained at all times.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a press of the character described the combination with a ram of a plurality of units arranged lengthwise of said ram for actuating the same, each of said units including independently functioning yielding means.

2. In a press of the character described the combination of a ram, a plurality of units for causing reciprocatory movements of said ram, each unit including a gear which is mounted to rotate and move bodily, and yielding means for permitting bodily movement of the said gear in one direction.

3. In a press of the character described, the combination of a ram having a rack bar connected therewith, a plurality of means arranged lengthwise of and engaging the said rack bar for actuating the same in a direction to cause a compressive movement of the said ram, and separate means associated with each of said plurality of means for permitting yielding movement of the said rack bar engaging means.

4. In a press of the character described the combination of a ram having a rack bar, a plurality of units for actuating the said ram, said units being located at different points lengthwise of the said rack bar, each unit including a gear in engagement with the said rack bar, pivoted means for supporting the said gear, and yielding means tending to prevent movement of the said support in one direction.

5. In a press of the character described the combination of a ram having a rack bar, means for actuating the said rack bar, said means including a gear in engagement with the said bar, pivotal means for supporting the said gear, an arm extending horizontally from the said pivoted supporting means, means for preventing movement of the said arm in one direction, and yielding means for

permitting while resisting movement of the opposite direction.

6. In a press of the character described the combination of a ram provided with a rack bar, a plurality of units located at different points lengthwise of the said rack bar, each unit having means in engagement with the said rack bar for actuating the latter to effect compressive movement of the said ram, pivoted supports for the said means, arms extending horizontally from the said supports, and yielding means resisting but permitting movement of the said arms in one direction.

7. In a press of the character described the combination of a ram having a stem, a plurality of separate and independent means in engagement with opposite sides of the said stem for actuating the said ram to compress an object within the press, said means being arranged lengthwise of said stem, and means for equalizing the forces exerted by the said independent ram actuating means.

8. In a press of the character described the combination of a ram having a stem having teeth upon opposite sides thereof, a plurality of units located upon opposite sides of the said stem at different points lengthwise of the latter for actuating the said ram, each of said units having a gear in engagement with teeth upon the adjoining portion of the said stem, a pivotal support embodied in each of said units for supporting the gear of said unit, means for driving each of said gears to actuate the said ram, and means associated with each unit for permitting independent yielding movement of the gear thereof with respect to the gears of other units.

9. In a press of the character described the combination of a ram having a plurality of stems projecting rearwardly therefrom, each of said stems having teeth upon opposite sides thereof, a plurality of mechanical units located at different points lengthwise of the said stems for actuating the said ram, each of said units comprising a gear in engagement with teeth upon the said stems, pivoted means for supporting said gears, each pivoted means having an arm projecting rearwardly therefrom, means for limiting movement of said arm in one direction, and yielding means for resisting while permitting movement of the said arm in the opposite direction.

10. In a press of the character described the combination of a ram having a rack bar extending rearwardly therefrom, said rack bar having teeth upon the top and bottom sides thereof, means for supporting and guiding the said rack bar, a plurality of units located above and below the said rack bar in positions lengthwise of the latter for actuating the said ram, a plurality of shafts extending transversely of the said press, said shafts being rotatable, a gear mounted on each shaft, said gear constituting a part of each actuating unit, a gear in each unit interposed between said first named gear and the said rack, means pivotally mounted upon the said shaft for supporting the second named gear of each unit, each of said means having arms extending laterally therefrom in directions substantially parallel with the said rack bar, and yielding resistance means for permitting the said arms to swing in directions away from the said rack bar to relieve any extraordinary resistance which may be encountered by the second named gear of any one of the said units.

11. In a press of the character described the combination of a ram, a plurality of separate and independent means arranged lengthwise of said ram for actuating the same to compress an object within the press, and means for equalizing the forces exerted by the said independent ram actuating means by yielding of one actuating means without yielding of the other.

12. In a press of the character described the combination of a ram, a plurality of units for causing reciprocatory movements of said ram, each unit including a gear which is swingingly mounted to oscillate bodily, and yielding means for permitting swinging movement of the said gear.

13. In a press of the character described the combination of a ram, a bar therefor having a rack surface and a pair of driving mechanisms for the bar placed at different positions along the length of the bar and each comprising a gear engaging the bar, rotatable about its own axis and revoluble about an axis spaced from its axis to swing in a direction generally tangential to the rack, separate driving means for the two gears and resilient retarding means for resisting the swinging movement whereby independently the two gears are free to swing one without the other or both together to resiliently take up lost motion in the driving of the ram.

14. In a press of the character described, a ram, a rack bar for driving the ram and having rack surfaces on opposite sides of the bar, gears on opposite sides of the rack bar engaging the rack surfaces, driving means for said gears turning them about their axes to drive the ram, rocking supports for said gears rocking about the axes outside of their centers and swinging them across the rack surfaces, and resilient means for supporting the gears to resist the rocking movement, adapted to provide independent rocking of said gears whereby the gears are resiliently adapted to take up lost motion and work together.

15. In a press of the character described, a ram having a rack bar extending rearwardly therefrom having teeth on opposite sides, means for supporting and guiding the rack bar, gears for engaging opposite sides of the rack bar and centered to swing about sup-

ports outside of their own axes, driving gears for the engaging gears, frames supporting and swinging the gears, and spring supports for the frames to restrain them from the swinging movement retracting the ram.

16. In a press of the character described, a ram having a rack bar extending rearwardly therefrom having teeth on opposite sides, means for supporting and guiding the rack bar, gears engaging the rack bar at different points and adapted to swing across the teeth on the rack bar about the axes outside of the gear axis and spring means acting upon a leverage larger than the difference between the axes and retarding retracting movement of the ram.

17. In a press of the character described, a ram having a rack bar extending rearwardly therefrom having teeth on opposite sides, means for supporting and guiding the rack bar, gear driving means for the rack bar engaging opposite sides of the bar, and a spring for each driving means retarding in the direction of the length of the bar against lengthwise retractive bodily movement of the gears of the gear driving means.

18. In a press of the character described, a ram having a rack bar extending rearwardly therefrom having teeth on opposite sides, means for supporting and guiding the rack bar, and a plurality of separate gear driving means for the bar spring retarded against bodily movement across the teeth of the bar and adapted to move bodily at the same time in the same direction against the spring retardation.

In testimony that I claim the foregoing as my invention I have hereunto signed my name this 27th day of May, A. D., 1930.

EDWARD T. PETERSON.