T. F. BAILY.

ELECTRIC POWER HAMMER.

APPLICATION FILED MAY 19, 1909.

930,022. Patented Aug. 3, 1909.

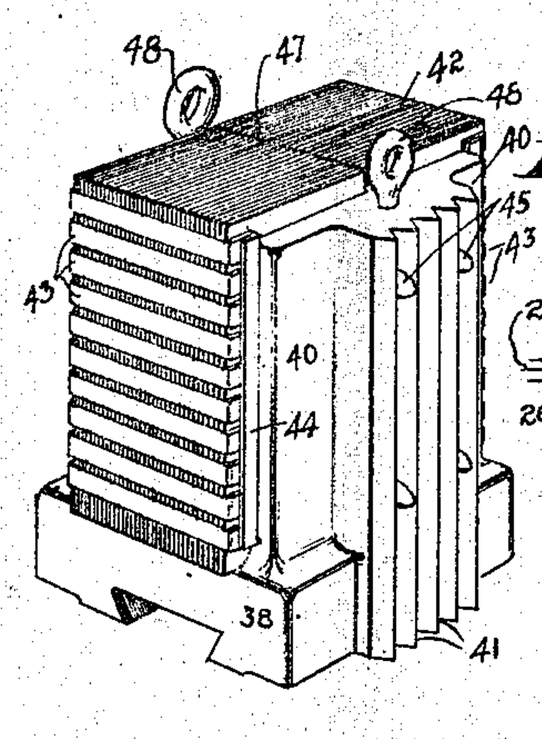

Fig. 3.

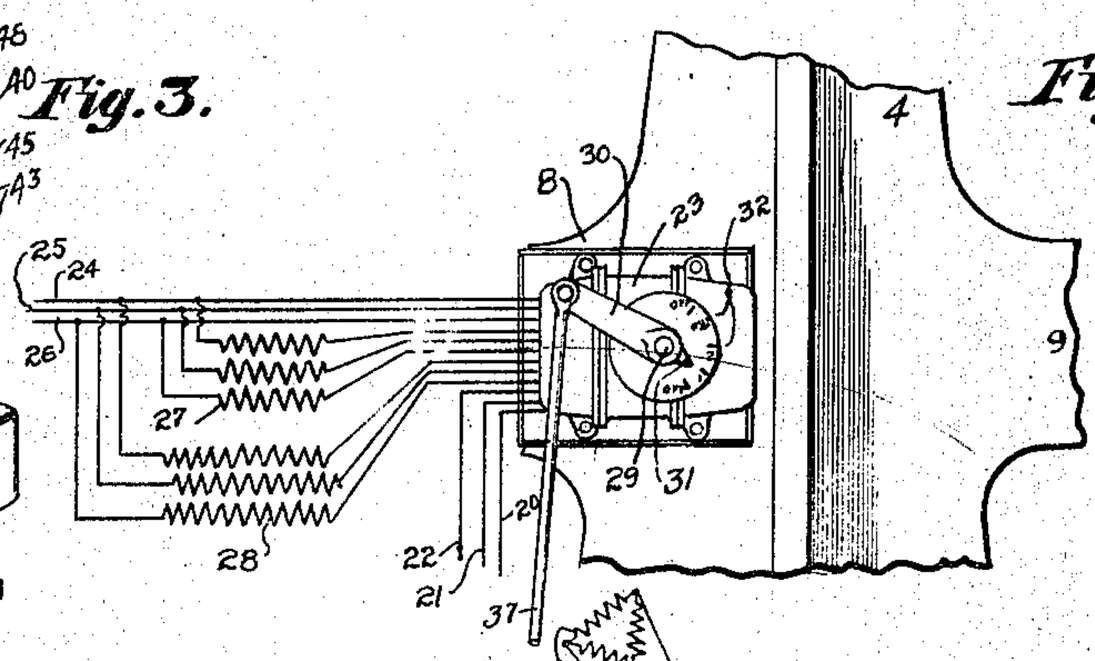

Fig. 4.

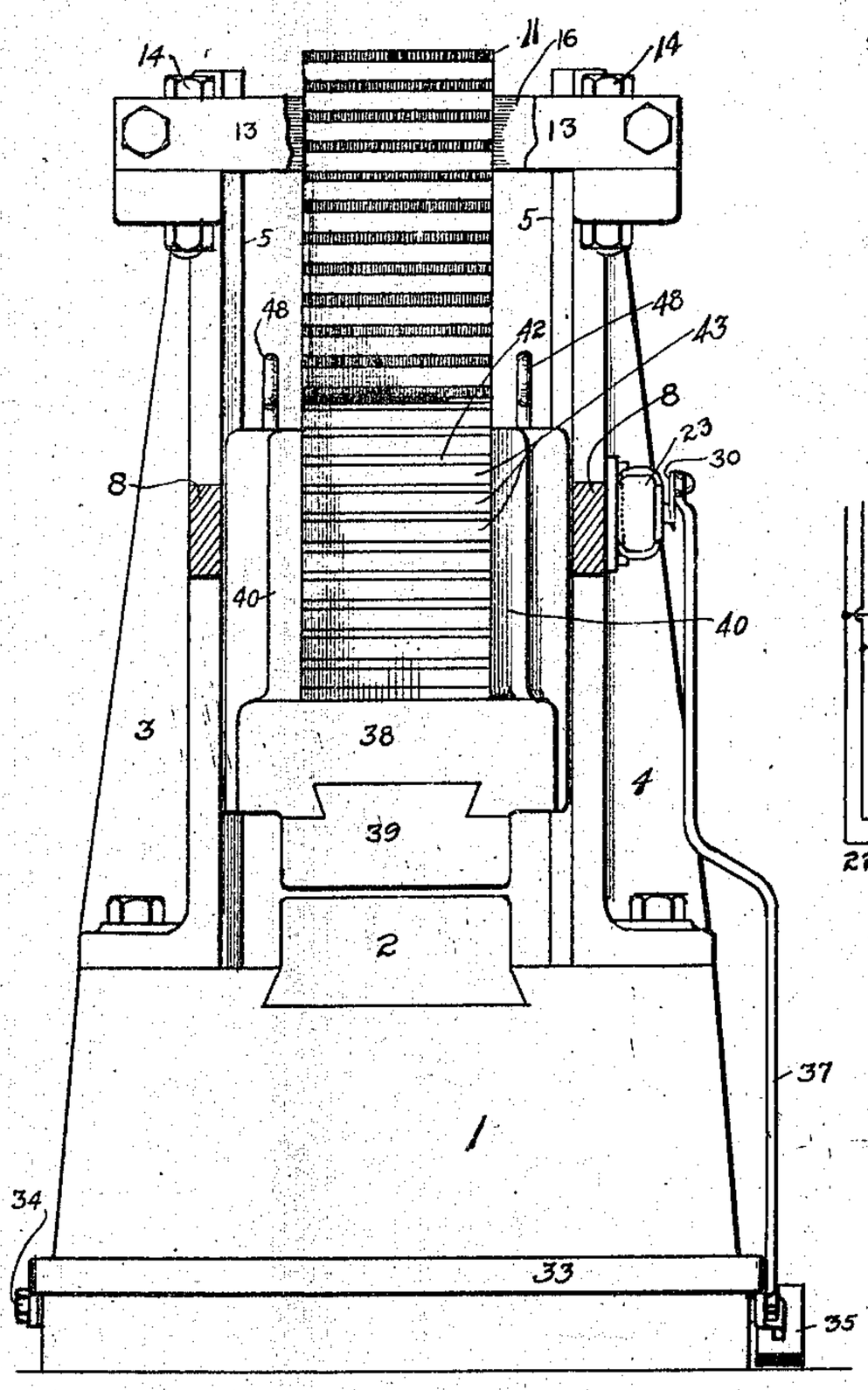

Fig. 1.

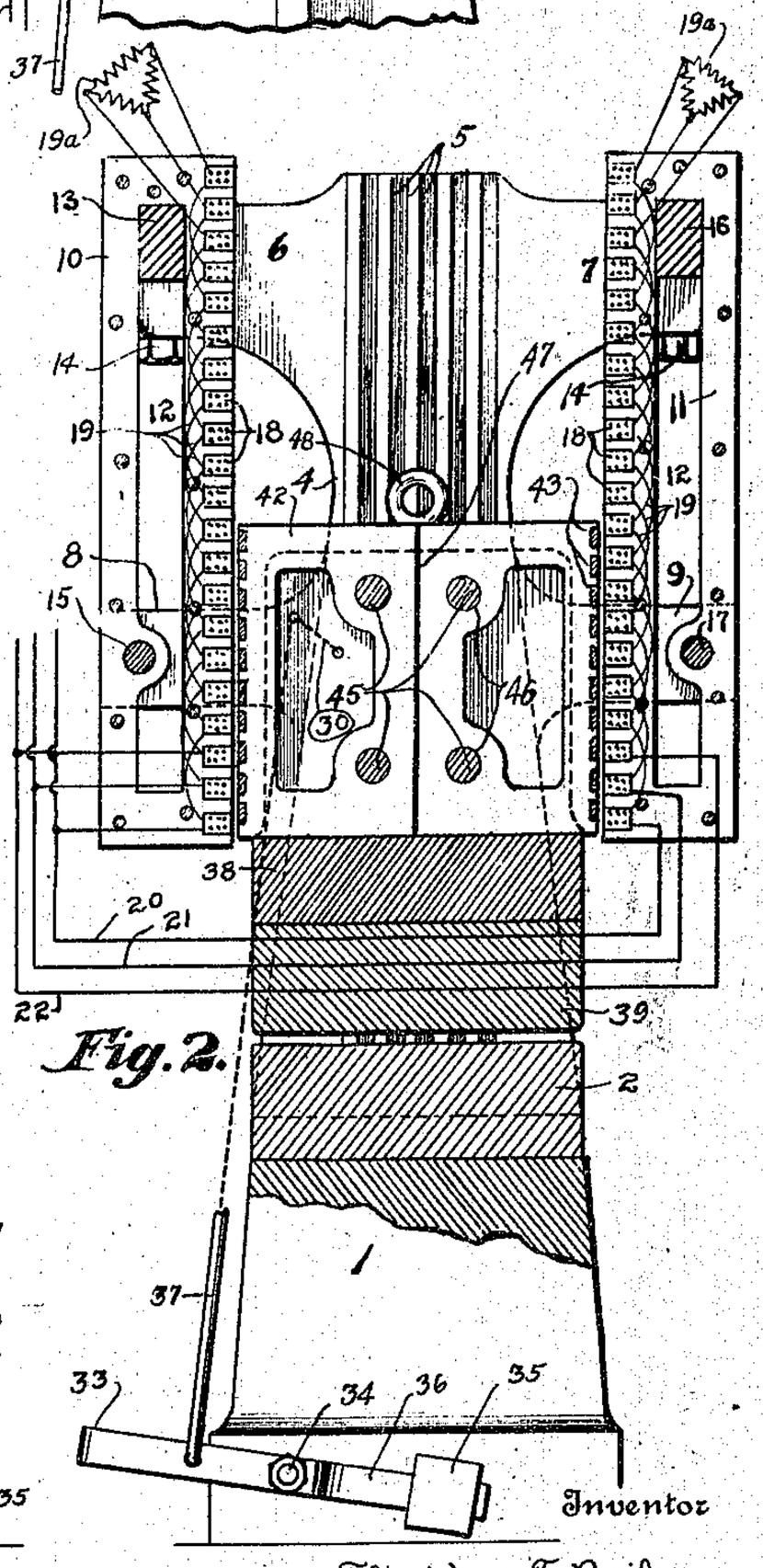

Fig. 2.

Witnesses

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UNITED STATES PATENT OFFICE.

THADDEUS F. BAILY, OF ALLIANCE, OHIO, ASSIGNOR OF ONE-HALF TO THE TRANSUE & WILLIAMS COMPANY, OF ALLIANCE, OHIO, A CORPORATION OF OHIO.

ELECTRIC POWER-HAMMER.

No. 930,022. Specification of Letters Patent. Patented Aug. 3, 1909.

Application filed May 19, 1909. Serial No. 497,079.

To all whom it may concern:

Be it known that I, THADDEUS F. BAILY, a citizen of the United States, residing at Alliance, in the county of Stark and State of Ohio, have invented a new and useful Electric Power-Hammer, of which the following is a specification.

My invention relates to improvements in power-hammers adapted for use in forging and other work requiring the use of a hammer adapted to yield blows of varying intensity as the nature of the particular work to be done may require, and has peculiar reference to such a device as that mentioned in which an alternating electric current is used to supply the power for its operation.

The objects of my improvement are to provide an electric power-hammer adapted to be operated by an alternating current, the hammer being of peculiarly simple, compact and durable construction, which will be efficient and which may be fully and easily controlled.

One of the important objects of the invention especially to be noted is to do away with the piston rod or other intermediate connecting means between the ram and that movable portion of the construction to which the power is applied. Heretofore much annoyance has been caused the users of power hammers by the wearing or breaking of the said piston rod or connecting means. In the construction hereinafter set forth it will be noted that all of the annoying difficulties heretofore experienced by reason of the so called piston head construction are wholly obviated.

These objects, together with other objects readily apparent to those skilled in the art, I accomplish by the construction illustrated in the accompanying drawing, in which—

Figure 1 is a front elevation of an electric power-hammer embodying my invention, parts including the front primary coils being broken away to more fully disclose the construction. Fig. 2 is a view partly in transverse vertical section of the hammer illustrated in Fig. 1. Fig. 3 is a perspective view of the ram. Fig. 4 is an enlarged fragmentary view illustrating a portion of the frame of the device with the controller arranged thereon and illustrating a portion of the wiring.

Throughout the several views similar numerals of reference indicate similar parts.

The numeral 1 indicates the base of the hammer which may be of the form illustrated and preferably of considerable weight and of great strength. Upon the base 1 is suitably arranged in any desired mechanical manner the anvil 2 upon which the work is intended to be laid. Mounted upon the base 1 and connected thereto on both sides of the anvil 2 are the vertical frame pieces 3 and 4, the inner sides of which are arranged in parallel relation to each other and provided with the vertical parallel grooves and ridges 5 adapted to guide the ram in the manner hereinafter to be more fully described. Formed integrally with the vertical frame pieces are the forwardly and rearwardly extending arms 6 and 7 at the top and 8 and 9 intermediate the top and the base 1. The purpose of the said arms is to support the laminated pole pieces upon which the primary coils are arranged.

The front laminated pole piece 10 and the rear laminated pole piece 11 are of substantially the same construction. Each piece consists of a built up or laminated structure, each of the laminations being preferably stamped from sheet metal and of the form illustrated in Fig. 2. When completed each pole piece presents an inner, flat, vertically disposed face in which are cut transverse grooves vertically spaced from each other and adapted to receive the primary coils. It may also be desirable to arrange the pole pieces with the vertically disposed slots 12. From one arm 6 to the other arm 6 extends the front pole piece supporting bar 13, which extends through the said pole piece transverse to the laminations and may be located at the top end of the slot 12 if desired. The bolts 14 extend vertically through the bar 13 and the arm 6 for the purpose of securing the said bar to the said arms. Extending through the pole pieces from side to side and transversely with reference to the laminations is an aperture through which the cross-bar 15 extends, the said bar being securely fastened to the arms 8 in any appropriate mechanical manner for the purpose of preventing movement of the pole piece 10 with reference to the said arms. The supporting bar 16 is arranged upon and connected to the rear arms 7 in a manner similar to that just described for the cross-bar 13, and the rear pole piece 11 is supported upon the supporting bar 16 as the pole piece 10 is supported upon the bar 13. Likewise the cross-bar 17

extends from one arm 9 to the other arm 9 and performs a function with reference to said arms and pole piece 11 similar to that performed by the cross-bar 15 with reference to the pole piece 10 and the arms 8. It should be noted that the inner faces of the pole pieces 10 and 11 should be arranged in parallel relation to each other.

The transverse grooves in the inner faces of the pole pieces are preferably an equal distance from each other and constitute two vertically arranged series of such grooves, each groove on one pole piece corresponding to a similar groove in the other vertical series of grooves in the other pole piece. Arranged in each transverse groove in the pole pieces is a primary coil 18, each coil being separately prepared, slipped into its appropriate groove and secured in said groove in any suitable manner. The coils so arranged thus constitute two parallel vertically disposed series arranged opposite each other and of similar construction. Vertical connections 19 are then arranged connecting the first with the fourth, the fourth with the seventh, and the seventh with the tenth coil and so on through the vertical series. The second coil is likewise connected with the fifth, the fifth with the eighth and the eighth with the eleventh and so on through the series. The third coil is connected with the sixth, the sixth with the ninth, the ninth with the twelfth and so on through the series, the said coils and connections being arranged in the manner common in the construction of three-phase induction motors. At the upper end of each series is an appropriate three-phase motor triangular connection 19^a forming the resistance inter-connection of the last three coils of each series.

It should be noted that the two series of coils are connected in parallel, the conductor 20 leading to the first coil on both series, the conductor 21 leading to the second coil in both series and the conductor 22 leading to the third coil in both series.

Mounted upon the vertical frame piece 4 is a controller 23 adapted to throw the current off, to throw it into circuit under great resistance, to throw it into circuit under small resistance, to throw it into circuit without resistance and to throw it entirely out of circuit in the order mentioned. The details of the construction of the controller are in no wise claimed in the present invention and such details are therefore not shown or described. The conductors 24, 25 and 26 are adapted to conduct a tri-phase alternating current from a suitable generator to the controller, the resistance shown at 27 being thrown into circuit by the controller when it is desired to have relatively small resistance and the resistance 28 is also adapted to be thrown into circuit when it is desired to have relatively greater resistance. The controller is operated by the rotation of the shaft 29 which protrudes from the controller case and is provided with the controller lever 30 fixedly mounted on said shaft. Formed integrally with the lever 30 the pointer 31 may be arranged if desired and a disk provided with appropriate graduations as illustrated at 32 may be provided over which the pointer 31 may move. In the controller illustrated in the drawings when the pointer 31 is directed substantially in a downward direction the current is cut out of circuit. When the shaft 29 is rotated to bring the pointer 31 to the first division of the graduations the resistance at 28 is thrown into circuit. When the pointer 31 is brought to the second graduation the resistance 27 is thrown into circuit. When the pointer 31 is brought to the third graduation all resistance is cut out of circuit and the current is allowed to flow into the conductors 20, 21 and 22 at the full strength at which it is received from the generator through the conductors 24, 25 and 26. When the pointer 31 moves to the fourth graduation or top the current is entirely cut off. The shaft 29 is not intended to make a complete revolution but only a substantially one-half revolution. If the pointer 31 is brought to the top or fourth graduation and then returned to the downward position first mentioned the current will remain cut out of circuit during the return movement of the said pointer from the said fourth graduation downwardly to its lowest position. If, however, the pointer is stopped at either the second or third graduations and then caused to return to the downward or first position the current will remain in circuit and will be caused to pass through the various resistances denoted by the graduations in the reverse order from that in which they have been thrown into circuit as the pointer was previously moved upwardly.

The treadle 33 is pivoted to the base 1 at the points 34 and a weight 35 upon an extension 36 of the said treadle is adapted to maintain the said treadle normally in its upper position, in which position the operator may readily depress the said treadle 33 by pushing downward upon the same with his foot. Pivotally connected to the treadle 33 and to the controller lever 30 is the connecting rod 37. The arrangement of said connecting rod is such that when the treadle 33 is depressed the lever 30 will be pulled downwardly, rotating the shaft 29 and moving the pointer 31 over the various graduations upon the disk 32, as hereinafter described. It should be stated that the purpose of the treadle 33 and the connecting bar 37 is only for convenience in operating the controller 23 and it will be obvious that the treadle 33 and connecting rod 37 may well be exchanged for some equivalent mechanism adapted to the

be operated by hand if so desired. It should also be noted that the controller 23 may be located at some distance from the power-hammer, if desired, the conductors 20, 21 and 22 and 24, 25 and 26 being extended and appropriately connected to the said controller located at a distance from the said hammer. In some instances it may be thought desirable to so remove the controller from the location illustrated in the drawings to avoid possible injury to the controller by reason of the necessary jarring incident to the use of the hammer.

The pole pieces, coils and connections hereinbefore described having been arranged and the conductors 24, 25 and 26 connected to a suitable source of tri-phase alternating current, it will be understood that an upwardly traveling magnetic field will be produced adjacent the two vertical series of coils in the pole pieces, each pole piece with the coils so arranged thus resembling to an extent the primary of an induction motor.

It should be noted that when the treadle 33 is in its upper position and the pointer 32 directed substantially downward the current will be cut out of circuit and no magnetism will be present adjacent the pole pieces. If now the treadle is depressed slightly, bringing the pointer 31 to the first graduation beyond the "off" position the resistance 28 will be thrown into circuit and a relatively small amount of magnetism will be produced adjacent the pole pieces. If then the treadle is depressed until the second graduation on the controller is reached the magnetism in the pole pieces will be increased by reason of the fact that the resistance 27 only will be placed in the circuit. If the treadle is then depressed until the third graduation is reached the full strength of current will be conducted to the coils in the pole pieces and the full strength of upwardly traveling magnetic field will be produced. If the treadle be further depressed so as to bring the pointer 31 to the fourth graduation or uppermost position the current will be cut off and the magnetism adjacent the pole pieces immediately discontinued. The treadle may then be allowed to return to its upper position while the pointer 31 travels again downwardly to the lower "off" position, no current being thrown into circuit during the return of the said pointer, as hereinbefore described. It should be noted, however, that if the treadle be so depressed as to stop the pointer 31 short of the extreme upper position, and then allowed to return to the lower "off" position the current will remain in circuit during the return of the said pointer, the resistances 27 and 28 being thrown into circuit in the reverse order from that in which they were thrown into circuit as the pointer 31 was previously moved upwardly.

It should be noted that the controller 23 may be so arranged that the current may not only be thrown on with varying resistances and off again, but may also be reversed, and this reversal of current, by means of an appropriate construction of the controller, may be accompanied with the throwing in of appropriate resistances. The construction of the controller, as hereinbefore mentioned, is not herein claimed as a part of the invention and hence no detailed description of the same is deemed necessary. It will be obvious, however, to those skilled in the art, that the controller may be so varied in its construction that the magnetic field adjacent the pole pieces may be caused to travel either upwardly or downwardly and at varying intensities or may be cut off when desired.

The ram consists of the head portion 38 to which the hammer 39 is adapted to be connected and also the integral, spaced, upwardly extending side flanges 40 to which, as also to the head 38, are connected the grooves and ridges 41 adapted to engage the grooves and ridges 5 in the frame pieces 3 and 4 hereinbefore previously described. It should be noted that the grooves and ridges 41 extend practically the full length of the ram and that there is a plurality of such grooves and ridges, such construction being preferable because of the accuracy of movement thereby produced and also because of the reduction of friction and of apparent wear. Arranged between the spaced flanges 40 is a built up or laminated structure 42 which projects slightly beyond the front and rear edges of the said flanges. In the front and rear projecting portions of the laminated structure transverse grooves are cut thus providing for the inlaying of the copper bars 43, constituting the secondary winding. At each end of the copper bars all of the bars of the vertical series are connected by the bar 44 in the manner well understood to those skilled in the art of induction motor building, the laminated structure 42 with the bars 43 and 44 thus constituting what is commonly called a "short circuited secondary." It should be understood that the structure 42 is firmly fixed with reference to the flanges 40 and the head 38, and this is preferably accomplished by means of bolts or pins extending transversely of the laminated sheets constituting the structure 42 and firmly connected to the flanges 44, such bolts or pins being numbered 45 in the drawings and adapted to be entered through the apertures designated by the numeral 46. It may be thought desirable to form the laminated sheets 42 in two sections, as fully illustrated in Fig. 2, the insulation 47 being arranged between the two series of sheets.

When constructed, the ram should be arranged between the vertical frame pieces 3 and 4, with the grooves and ridges 41 in en-

gagement with the grooves and ridges 5, and the bars 43 located adjacent the pole pieces 10 and 11. It will thus be seen that the pole piece 10 together with the adjacent side of the short circuited secondary constitutes one electro-magnetic motive element, while the pole piece 11, together with its adjacent portion of the short circuited secondary constitutes a second electro-magnetic motive element, and that the magnetic pull of the two elements will coöperate in the lifting of the ram in such wise that the said ram will be raised in a true vertical direction by the upwardly traveling magnetic fields in a true condition of balance or equipoise.

It should be noted that in placing the ram between the frame pieces and pole pieces it is only necessary to lift the said ram vertically out of the top of the frame composed of said pieces and for convenience in lifting the ram the eye-bolts 48 are provided which are firmly connected to the ram and in which appropriate hooks connected with a tackle may be arranged for lifting and placing the said ram. It should be noted that when the ram is lifted from the frame work all parts of the primary winding will be readily accessible and that if desired rams of different weights may be used on the same power-hammer by merely lifting one ram out of the frame work and substituting another ram of appropriate weight for a different class of work to be done. Such substitution of rams may also be found convenient if for any reason the ram in use should become injured. Such injured rams may be easily lifted out and repaired while a substitute ram is placed within the frame, thus avoiding unnecessary delays for repairs. It should be especially noted in this connection that the said ram may be lifted out without removing or displacing any of the parts of the hammer.

A power-hammer of the character described having been provided a ram of appropriate weight should be selected and arranged within the frame. The anvil 2 and the hammer 39 being properly placed and attached and being of appropriate shape for the work in hand the ram may be lifted at will by the operation of the controller 23 through the treadle 33. The ram may be lifted to the full height of the pole pieces and allowed to drop of its own weight by bringing the pointer 31 gradually over the graduations on the disk 32 until the said pointer reaches the uppermost graduation when the current will be cut out of circuit. If desired, however, the pointer 31 may be raised but a few of the graduations on the disk 32 and then allowed to descend, in which case the resistance being switched into circuit in the inverse order from that in which it is switched into circuit by the ascending pointer, the ram will be retarded in its downward movement, thus descending with less force and speed, thereby dealing a blow of less intensity. If desired an appropriate controller may be arranged whereby the current may not only be graduated and cut in and out of circuit, but also be reversed, in which case the ram may be brought downward not only by its own weight but by a downwardly traveling magnetic field similar to the upwardly moving magnetic field by which the ram is raised. It will thus be seen that by properly controlling the tri-phase alternating current supplied to the conductors 20, 21 and 22 the movements of the ram may be fully and completely controlled, and that blows of varying intensity and rapidity may be produced at the will of to operator.

While I have shown and described my invention as being operated by a three-phase alternating current and such is the preferable construction, yet I do not desire to be limited to such construction, as it is evident that the construction might be adapted for single or two-phase currents without departing from the spirit of the invention. It should also be stated that by the use of the word controller herein I do not desire to be limited to any particular kind of controller, as it is evident that in some instances a simple switch or auto-starter might be sufficient to properly operate the device and that in any such instances the said switch or auto-starter would be such a controller as would fulfil the spirit and meaning of the term controller as used. I therefore desire to interpret the word controller as meaning any device for switching or controlling the electric current supplied to the device.

I claim:

1. An electric power-hammer comprising a plurality of spaced, parallel series of coils wound and connected in accordance with three-phase induction motor construction, the coils in the series connected in parallel to conductors of a tri-phase alternating current, a controller arranged within the circuit of said conductors for controlling the current supplied to the said coils; and a ram comprising a head, a hammer and a short circuited secondary connected to said head, the said ram located between the said parallel series of coils and adapted to be moved in a line parallel with said coils by the traveling magnetic field produced adjacent to said coils by the said current.

2. An electric power-hammer comprising a plurality of spaced series of coils arranged on pole pieces, the said coils wound, disposed and connected in accordance with induction motor construction, the coils in the different series connected in parallel to conductors of alternating current, a controller arranged within the circuit of said conductors for controlling the current supplied to the said coils,

and a ram comprising a head, a hammer and short circuited secondaries connected to said head, each of said secondaries located adjacent one of the series of coils, the said ram located between the said plurality of series of coils and adapted to be moved in a line parallel to said series of coils by the traveling magnetic field produced adjacent to said coils by the current supplied to said coils through said conductors.

3. An electric power-hammer comprising a plurality of spaced, parallel series of coils wound and connected in accordance with three-phase induction motor construction, the coils in the various series connected in parallel to conductors of a tri-phase alternating current, a controller arranged within the circuit of said conductors for controlling the current supplied to the said coils, and a ram comprising a head and a short circuited secondary immediately connected to said head, the said ram located between the said parallel series of coils and adapted to be moved in a line parallel with said parallel series.

4. An electric power-hammer comprising a plurality of spaced series of coils arranged on pole pieces, the said coils wound, disposed and inter-connected in accordance with induction motor construction, the coils in the different series connected in parallel to conductors of an alternating current, a controller arranged within the circuit of the said conductors for controlling the current supplied to said coils, and a ram comprising a head and short circuited secondaries immediately connected to said head, each of said secondaries located adjacent one of the series of coils, the said ram located between the said plurality of series of coils and adapted to be moved in a line parallel with said series.

5. In an electric power-hammer, in combination, a plurality of vertically disposed series of spaced coils wound and connected in accordance with induction motor construction, with a ram adapted for vertical movement intermediate said plurality of series of coils, said ram comprising a head, a hammer connected thereto, spaced flanges connected to said head and a plurality of short circuited secondaries connected to said head, each of said secondaries being arranged adjacent one of the series of coils and adapted to remain adjacent the said series during the movements of said ram.

6. In an electric power-hammer the combination of a plurality of laterally spaced longitudinal series of coils, the coils of each series wound, disposed and connected in accordance with induction motor construction, and a ram located intermediate the various laterally spaced series of coils and adapted for movement in line with the said series, the said ram provided with short circuited secondaries, each of said secondaries adapted to be actuated by a corresponding series of coils means for conducting alternating current to said series of coils and the various series connected in parallel.

7. In an electric power-hammer the combination of a plurality of spaced, parallel, straight series of coils constituting a plurality of induction motor primaries and a ram located between said spaced series and adapted for movement in a line parallel with said series, said ram provided with a plurality of secondaries, each secondary having its face adjacent its corresponding primary parallel with said primary, the various series constituting said primaries connected in parallel, and means for conducting an alternating current to said primaries, whereby the said ram may be moved in a line parallel with said spaced primaries and maintained in a condition of equipoise during said movement.

8. In an electric power-hammer a ram comprising a head, a hammer connected to said head, spaced flanges connected to said head, a laminated structure arranged between said spaced flanges and connected to said head, and a vertical series of transversely disposed copper bars inlaid in grooves in the said laminated structure, and means for short circuiting the said bars.

9. In an electric power-hammer a ram comprising a head, a hammer connected to said head, spaced flanges connected to said head, a structure arranged between said spaced flanges and connected to said head, and a series of transversely disposed copper bars inlaid in grooves in the said structure, and means for short circuiting the said bars of the series.

10. An electric power-hammer comprising a base, spaced, vertical frame pieces mounted upon said base, said frame pieces provided upon their inner sides with vertically disposed grooves and ridges, said frame pieces provided with forwardly and rearwardly extending arms, front and rear pole pieces mounted upon said arms, and held in fixed, spaced vertical, parallel position, said pole pieces provided with transverse slots upon their inner sides, a vertical series of coils arranged in the slots of each pole piece, said coils being connected in accordance with three-phase induction motor primary windings, a ram located between the spaced frame pieces and between the spaced pole pieces, said ram comprising a head, a hammer connected to said head and spaced flanges connected to said head, said flanges and head provided with grooves and ridges corresponding to and adapted to slide vertically in the said grooves and ridges in the said frame pieces, a laminated structure located between said flanges and connected thereto, said laminated structure having its sides arranged closely adjacent the said pole pieces, said structure provided with transverse grooves, copper bars inlaid in said grooves

and said bars short circuited with each other, tri-phase alternating current conductors, the coils in the two vertical series connected in parallel to said conductors and a controller arranged in the circuit of said conductors and adapted for controlling the current conducted to the primary windings substantially as described.

In testimony that I claim the above, I have hereunto subscribed my name in the presence of two witnesses.

THADDEUS F. BAILY.

Witnesses:
IRENE LUTZ,
WILLIAM H. MILLER.