Oct. 31, 1939. A. L. BAUSMAN 2,178,416

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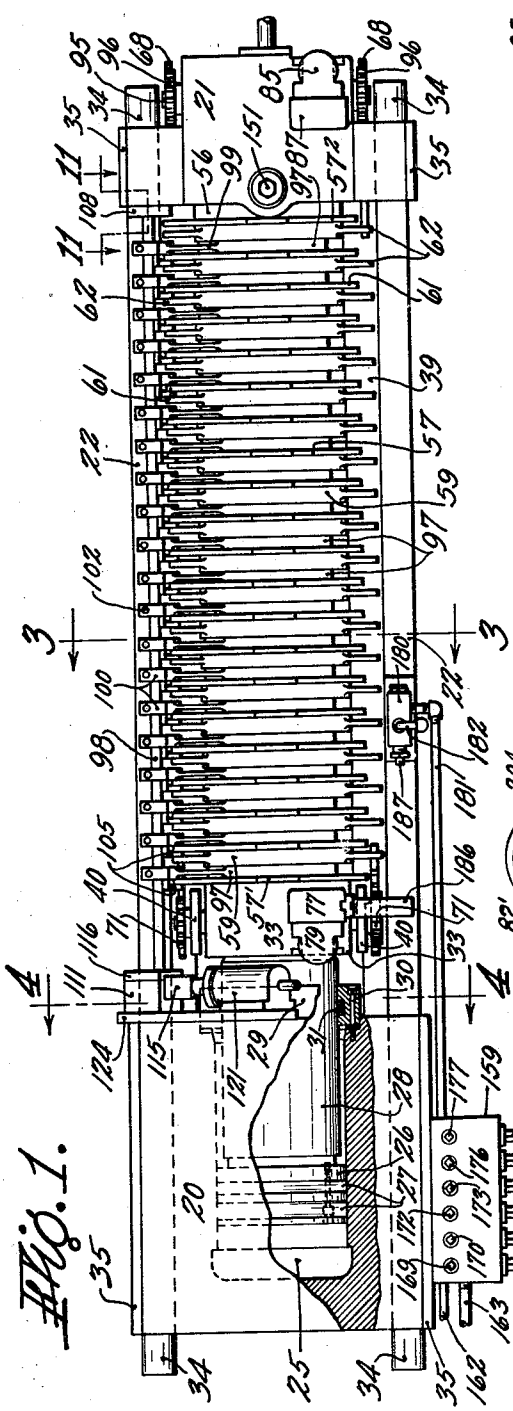


Fig. 1.

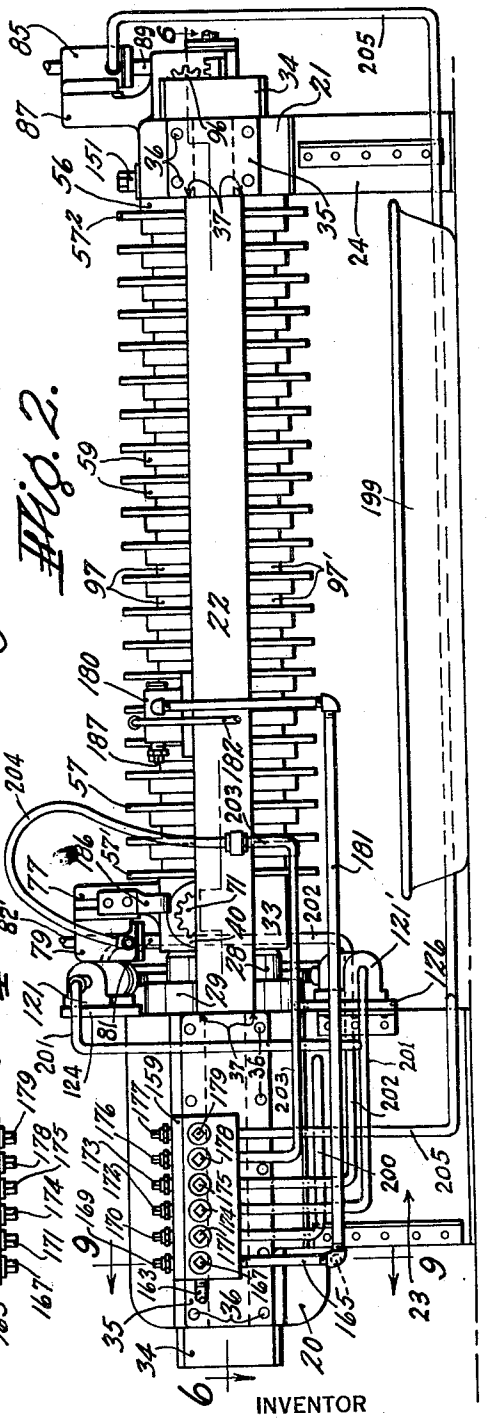


Fig. 2.

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Fig. 3.

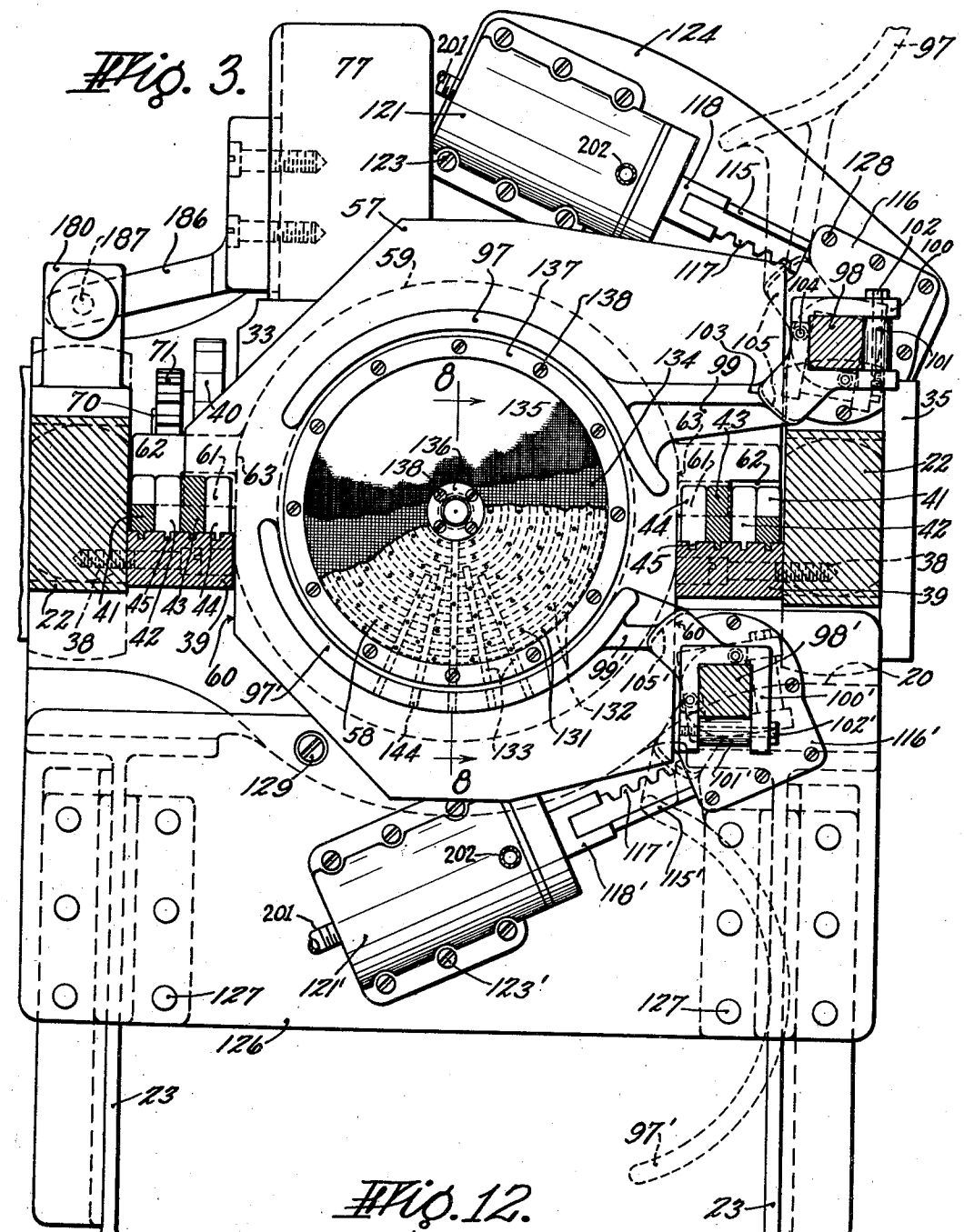
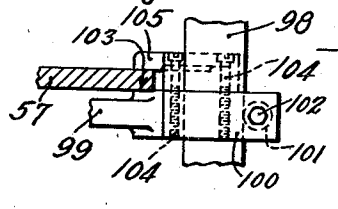


Fig. 12.



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Fig. 4.

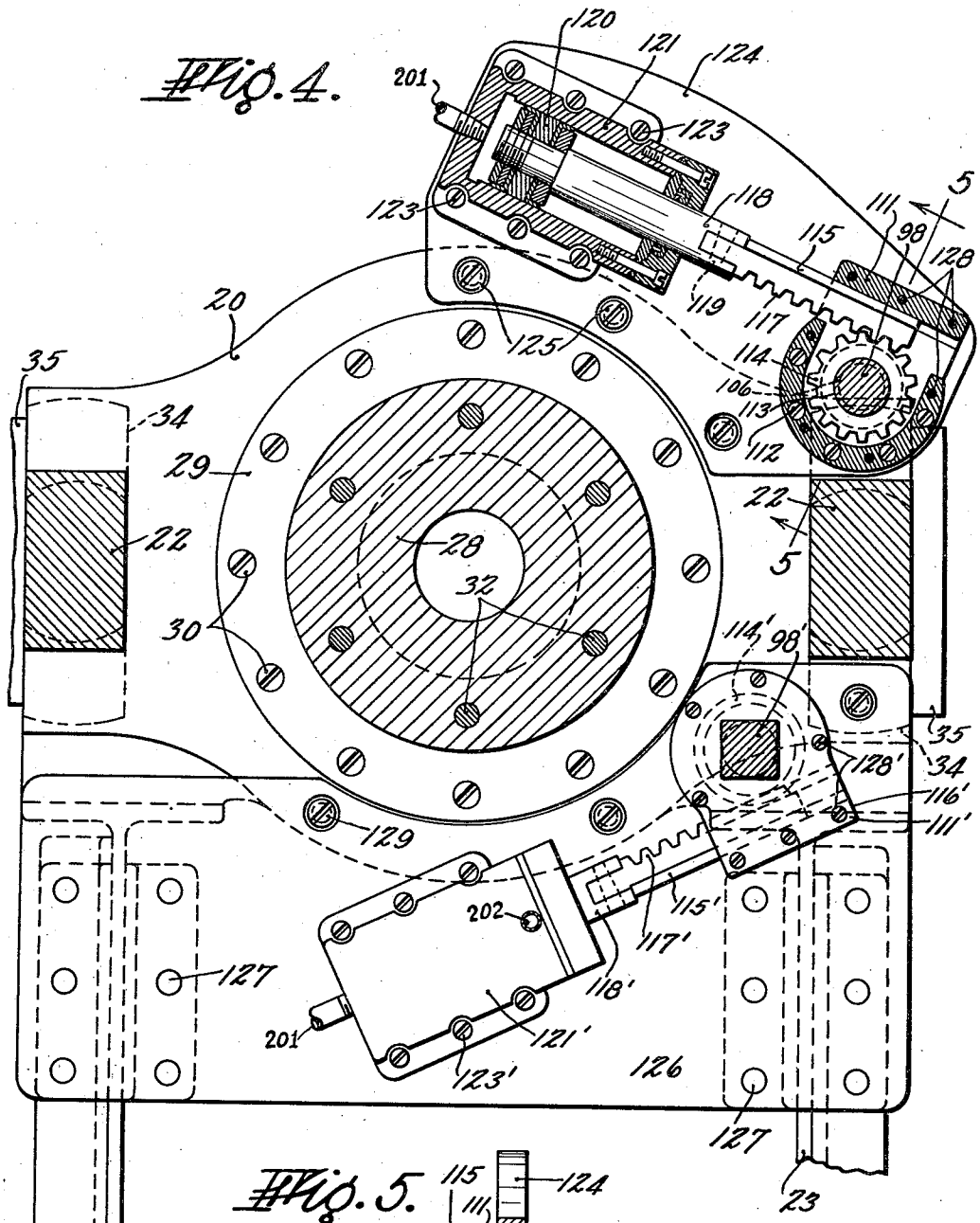
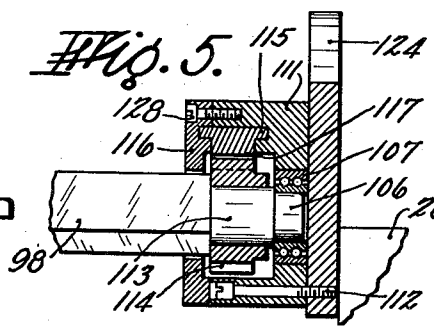


Fig. 5.



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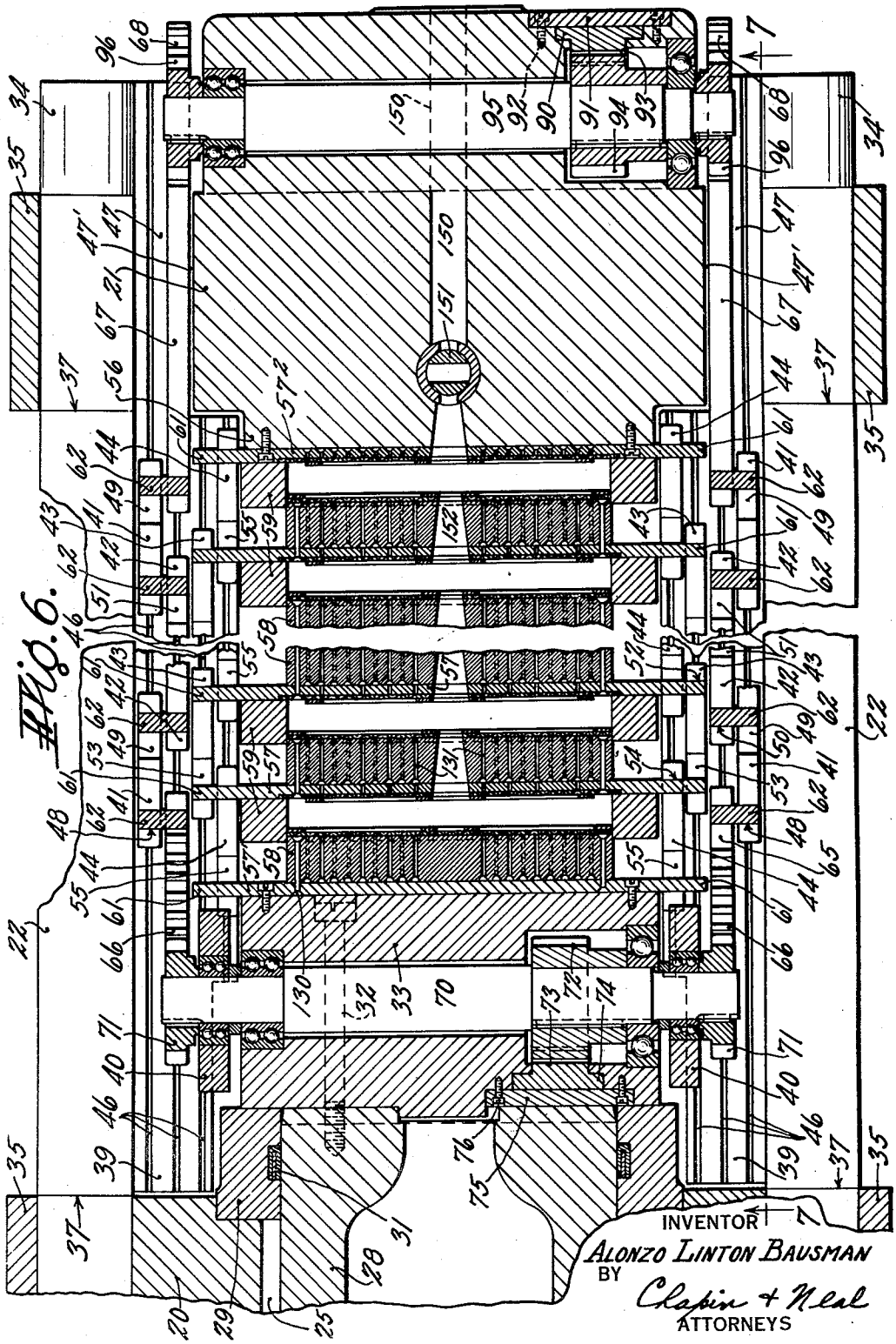


Fig. 6.

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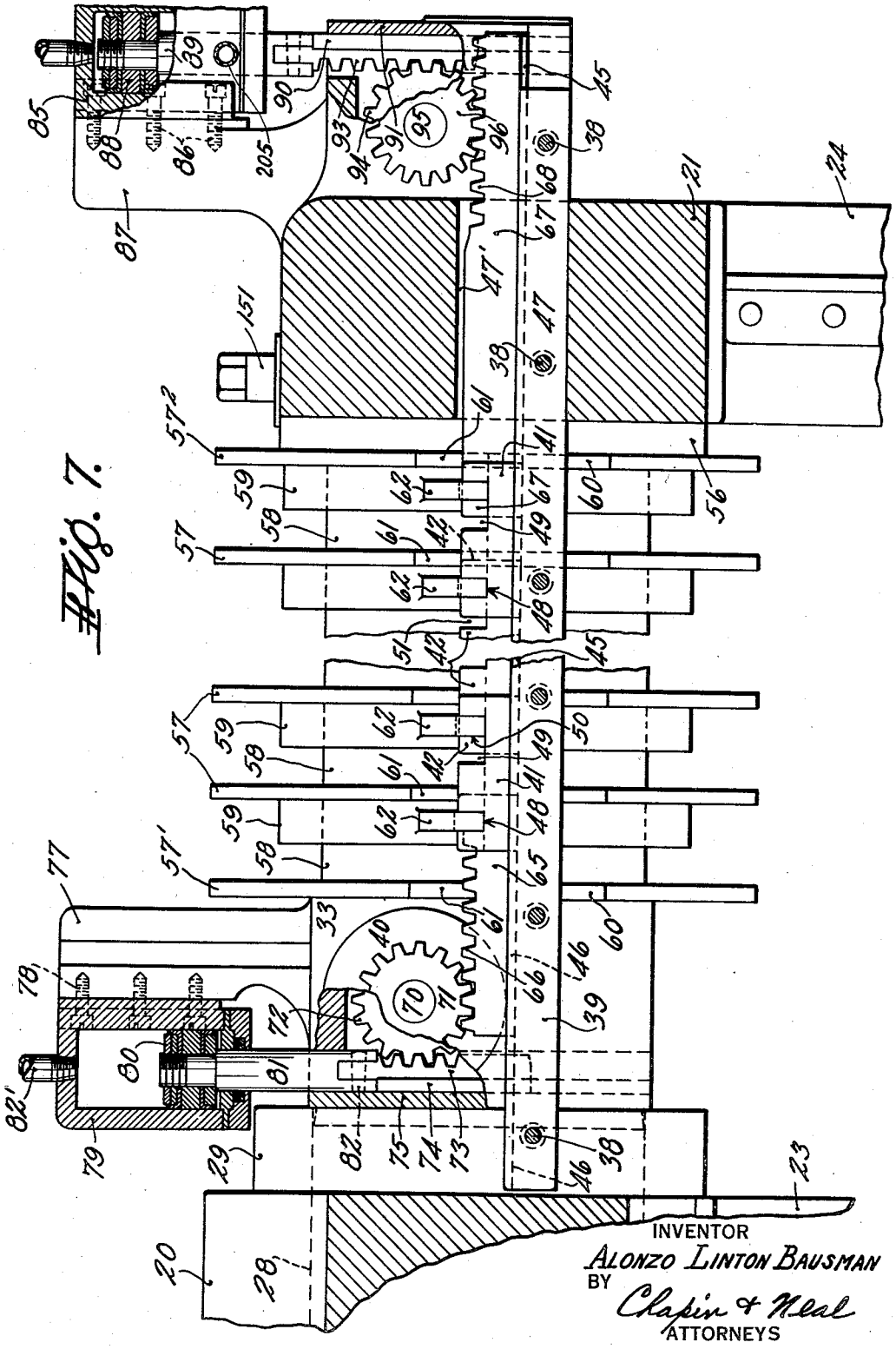


Fig. 7.

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Fig. 9.

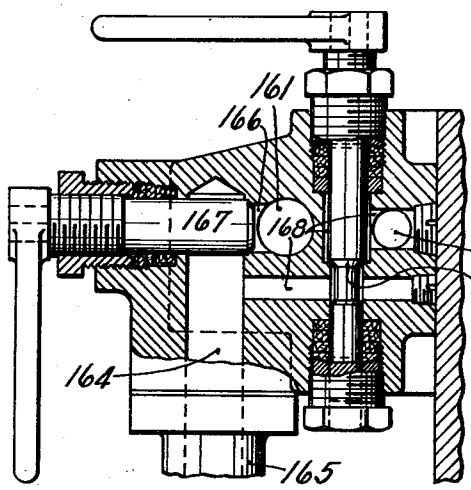


Fig. 8.

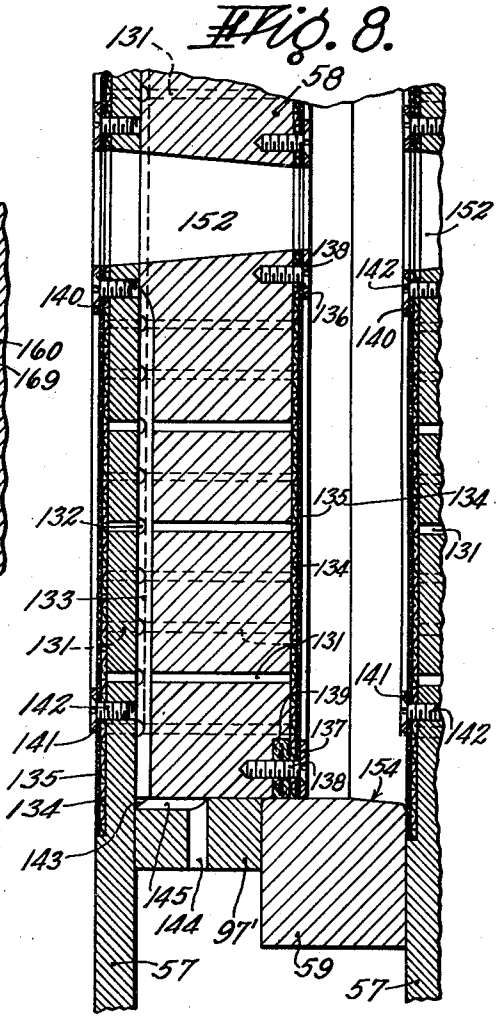


Fig. 10.

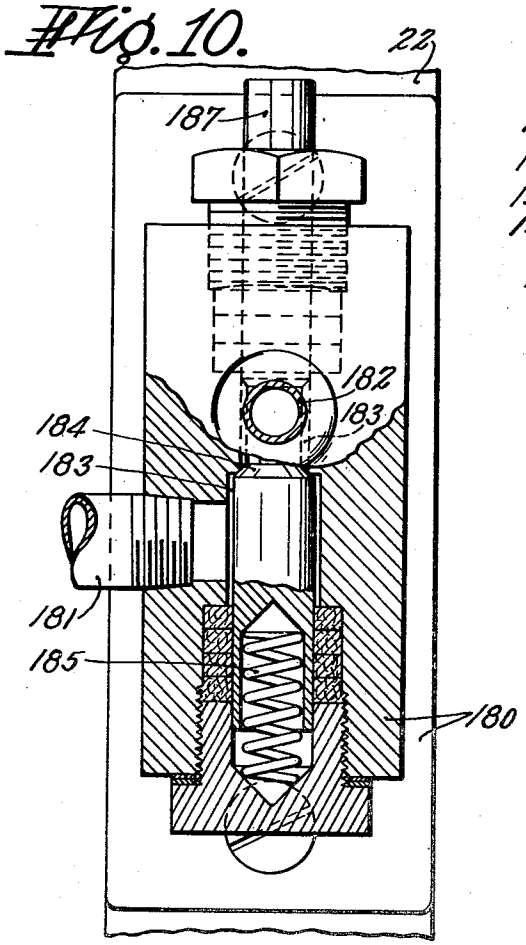
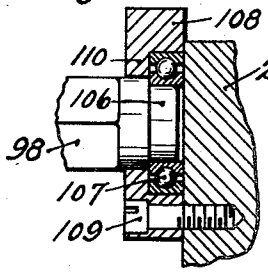


Fig. 11.



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Patented Oct. 31, 1939

2,178,416

UNITED STATES PATENT OFFICE

2,178,416

FILTER PRESS

Alonzo Linton Bausman, Springfield, Mass.

Application March 5, 1937, Serial No. 129,246

16 Claims. (Cl. 100—50)

This invention relates to improvements in filter presses, such as are used for the purpose of separating the liquid constituents from the solid constituents of materials in a semifluent state. An example of one use of the press is in extracting cocoa butter from cocoa liquor, leaving as a solid residue cocoa in the form of cakes.

The invention has for an object the provision of a press of this character which is substantially automatic in its operation, eliminating much of the manual labor formerly necessary and particularly the manual labor required to empty the press at the end of one operation and recondition it for a subsequent operation and, by so doing, reducing to a negligible minimum the time interval between successive operations of the press.

More particularly, the invention has for an object the provision of improved means whereby the several filter-carrying members may be spread apart, after a pressing and filtering operation of the press, and uniformly spaced apart preparatory to removal of the pressed cocoa cakes.

Another object of the invention is to provide improved means for moving the collector rings to cause each to be telescoped over one of the filter-carrying members with which it cooperates, whereby to strip the pressed cakes from the rings and allow them to drop between the spread-apart, filter-carrying members.

Another object is to provide improved means for mounting and operating the spacer fingers, which are used to prevent relative movement of the filter carrying members and the collector rings during the operation of filling the press.

Other objects will appear as the detailed description proceeds and will be pointed out in the appended claims.

The invention will be disclosed with reference to the accompanying drawings, in which:

Fig. 1 is a small-scale plan view of a press embodying the invention, certain link blocks, which are illustrated in Figs. 3, 6 and 7, being omitted so as not to unduly complicate the illustration;

Fig. 2 is a side elevational view thereof;

Fig. 3 is a cross sectional view taken on the line 3—3 of Fig. 1, with parts broken away for clearness of illustration;

Fig. 4 is a cross sectional view taken on the line 4—4 of Fig. 1 with parts in elevation for clearness of illustration;

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is a fragmentary sectional plan view taken on the line 6—6 of Fig. 2;

Fig. 7 is a fragmentary sectional elevational view taken on the line 7—7 of Fig. 6;

Fig. 8 is a fragmentary cross sectional view taken on the line 8—8 of Fig. 3;

Fig. 9 is a fragmentary cross sectional view taken on the line 9—9 of Fig. 2;

Fig. 10 is a top plan view, partly in section, of the safety valve;

Fig. 11 is a sectional view taken on the line 11—11 of Fig. 1; and

Fig. 12 is a fragmentary plan view showing a detail of the mounting of the spacing fingers.

Referring to these drawings and first to Figs. 1 and 2 thereof, the press proper includes fixed heads 20 and 21, interconnected by two laterally-spaced, longitudinally-extending horizontal bars 22 which maintain the two heads longitudinally spaced one from another. The heads 20 and 21 are supported at the desired level above the floor by suitable standards 23 and 24, respectively, to which the heads are suitably fixed. The head 20 is the pressure head and is formed interiorly with a cylinder 25, the left hand end of which is closed and in which is slidably mounted a ram, having a piston portion 26 with packings 27 for sealing engagement with the peripheral wall of the cylinder and a hollow barrel-like part 28 which extends out of the cylinder toward the head 21 through a removable cylinder head 29 secured as indicated in Fig. 4 by bolts 30 to head 20. The barrel 28, where it passes through head 29, is sealed by packing 31 mounted in a groove in the head. Secured to the outer end of the barrel 28 of the ram (as by a series of bolts 32 indicated in part in Figs. 4 and 6) is a follower or pressure abutment 33 in the form of a large block of substantially square cross section. Liquid, such as oil under pressure, may be admitted to either end of cylinder 25 to move the ram in either direction. For moving the ram on its forward stroke (toward head 21), liquid is admitted to the left hand end of cylinder 25 while the right hand end thereof is connected to exhaust. The liquid under pressure then acts on the full cross sectional area of piston 26 to produce the heavy total pressure required for the pressing operation. For the return stroke, liquid under pressure is admitted to the right hand end of cylinder 25 while the left hand end thereof is connected to exhaust. The effective area of the right hand face of piston 26 is relatively small and a much lower but sufficient total pressure is

developed to return the ram after the pressing operation.

Each tie bar 22 has T-heads 34, one at each end thereof, with which the outer ends of the heads 20 or 21, as the case may be, abut, whereby the heads are held against spreading apart. Each head 20 or 21, as the case may be, is provided on opposite sides with slots, into which portions of the tie bars fit, and the bars are held in place in these slots by plates 35, secured to the head by screws 36. The portions of each tie bar which are received in the aforesaid slots, are of less width than the portions which extend between the two heads, thus affording shoulders 37 for engagement with the inner and adjacent ends of the heads 20 and 21 to prevent them from being drawn toward one another.

Fixed to the inner face of each tie bar 22 by a series of cap screws 38 (Fig. 3) is a horizontal rail 39 having a flat upper face. These rails 39 serve as trackways for rolls 40 carried by the follower 33, one on each of two opposite sides thereof, whereby the forward end of the ram is supported and guided and held against turning about its axis. These rails further serve as trackways to support and guide four rows of link blocks (Figs. 3 and 6), the blocks of the outer row being marked 41, those of the next adjacent row 42, those of the next row 43 and those of the innermost row 44. These blocks are best shown in Fig. 6. Each of these blocks has a tongue 45 depending from its otherwise flat bottom face and the upper face of each rail is provided with four parallel longitudinal grooves 46, one for each series of link blocks, to receive the tongues 45 thereof. Each block is mounted to slide on its trackway in a direction longitudinally of the press. Each rail 39 (Fig. 6) extends from the pressure head 20 to the resistance head 21 and a portion 47 of reduced width (sufficient only for the two outermost rows of link blocks) extends along the head 21 to the outer end thereof, being received in a groove 47′ which lies in back of the adjacent tie bar 22.

The links 41 and 42 are identical in form and dimensions. The links 43 and 44 are identical in form and dimensions and they differ from links 41 and 42 only in dimensions. Each link has two longitudinally-spaced notches of rectangular form each extending from the upper face of the link downwardly. The bottom of each notch is flat and horizontal and lies in a horizontal plane which passes through the center line of the press, i. e., the center line of ram 26. One notch in each link is longer than the other. The short and long notches of links 41 are designated as 48 and 49, respectively; those of links 42 as 50 and 51; those of links 43 as 52 and 53; and those of links 44 as 54 and 55. These link blocks serve to support the press units (next to be described) acting as weight-bearing shoes or runners which are slidable on the rails 39. They also have other important functions which will later be described.

The press units, of which twenty are herein shown in Fig. 1, are mounted in coaxial relation and in the form of a horizontal column between the follower 33 and a cylindrical abutment 56 on the inner end of the resistance head 21. This series of units lies between the tie bars 22 and, as mentioned, are supported on opposite sides from the rails 39 on the tie bars through the intermediary of the links, above described. Each press unit comprises a plate 57 (Fig. 6), a disc 58 fixed thereto and an annular ring 59 into which disc 58 fits in plunger-like fashion. Each plate 57 and each of the end plates 57^1 and 57^2 has two vertical side edges 60 (Fig. 3), extending downwardly from the horizontal center line of the plate, and two lugs 61 projecting one beyond each such edge. The lower faces of these lugs are alined and both lie in the horizontal center line of the plate. Each lug 61 fits into a short notch in one of the links 43 or 44, and into a long notch in the other link, being supported by both links. The plate is so formed as to clear the links 41 and 42. These lugs 61, when their lower faces rest on the bottoms of the notches in links 43 and 44, support the plate so that its center line lies in the same horizontal plane as the center line of the ram. The edges 60 slidably engage the inner vertical faces of the rails 39 and thereby the center line of the plate is located in the same vertical plane as the center line of the ram. The rings 59 are also provided with supporting lugs 62, one on each of two opposite sides thereof, and each such lug is of L-shaped form with an outer part to rest in the notches of links 41 and 42 and an inner part which overlies and clears the links 43 and 44. The lower faces of lugs 62 lie in the horizontal center line of the ring and thus when these lugs are seated in the notches of the links, the ring has its center line located in the same horizontal plane as the center line of the ram. Each ring also has two vertical sides 63 which lie closely adjacent one to each rail 39 and locate the ring laterally in close alinement with the ram but since the plunger disc 58 is engaged in the ring and fixed to plate 57 which is accurately alined as described, the plunger will aline the ring.

The first plate 57^1 of the series is fixed (Fig. 6) to the outer end face of the follower 33. A similar plate 57^2 is fixed to the abutment 56 of the resistance head 21 but the plate 57^2 has no plunger disc 58 fixed to it. All of the plates 57 and the plate 57^1 are interconnected by a linkage made up of the two inner rows of link blocks 43 and 44. This linkage enables the plates to be separated by the action of ram 28, when moved to the left on its return stroke, and limits the extent of separation of the plates and secures uniform spacing of the plates when the ram is drawn back as far as possible. The first plate 57^1 of the series has its lugs 61 resting one in each of the long notches 55 of a pair of links 44, free for limited longitudinal movement relatively thereto. The short notches 54 of these links receive and closely fit the lugs 61 of the next succeeding plate of the series, whereby the latter is held against longitudinal movement relatively to this link. The lugs 61 of the second plate of the series also extend one into each of the long notches 53 of the links 43 in the adjacent row and can move longitudinally relatively thereto. The third plate 57 has its lugs engaged in the short notches of links 43 and also in the long notches of a second pair of links 44, the short notches of which are engaged by the fourth plate 57 and so on until the plate 57^2 is reached, the lugs of which fit in the short notches 54 of links 44. There are ten links 43 and ten links 44, and except for the end plates 57^1 and 57^2, each plate is supported by two links and engaged in a short notch in one and a long notch in the other. The plates 57^1 and 57^2, being fixed to a follower 33 and head 21, require no other support. When the ram is drawn back (to the left) the first plate 57^1 of the series moves with it.

Eventually the lugs of such plate strike the left hand end walls of the long notches 55 of links 44 and these links and the second plate then move with the ram. When the lugs of the second plate engage the left hand end walls of the long notches 53 of links 43, the latter are moved and with them the third plate of the series. As the ram moves to the left, the plates are successively brought into motion, as the lost motion in the link connections between succeeding plates is taken up, until finally all the lost motion in all the link connections is taken up, when the ram is stopped. The several plates are then uniformly spaced and positioned as shown in Figs. 6 and 7.

The rings 59 are similarly interconnected by a linkage composed of ten links 41 and nine links 42, each ring except the end ones having its lugs 62 engaged with a link 41 on a link 42, such lugs fitting into a long notch of one and a short notch of the other. One end ring 59, the first of the series, has its lugs 62 engaged in the short notches 48 of links 41. This same ring also has each of its lugs 62 closely fitting in notches formed one in the upper face and near the right hand end of each of a pair of long links 65. The links 65 slide in the same grooves as links 42 and at their left hand ends have rack teeth 66 formed in their upper faces. The other end ring 59, the last of the series, has its lugs 62 engaged in the long notches of the last pair of links 41 of the series. These lugs also closely fit in notches formed one in each of a pair of long links 67 which slide in grooves in the narrow portions 47 of rails 39. The right hand ends of links 67 have rack teeth 68. This ring linkage, like the plate linkage, serves to limit the extent to which the rings can be drawn apart and maintains them uniformly spaced. For a reason to be later described, the rings move back with the plates when the ram is drawn back to its extreme left hand position. All the lost motion is then taken up in the linkage for both rings and plates. While the ring linkage is thus stretched out to the limit, it may be moved first to the left and subsequently to the right, thereby moving all the rings 59 back over their respective plunger discs 58 and subsequently restoring them.

For the purpose of thus moving the rings 59 relatively to their respective plates 57 and plunger discs 58, hydraulic means are provided, mounted in part on the follower 33 and in part on the resistance head 21 (Figs. 6 and 7). Rotatably mounted in ball bearings in the follower 33 (Fig. 6) is a horizontal shaft 70 which extends transversely through the follower and projects beyond both sides thereof. The ends of shaft 70 overlie the rails 39 and support the described ram-supporting rolls 40, which are mounted on ball bearings on the shaft. Fixed one to each of the extreme ends of shaft 70 are gears 71, which mesh one with each of the racks 66. This shaft has fixed thereto a gear 72 (Figs. 6 and 7) located in a recess in the follower 33 and meshing with a rack 73, fixed to a slide 74 which is mounted to slide vertically in ways formed in the rear end of the follower. The slide is held in place by a plate 75 secured by cap screws 76 to said end of the follower. The follower has an upstanding bracket 77 (Fig. 7) to which is secured by screws 78 a cylinder 79, having therein a piston 80, the rod 81 of which extends downwardly and has it lower end slotted to receive the upper end of slide 74 which is secured thereto by a pin 82. Liquid under pressure may be admitted to the lower end of the cylinder beneath piston 80 through a pipe 203 and a flexible hose 204. The upper end of the cylinder is open to the atmosphere through suitable pipe connections indicated in part at 82'. Thus, the piston may be raised by hydraulic pressure to effect movement of the ring linkage and all the rings to the left. This hydraulic motor is single acting. No pressure liquid is admitted to the upper end of the cylinder which normally contains nothing but air.

The return movement of this linkage is effected by a similar, single-acting hydraulic motor, the cylinder 85 of which is secured by cap screws 86 to a bracket 87, upstanding from the resistance head 21. This cylinder contains a piston 88 having a rod 89 connected to a slide 90 mounted to slide vertically in ways formed in head 21 and held in place by a plate 91 and screws 92. The slide carries a rack 93 which drives a gear 94 fixed to a horizontal shaft 95 which is mounted in ball bearings in head 21 and extends transversely therethrough. The ends of shaft 93 project beyond opposite sides of head 21 and have fixed thereto gears 96 which mesh one with each of the described racks 68. Liquid under pressure may be admitted to cylinder 85 beneath the piston 88 to raise the same and, through the connections described, shift the ring linkage to the right, restoring it to the position occupied prior to the movement of it by the piston 80. The upper end of cylinder 85 is connected to atmosphere. Movement of piston 88 upwardly pulls piston 80 downwardly and vice versa.

There are provided in connection with each of the press units, spacer fingers. These fingers are movable from an active position, wherein they lie between the plunger-bearing face of the plate 57 of the unit and the adjacent face of the ring 59 of the unit and prevent inward movement of the plunger 58 in the ring, to an inactive position wherein they are completely withdrawn from said position and enable the plungers to move inwardly in their rings for the pressing function. These fingers are provided in upper and lower sets, there being an upper and a lower finger for each press unit. The two sets of fingers are alike in construction and mounting and they are operated by similar means, wherefore only the upper set of fingers and their associated parts will be described and corresponding parts of the lower set will be designated by the same reference numerals with the addition of a prime.

The upper fingers are marked 97 and all of them are mounted on a bar of non-circular cross section which is conveniently square, such as shown at 98. Each finger has the form of a portion (somewhat less than half) of a hollow cylinder, the curvature of which is such that the fingers, when in active position, are substantially coaxially disposed with reference to the press units. Each finger is connected by an arm 99 to a substantially U-shaped yoke 100 which slips over the finger bar and slidably engages three of the four faces thereof. The fourth face is engaged by a roll 101 mounted between the two legs of the yoke and held in place by a screw 102. By removing the screw and roll the finger may be slipped off the shaft. By this provision for quick and convenient mounting and dismounting, fingers of one width may be removed and others of a different width substituted, as is often desired. Each arm 99 at a location near its yoke 100 has a finished pad 103 adapted to engage one face of

a plate 57. Secured by screws 104 to yoke 100 is a short arm or clip 105 adapted to engage the opposite face of the same plate 57. The rear upper corner of plate 57 is engaged between the parts 103 and 105 in all positions throughout the range of normal swinging movement of the finger 97. Therefore, when the plates 57 are moved axially, they will cause the fingers 97 to move axially along the finger bar 98, thus retaining each finger in proper axial position with reference to its plate. The fingers 97' are similarly engaged with the lower rear corners of plates 57. The fingers swing through an arc of somewhat more than 90° from their active positions, shown by full lines to their inactive positions shown by dotted lines. When the fingers 97 are in their inactive positions, they may be removed from the bar 98 which turns them by a vertically upward pull after the screws 102 and rolls 101 which retain them on the bar have been removed, and it is not necessary to first remove the clips 105.

In the case of the lower fingers 97', the U-shaped yoke 100' of each is mounted at right angles to the arm 93' and engages the top and both side faces of bar 93', the better to support the weight of each finger. To remove each lower finger, its clip 105', screw 102' and roll 101' are first removed. Then the finger 97', if in its inactive position, may be moved laterally to the left far enough to withdraw its yoke 100' from shaft 98', after which the finger can be drawn downwardly.

The finger bar 98 at its ends is formed with trunnions 106 which are rotatably supported by ball bearings 107. One of these bearings is mounted in a cylindrical case 108 (Fig. 11) secured by screws 109 to the inner end face of the resistance head. The case 108 has a flange 110 which with the adjacent face of head 21 retains the bearing in proper axial position. The other bearing (Figs. 4 and 5) is mounted in a case 111 secured by screws 112 to a plate 124 which in turn is secured by screws 125 to the inner end face of head 20. Adjacent the trunnion 106 in case 111, the finger bar 98 has a cylindrical part 113 to which is fixed a pinion 114. The shoulder on bar 98 formed at the junction of the part 113 with the adjacent trunnion 106 cooperates with the adjacent end face of plate 124 to retain the bearing in position axially. The case 111 is formed with ways in which a slide 115 is mounted. This case has a removable cover 116 which is secured to case 111 by screws 120 and which enables the slide to be slid into the ways, the ways being in part formed in this cover section. The slide 115 carries a rack 117 which meshes with pinion 114. One end of the slide 115 fits into a slot in the forward end of a piston rod 118 and is fixed thereto by a pin 119. The rod 118 has fixed to its inner end a piston 120 which slides in a cylinder 121 to opposite ends of which liquid under pressure may be admitted or exhausted through the pipe connections indicated at 201 and 202 in Fig. 2, whereby the fingers 97 are positively moved in both directions. The cylinder 121 is secured by screws 123 to plate 124. The lower cylinder 121' is mounted on a plate 126 which extends across between the standards 23 and is secured by bolts 127 thereto and by screws 129 to head 20.

Referring now to Fig. 6, each plunger disc 58 is secured, as by rivets 130, to one face of a plate 57, the first disc 58 of the series being fixed to plate 57^1 which is imperforate. Except for plate 57^1 all the plates and discs are perforated, each having a large number of small holes 131 arranged in a plurality of circular series (Fig. 3). That face of each disc 58 which abuts a plate 57 is formed with a plurality of coaxially-disposed circular grooves 132 each serving to interconnect all the holes of one series. The face of the disc 58 which abuts plate 57^1 is similarly formed. In a lower sector of each disc are several radial grooves 133 (Fig. 3) for connecting the circular grooves 132 to the lower portion of the outer periphery of the disc. Each disc 58 and each plate 57 and plate 57^2 carries a suitable filter pad (Fig. 8), one on each of the exposed and non-abutting faces of each. These pads may consist of an inner screen 134 of relatively coarse mesh and an outer screen 135 of very fine mesh. The filter pad in the disc is held in place by inner and outer rings 136 and 137, secured by screws 138. A suitable packing 139, such as camel hair, is mounted beneath the inner screen and held in place by the outer ring 137, such packing serving as a peripheral seal between the plunger-like disk and the ring in which it slides. The filter pad on the plate 57 is held in place by inner and outer rings 140 and 141, respectively, secured to the plate by screws 142. This pad is mounted in a large circular recess in the exposed face of the plate and projects slightly beyond such face. The outside diameter of the pad is larger than the inside diameter of the ring so that the pad will be clamped between the ring and plate to seal the joint therebetween. The plate 57^1 (Fig. 6) carries no filter pad. The plate 57^2 is like plate 57 except that the face, which abuts head 56, is formed with circular and radial grooves like the grooves 132 and 133.

Each lower finger 97' along that portion of one of its inner edges, which portion underlies the outer ends of the several radial grooves 133, is bevelled as at 143. There are several holes 144 through each finger 97' leading from the inner to the outer face thereof. Each such hole at its inner end is connected by a groove 145 to the bevelled edge 143. The purpose of these provisions is to conduct the cocoa butter (extracted during the filling operation) from the radial grooves allowing a free downward flow into the underlying receiving pan.

The liquor, from which the cocoa butter is to be extracted is pumped into the several rings through an axial passage 150 (Fig. 6) in the resistance head 20. The usual valve 151 mounted in said head controls said passage. That portion of the passage extending from the valve 151 through the pressure abutment 53 and the plate 57^2 fixed thereto is tapered, diverging toward the ram. Each plate 57 and its attached disc 58 is formed with an axial passage 152 similarly tapered. The disc 58 which is fixed to plate 57^1 has no passage such as 152. The tapered portions facilitate removal of the plugs of cocoa that remain therein after the pressing operation has been completed and the cocoa cakes have been removed. On a succeeding operation, the liquor pumped into the press will blow out all these plugs into the adjacent rings 59. That portion of each ring 59, which receives the pressed cake, is preferably tapered as at 154 to facilitate ejection of the cake.

The control of the several hydraulic cylinders described is effected by a series of valves mounted in a block 159 (Figs. 1 and 2), secured to one of the plates 35 on head 20. This block has two spaced longitudinal passages 160 and 161 (Fig. 9),

extending from the left hand end of the block inwardly toward but not to the right hand end. Passage 160 is for supplying liquid under pressure to the various cylinders and is connected to a supply pipe 162 (Fig. 1). Passage 161 is for exhausting fluid from such cylinders and is connected to an exhaust pipe 163. Fig. 9 shows the valve control for the left hand end of the ram cylinder 25. A vertical passage 164 leads from the level of the passages 160 and 161 downwardly to the bottom of the block where it connects with a pipe 165 leading to said end of said cylinder. A branch passage 166, controlled by a valve 167 leads from exhaust passage 161 to passage 164. A branch passage 168, controlled by a valve 169, leads from the pressure passage 160 to passage 164. A similar arrangement is provided for the right hand end of cylinder 25, the pressure and release valves being marked 170 and 171 (Fig. 1), respectively controlling admission to and exhaust from a pipe 200 (Fig. 2) leading to the right hand end of cylinder 25. By opening valves 169 and 171 and closing valves 167 and 170, the ram will be moved on its pressure stroke. By closing valves 169 and 171 and opening valves 167 and 170, the ram will be moved on its return stroke.

There are four other pressure valves, the stems of which project above the top of block 159 and four other release valves the stems of which project from the side of the block. The pressure valves 172 and 173 control the admission of pressure fluid to pipes 201 and 202 which lead to opposite ends of the finger-operating cylinders 121 and 121', which are connected together to operate simultaneously, and control the lowering and raising, respectively, of the fingers. The release valves 174 and 175 control exhaust through pipes 201 and 202 from the same ends of cylinders 121 and 121' which are controlled by valves 172 and 173, respectively. The pressure valves 176 and 177 control admission of fluid to pipes 203 and 205, respectively, and thus to the link operating cylinders 79 and 85 respectively, and the corresponding release valves marked 178 and 179, control exhaust from said cylinders through pipes 203 and 205 respectively, the cylinders 79 and 85 being single-acting. The cross section shown in Fig. 9, showing the companion pressure and release valves 167 and 169 is typical of the five other sets of companion pressure and release valves.

A safety valve (shown in detail in Fig. 10) is provided to prevent damage by the ram on its forward stroke in the event that the ram is operated while the various rings 59 are empty or insufficiently filled. Fixed to the top of one of the tie bars 22 is a valve body 180 into which leads a pipe 181 extending from the pipe 165. An exhaust pipe 182 leads from the body 180. Within the body is a passage 183 controlled by a valve 184 and adapted to interconnect pipes 181 and 182 when valve 184 is open. This valve is normally closed by a spring 185 and is adapted to be opened only when an abutment 186 (Fig. 1) on follower 33 engages and moves the stem 187 of the valve. The parts are so located that the valve will be opened before the piston 26 can abut head 29. The opening of the valve serves to bleed the pipe 165 through which pressure liquid is conducted to the left hand end of cylinder 25 and thus stops the ram if it exceeds a predetermined outer limit on its pressure stroke.

The operation of the press will next be described. Assuming that the parts occupy the relative positions shown in Figs. 1, 2 and 3, the press is ready for filling. That is, the several press units are clamped together between the follower 33 and the abutment 56 on head 21 by pressure applied to the left hand end of the piston 26 of the ram. Liquid, such as oil, under pressure of around 1200 lbs. per sq. in., is admitted to the left hand end of cylinder 25. The fingers 97 and 97' are in active position and space apart the plates 57 and rings 59, whereby each plunger disc 58 is held against inward movement in its ring 59 and in a retracted position such as is shown in Fig. 3. The valve 151 is then opened and the liquid, for example chocolate liquor, is pumped in through the passage 150 in head 21 to and through the central holes 152 in the discs and plates until all the chambers within the rings 59 are filled. As pressure builds up in these chambers, the filtering process begins, cocoa butter being expressed through the filter pads 134, 135 and being conducted through the holes 131 in the discs and plates into the grooves 132 and 133 and through the holes 144 in fingers 97', to fall into an underlying pan 199. The pumping of liquor continues until sufficient cake-forming mass has been built up in the rings.

When one has extracted all the butter which it is possible to extract in this way, the valve 151 is closed and pumping of the liquor is stopped. Then the pressure on the ram is relaxed enough to allow the plates 57 and rings 59 to separate slightly in an axial direction and release the clamping pressure on the fingers 97 and 97' to enable them to be moved into their inactive positions (shown in dotted lines in Fig. 3) by the application of liquid under pressure to the left hand ends (as viewed in Fig. 3) of cylinders 121 and 121'. For separating the rings and plates for this purpose, the ram may be positively moved to the left by liquid pressure admitted to the right hand end of cylinder 25. Sometimes, however, this may not be necessary because when the pressure in the left hand end of cylinder 25 is allowed to drop below the pressure of the liquor in the chambers of the discs, the plates and rings tend to spread apart by the expansion of the liquor in said chambers to a degree sufficient for the purpose. The spacing fingers having been withdrawn, liquid is pumped into the left hand end of cylinder 25 to drive the several plunger discs into their rings for the purpose of extracting further cocoa butter by hydraulic press action. A very heavy pressure is needed for this purpose, the unit pressure in cylinder 25 being run up to around 6500 lbs. per sq. in. at the end of the pressing operation.

When all the butter that it is possible to extract in this way has been expressed, the ram is moved back as far as possible (until follower 33 abuts head 29 as shown in Fig. 6) by releasing pressure from the left hand end of the cylinder 25 and admitting pressure into the right hand end thereof. This causes the series of plates consisting of 57^1, 57 and 57^2 to be spread apart sufficiently so that there is created between the filter pad carrying face of each plunger disc 58 and the plate 57 of the next succeeding press unit, a space of an axial length greater than that of the pressed cake within the disc. As the ram moves back, the first plate 57^1, fixed thereto, moves with it and carries along the attached plunger disc 58 of its unit together with the ring 59 and the pressed cocoa cake contained within such ring. The adhesion of such cake to the plate 57 of the next unit is broken and the cake remains substantially unmoved within the ring,

adhering to the ring and plunger disc which together present to the cake a greater area of surface than does the plate 57. So the ring 59 of the first press unit together with the cocoa cake is drawn along with plate 57^1 and plunger disc 58, the ring and disc retaining their same relative positions. The plate of the second press unit is next moved, being picked up and moved by the links 44 and carrying with it its ring and the cocoa cake therein. As before, the ring 59 travels with the plate 57 because of the adherence of the cocoa cake to the ring 59 and to the plunger disc 58 of plate 57. The plate 57 of the third press unit is next moved, being picked up and moved by the links 43 and carrying with it its ring and the cocoa cake therein, and so on until all the plates 57 have been moved and all the cocoa cakes have been pried from plates 57. The plates 57, 57^1, 57^2 are then uniformly spaced, as shown in Fig. 6, and the plates 57 and 57^2 have been moved axially away from the cocoa cakes, theretofore adhering to them, to allow room for the cakes to drop when the rings 59 are subsequently moved back over the cakes. The linkage which interconnects the plates is drawn taut and held so by pressure on the right hand end of piston 26. The linkage interconnecting the rings is likewise drawn taut. Then pressure is applied to the lower end of cylinder 79 (Fig. 7) to raise piston 80 and draw the taut linkages, which interconnect the rings, to the left, thereby moving all the rings 59 toward their respective plates and completely telescoping them over their respective plunger discs 58, leaving the cocoa cakes unsupported whereupon they all drop. As the rings 59 are thus moved, the cakes are disturbed and their hold on plates 57 is probably loosened. In any event, as soon as the rings are completely drawn back, all the cakes drop by their weight. They are, as usual, received in an underlying pan such as 199.

After the cocoa cakes have been dropped out of the press, it is necessary to reposition the parts for another operation. The first step is to admit pressure liquid to the lower end of the cylinder 85 to raise its piston 88 and through the gears 96 and rack 98 to shift the linkage for the rings 59 to the right until each is drawn away from the plate of its press unit and into abutment with the plate of the next unit. The parts are thus restored to the positions shown in Figs. 6 and 7. Pressure liquid is then admitted to the right hand ends of cylinders 121 and 121' (Fig. 3) to cause the fingers 97 and 97' to move back into active and spacing position. Then pressure liquid is admitted to the left hand end of cylinder 25 to cause the ram to move forward and clamp the press units together in position for filling. In the next filling operation, the chocolate liquor entering the press under heavy pressure will blow out the plugs of cocoa cake which remain in the holes 152 and in the outlet portion of the passage 150. These plugs remain in collecting chambers formed within the rings and become mixed with the liquor pumped into such chambers.

It is to be noted that the ring linkage operates on the return stroke of the ram as if the end links 65 were fixed to follower 33. Considering Fig. 7, as the ram moved to the left into the position shown the links 65 had to move in unison with it because the piston 80 cannot move down in its cylinder as would be necessary for the purpose. Neither can the piston 88 move down in its cylinder 85 because all the space in the cylinder below the piston is filled with oil and the valve controlling the exhaust from the lower end of the cylinder is closed. Thus, one end of the rink linkage is for all practical purposes fixed to head 21 and the other end is fixed to the ram except in the initial part of its return stroke. The reason for this qualification will be clear from an inspection of Fig. 7. Assume that the ram is to move forward (to the right) there must, in order to force the first plunger 58 into its ring 59, be relative movement between that ring and the follower 33. So, as the ram advances, the racks 66 will move to the left and, turning gears 71 and 72, will raise the piston 80 slightly in its cylinder. Therefore, as the ram commences its return stroke, the racks 66 will not move with the follower 33 until the piston 80 again moves back into the position shown.

It will thus be seen that the entire operation of the press is effected automatically under manual control by the several valves described. The press units remain in place in the press and all the operator has to do is actuate the valves in proper sequence at the proper times. The heavy labor formerly necessary, including prying successive press units apart and prying the rings off the plunger discs so that the rings, with the cakes therein, could be manually removed from the press so that the operator could crack up the cocoa cake with a mallet to free it from the ring, has been eliminated. The work can be accomplished more quickly, more neatly and with a minimum of labor. The rings, plates and discs will have a longer useful life because they are not removed and not subjected to the rough handling which is liable to injure them.

It is frequently desired to produce cocoa having different percentages of cocoa butter. Breakfast cocoa, for example, needs a higher percentage of cocoa butter than cocoa used for flavoring ice cream, for example. To vary the cocoa butter content, I substitute fingers of different width so that a cake of different thickness will be produced. More cocoa butter can be expressed when the residue cake is thin and such cake will be drier. The arrangement described above enables the fingers to be quickly and easily removed from their bars and other fingers substituted. I prefer to make the fingers of aluminum or the like to secure light weight, which is desirable both for easy handling manually and for actuation automatically with less power.

The linkages described which interconnect the rings and those which interconnect the plates serve also as shoes for slidably supporting the plates and rings from the rails 39. They present bearing surfaces of substantial area as compared with that which would otherwise be available if, following prior practice, the lugs 61 and 62 rested directly on the rails. The weight of ring and plates is distributed over a greater area so that the pressure per unit of area on the rails is much less than formerly. The plates and rings slide more smoothly on the rails and are maintained in the desired erect positions and cannot easily be tipped out of such positions.

The power operated linkage for shifting the rings relatively to their plunger discs is an important feature of the invention as is also the linkage for separating the plates on retraction of the ram. The automatic removal of the cakes is effected wholly automatically and expeditiously, no manual effort being required other than to operate the necessary control valves.

What I claim is:

1. In a press, a plurality of filter-carrying

members, a plurality of rings, said rings and members being coaxially disposed in column formation, each ring cooperating with a pair of members to form a closed chamber and movable axially relatively to one member of such pair, means for filling said chambers with liquid to be filtered, means for moving the members of each pair toward one another and for subsequently spreading them apart, linkage means interconnecting the several rings and enabling them to move toward one another when said members move toward one another and being extended and drawn taut when said members are fully spread apart, and means for moving said linkage means first in one direction to cause each ring to become completely telescoped over one of the members with which it cooperates and subsequently in the opposite direction to restore the rings to their original positions.

2. In a press, having a pressure head formed with a hydraulic cylinder, a ram in said cylinder, and a resistance head; a column of press units disposed in coaxial relation and mounted between the ram and resistance head, each unit comprising a ring and a pair of cooperating filter-carrying members one of which is movable as a piston in the ring, linkage means interconnecting all said members and connected at one end to said ram and at the other to said resistance head, said linkage means enabling movement of said members toward one another, means for moving said ram in one direction to shorten said column and move each member into its ring for the pressing action, means to move the ram in the opposite direction to elongate the column and spread apart said members until said linkage means is drawn taut, a second linkage means interconnecting said rings and being drawn taut when the first linkage means is drawn taut, said second linkage means enabling the rings to move toward one another when the ram is moved in the first-named direction, and means located in part on the resistance head and in part on the ram for reciprocating the second linkage means.

3. In a press, having a pressure head formed with a hydraulic cylinder, a ram in said cylinder, and a resistance head; a column of press units disposed in coaxial relation and mounted between the ram and resistance head, each unit comprising a ring and a pair of cooperating filter-carrying members one of which is movable as a piston in the ring, linkage means interconnecting all said members and connected at one end to said ram and at the other to said resistance head, said linkage means enabling movement of said members toward one another, means for moving said ram in one direction to shorten said column and move each member into its ring for the pressing action, means to move the ram in the opposite direction to elongate the column and spread apart said members until said linkage means is drawn taut, a second linkage means interconnecting said rings and being drawn taut when the first linkage means is drawn taut, said second linkage means enabling the rings to move toward one another when the ram is moved in the first-named direction, means located in part on the resistance head and in part on the ram for reciprocating the second linkage means, and means for actuating said reciprocating means to positively move the second linkage means first toward the ram to telescope each ring on one of its members and then in the opposite direction to return the rings to their former positions.

4. In a press, having a pressure head formed with a hydraulic cylinder, a ram in said cylinder, and a resistance head; a column of press units disposed in coaxial relation and mounted between the ram and resistance head, each unit comprising a ring and a pair of cooperating filter-carrying members one of which is movable as a piston in the ring, linkage means interconnecting all said members and connected at one end to said ram and at the other to said resistance head, said linkage means limiting the extent of separation of said members and enabling movement of them toward one another, means for moving said ram in one direction to shorten said column and move each member into its ring for the pressing action, means to move the ram in the opposite direction and spread apart the members until said linkage means is drawn taut, a second linkage means interconnecting said rings for limiting the extent of separation thereof on movement of the ram in the second named direction and enabling them to move toward one another when the ram is moved in the first-named direction, a hydraulic cylinder movable with the ram and having a piston connected to one end of the second linkage means, a second hydraulic cylinder mounted on the resistance head and having a piston connected to the other end of the second linkage means, the movement of the ram in the second-named direction drawing the second linkage means taut simultaneously with the first linkage means, means for actuating the first-named piston to draw the second linkage means toward the ram and completely telescope each ring over one of its members, and means for actuating the second piston to draw back the second linkage means and restore the rings to their former positions.

5. In a press, having pressure and resistance heads interconnected by a pair of laterally-spaced tie bars, a cylinder in the pressure head and a ram operating in said cylinder, together with a series of press units mounted in coaxial relation and in column form between the ram and resistance head and slidably supported from said bars; each unit comprising a ring and a plate having a plunger slidably engaged in the ring, said ram on its forward stroke movable toward the resistance head to shorten said column and force said plungers into the rings for the pressing action, means operable on the return stroke of the ram for separating the plates and uniformly spacing them one from the other, and links interconnecting each ring to the next ring of the series and each having hook-like parts for engaging the opposite and non-adjacent faces of the two rings which it interconnects and moving the one from the other during the return stroke of the ram and for enabling relative axial sliding movement of the rings the one toward the other during the forward stroke of the ram, means movable with the ram for drawing said links in one direction, and means on the resistance head for drawing the links in the opposite direction.

6. In a press, having pressure and resistance heads interconnected by a pair of laterally-spaced tie bars, a cylinder in the pressure head and a ram operating in said cylinder, together with a series of press units mounted in coaxial relation and in column form between the ram and resistance head and slidably supported from said bars; each unit comprising a ring and a plate having a plunger slidably engaged in the ring, said ram on its forward stroke movable toward the resistance head to shorten said column and force said plungers into the rings for the pressing action, means operable on the return stroke of the ram

for separating the plates and uniformly spacing them one from the other, trackways provided one on each of the adjacent faces of said bars, two series of links one series for each trackway and each series supported on its trackway for sliding movement in a direction parallel to the axis of said column, said series of links interconnecting said rings one series on each side thereof, each link of each series extending between two successive rings of the series and having hook-like parts to engage the opposite and non-adjacent faces of such two rings, whereby movement of one ring will eventually cause movement of the next ring of the series during the return stroke of the ram and whereby to enable relative axial movement between the rings during the forward stroke of the ram, each trackway affording two parallel tracks for the series of links thereon and successive links of the series being located in different tracks, means movable with the ram for drawing said links in one direction and means on the resistance head for drawing the links in the opposite direction.

7. In a press, having pressure and resistance heads interconnected by a pair of laterally-spaced tie bars, a cylinder in the pressure head and a ram operating in said cylinder, together with a series of press units mounted in coaxial relation and in column form between the ram and resistance head and slidably supported from said bars; each unit including a pair of members which are relatively movable on the forward stroke of the ram to effect a pressing action, a series of links one on each side of said press units for interconnecting one member of each pair to the corresponding members of adjacent pairs, each link having hook portions engageable with the opposite and non-adjacent faces of the two members which it interconnects and operable on the return stroke of the ram to limit the extent of separation of the last named members and cause one thereof to move the next, said links enabling the interconnected members to move toward one another on the forward stroke of the ram, the end links of the series having a connection one to the ram and one to said resistance head, whereby the return stroke of the ram spreads apart said members and uniformly spaces them, and trackways one on each tie bar for slidably supporting said links.

8. In a press, having pressure and resistance heads interconnected by a pair of laterally-spaced tie bars, a cylinder in the pressure head, and a ram operating in said cylinder, together with a series of press units mounted in coaxial relation and in column form between the ram and resistance head and slidably supported from said bars; each unit including a pair of members which are relatively movable on the forward stroke of the ram to effect a pressing action, a pair of parallel trackways provided on each tie bar, a series of links for each pair of trackways, each series interconnecting one member of each pair of press units to the corresponding members of adjacent pairs each link having hook portions engageable with the opposite and non-adjacent faces of the two members which it interconnects and operable on the return stroke of the ram to limit the extent of separation of the last-named members and cause one thereof to move the next, said links enabling the interconnected members to move toward one another on the forward stroke of the ram, the end links of the series having a connection one to the ram and one to said resistance head, whereby the return stroke of the ram spreads apart said members and uniformly spaces them, alternate links of each series being mounted to slide in different trackways.

9. In a press, having pressure and resistance heads interconnected by a pair of laterally-spaced tie bars, a cylinder in the pressure head, and a ram operating in said cylinder, together with a series of press units mounted in coaxial relation and in column form between the ram and resistance head and slidably supported from said bars; each unit including a pair of members which are relatively movable on the forward stroke of the ram to effect a pressing action, a pair of parallel trackways provided on each tie bar, a series of links for each pair of trackways, each series interconnecting one member of each pair of press units to the corresponding members of adjacent pairs, each link having hook portions engageable with the opposite and non-adjacent faces of the two members which it interconnects and operable on the return stroke of the ram to limit the extent of separation of the last-named members and cause one thereof to move the next, said links enabling the interconnected members to move toward one another on the forward stroke of the ram, the end links of the series having a connection one to the ram and one to said resistance head, whereby the return stroke of the ram spreads apart said members and uniformly spaces them, alternate links of each series being mounted to slide in different trackways, each said link having a first slot in which a portion of its member closely fits and by which it is fixed to such member and a second slot in which the next adjacent corresponding member is engaged with freedom for the aforesaid relative movement.

10. In a press, having pressure and resistance heads interconnected by a pair of laterally-spaced tie bars, a cylinder in the pressure head, and a ram operating in said cylinder, together with a series of press units mounted in coaxial relation and in column form between the ram and resistance head and slidably supported from said bars; each unit including a pair of members which are relatively movable on the forward stroke of the ram to effect a pressing action, a pair of parallel trackways provided on each tie bar, a series of links for each pair of trackways, each series interconnecting one member of each pair of press units to the corresponding members of adjacent pairs, each link having hook portions engageable with the opposite and non-adjacent faces of the two members which it interconnects and operable on the return stroke of the ram to limit the extent of separation of said last-named members and cause one thereof to move the next, said links enabling the interconnected members to move toward one another on the forward stroke of the ram, the end links of the series having a connection one to the ram and one to said resistance head, whereby the return stroke of the ram spreads apart said members and uniformly spaces them, alternate links of each series being mounted to slide in different trackways, said members being supported through the intermediary of said links from said trackways.

11. In a press, having a pressure head formed with a cylinder therein, a ram in said cylinder, a resistance head and a pair of laterally spaced tie bars interconnecting said heads; a series of press units each including a plate, a plunger fixed to the plate and a ring; said units mounted in coaxial relation and in column form between the

ram and resistance head, said bars having trackways one on each paralleling the axis of the column of units, said plates and rings each having on opposite sides supporting lugs, and shoes of a length in the direction of said axis greater than the axial length of said rings or plates and slidably supported on said trackways and in turn supporting through said lugs said rings and plates, said shoes arranged in two series one for said rings and one for said plates, each series having two rows on each trackway with the shoes of adjacent rows overlapping, the lugs of successive plates and rings fixed to shoes in different rows.

12. In a filter press, a pair of heads interconnected by tie bars and a ram operable in one of said heads, a series of press units slidably supported from said bars and mounted in column formation between the other head and the ram; each unit including a ring member, a plate member, a plunger carried by the plate member and movable in said ring member, a shaft non-circular in cross section and rotatably mounted at its ends in and extending between said heads, spacer fingers one for each press unit and each adapted to be moved into a position between the members of its units to limit relative movement thereof, said fingers supported on said shaft and slidable axially thereon in unison with one of the members of its unit, and means for swinging said shaft to simultaneously move said fingers into and out of said position.

13. In a filter press, a pair of heads interconnected by tie bars and a ram operable in one of said heads, a series of press units slidably supported from said bars and mounted in column formation between the other head and the ram, each unit including a ring member, a plate member, a plunger carried by the plate member and movable in said ring member, a shaft non-circular in cross section and rotatably mounted at its ends in and extending between said heads, spacer fingers one for each press unit and each adapted to be moved into a position between the members of its unit to prevent relative movement thereof, said fingers supported on said shaft and slidable axially thereon in unison with one of the members of its unit, and means for swinging said shaft to simultaneously move said fingers into and out of said position, each finger being mounted for convenient removal from said shaft and withdrawable radially therefrom when the fingers are moved out of spacing position.

14. In a filter press, a pair of heads interconnected by tie bars and a ram operable in one of said heads, a series of press units slidably supported from said bars and mounted in column formation between the other head and the ram; each unit including a ring member, a plate member, a plunger carried by the plate member and movable in said ring; a shaft non-circular in cross section rotatably mounted at its ends in and extending between said heads, spacer fingers one for each press unit slidably mounted on said shaft, each finger having an active spacing position in which it lies between the members of its unit to limit relative axial movement thereof and an inactive position in which it is withdrawn from the path of one member of its unit but still engaged with one face of the other member, a clip secured to each finger and engaging the other face of the last-named member and compelling the finger to slide on the shaft in unison with the movement of such member, and means for turning said shaft to move said fingers from one of said positions to the other.

15. In a press, having pressure and resistance heads interconnected by a pair of laterally-spaced tie bars, a cylinder in the pressure head, a ram operating in said cylinder, and a series of press units mounted in coaxial relation and in column form between the ram and resistance head and slidably supported from said bars; each unit including a pair of members which are relatively movable on the forward stroke of the ram to effect a pressing action, a series of links slidably supported for movement parallel to the axis of the press units, alternative links of the series being overlapped and slidable in different and non-interfering parallel paths, said links interconnecting one member of each pair to the corresponding members of adjacent pairs, each link extending between the two members which it interconnects and having hook-like parts for engaging the opposite and non-adjacent faces of such two members, the end links of the series being connected one to said ram and one to the resistance head whereby on the return stroke of the ram the interconnected members are successively moved and drawn apart into predetermined spaced relation and whereby movement of such members toward one another on the forward stroke of the ram is enabled.

16. In a press, having pressure and resistance heads interconnected by a pair of laterally-spaced tie bars, a cylinder in the pressure head, a ram operating in said cylinder, and a series of press units mounted in coaxial relation and in column form between the ram and resistance head, each unit including a pair of members which are relatively movable on the forward stroke of the ram to effect a pressing action, said bars having trackways one on each paralleling the axis of said series of units, one member of each unit having supporting lugs one on each side thereof, and shoes slidable on said trackways on which said lugs are supported, each shoe having a length in the direction of said axis greater than the axial length of any of said members, said shoes arranged in two series one for each trackway, each such series comprising two rows with the shoes of adjacent rows overlapping.

ALONZO LINTON BAUSMAN.