ABSTRACT: This filter press includes filter-plate-feeding members adapted for moving a plurality of filter plates backward one by one by passing the plates under the hangers of said train of filter plates and catching the same. The filter-plate-feeding members each have an opposed pair of paws that can be freely raised, the front paw thereof passing under the hanger and catching the same, the rear paw abuts against said hanger and brings the same into a halt. The pair of paws of the members are retreated and changed in operation in order to advance the plates one by one.
FILTER PRESS

This invention relates to a filter press and particularly to an automatic separation mechanism for its filter plates or filter plates and frames.

Included under filter presses are a single-type filter press comprising a plurality of filter plates alone and a double-type filter press having a plurality of filter plates and frames in alternate combination, but since the two types are structurally the same, this invention is applicable to both of them. It is to be understood that what is herein referred to as filter plates in this specification and claims is so termed with respect to that direction of motion for pressing which is set as a reference, and a first head side and a movable head side represent respectively "front" and "rear" or "forward" and "backward." Accordingly, the term "right" and "left" also correspond in like manner to the forward and backward directions from the reference.

A plurality of filter plates are pressed collectively in filtering work that is carried out on a filter press having a plurality of filter plates arranged in parallel to the longitudinal direction thereof, and after the material to be filtered has been pressed, the plurality of filter plates must be separated one by one and restored to their normal positions in order to remove cakes staying between filter plates.

The plurality of filter plates thus moved backward to a jammed relation to one another are generally moved forward collectively by a movable head, but forced pressing of the filter plates which are inclined even in a slight degree toward the left or the right tends to move the filter plates slantingly, thereby pushing a slide bar and bending the same. Furthermore, when the filter plates are moved forward, it sometimes happens that pieces of filter cloth must be cleaned one after another. In such a case, the filter plates must be moved forward one by one.

A primary object of this invention is to provide a new-type filter press capable of automatically separating a plurality of filter plates one by one and restoring them to their normal positions.

Another object of this invention is to provide a new type filter press capable of automatically separating filter plates one by one and moving them in either forward or backward direction.

Still another object of the invention is to provide an automatic separation mechanism for a filter press whereby a plurality of filter plates are separated intermittently and at fixed intervals.

Yet another object of the invention is to provide a filter plate feeding member having a symmetrical pair of paws adapted to function as a feeder and a stopper and which is used in the automatic separation mechanism for the filter plates.

A further object of the invention is to provide an endless chain for reciprocating the filter-plate-feeding member.

A further object of the invention is to provide a control device for automatically effecting positive or negative rotation of a reversible motor for driving the endless chain in order to reciprocate the filter-plate-feeding member.

A still further object of the invention is to apply the tension of the endless chain to the control device for changing the direction of rotation of the reversible motor for driving the endless chain.

Another object of the invention is to provide a changeover mechanism for changing over the action of a front pawl and a rear pawl in order to change the direction of feed of the filter plates.

In short, the filter press provided by the invention basically comprises endless chains disposed in parallel to both sides of a train of filter plates and having respectively one filter-plate-feeding member, a symmetrical pair of paws which are fitted to the filter-plate-feeding member so as to freely bring themselves into vertical positions and which are normally biased by a spring to rise and strike against a hanger of a filter plate, and a reversible motor for driving said endless chains by changing over the chains in either direction.

In the longitudinal direction of a filter-plate-feeding member is formed a long groove, into which a slidable member is slidable fitted said slidable member being provided forwardly and rearwardly thereof with horizontally projecting pins, a front pin being fitted into the transverse slot formed in the front half of a front pawl and a rear pin being fitted into the transverse slot formed in the rear half of a rear pawl. The upper end of a changeover lever fitted swingably by a pivot to the filter-plate-feeding member is inserted into the notch formed in the center of the slide block, and the side bar of the filter press is provided forwardly and rearwardly of the outside thereof with projections against which the projected lower end of the changeover lever strikes when a filter-plate-feeding member is moved.

Idle chain wheels fitted from outside to a swingable lever are pressed by springs into contact with the endless power transmission chains that transmit power to endless driving chains having a filter-plate-feeding member. A driven chain wheel is fitted to the same shaft as the chain wheel of one of the endless driving chains, and a driving chain wheel is designed to be attracted in the direction of the driven chain wheel by the tension produced on the endless driving chain. The lever is swung by the slack of the endless power transmission chain produced at this time, and this swing brings the lever into contact with a limit switch which gives an information sign for changeover of the direction of rotation of a reversible motor.

The structures and operation of this invention together with other objects and advantages thereof will be more clearly understood from the following detailed description made with reference to a preferred embodiment of the invention shown by way of example and to the accompanying drawings wherein:

FIG. 1 is a side view, broken in part, of the new-type filter press according to this invention;
FIG. 2 is a front view of the filter press of FIG. 1;
FIG. 3 is a sectional view, broken in part, of a filter-plate-feeding member for the filter press shown in FIG. 1;
FIG. 4 is an enlarged sectional view taken along line 4-4 of FIG. 3;
FIG. 5 is an enlarged sectional view taken along line 5-5 of FIG. 3;
FIG. 6 is an enlarged sectional view taken along line 6-6 of FIG. 3;
FIG. 7 is an enlarged sectional view taken along line 7-7 of FIG. 3;
FIG. 8 is a side view of the filter-plate-feeding member, showing the state in which the filter-plate-feeding member advances, a front pawl passes under the hanger of a filter plate, and a rear pawl is positioned immediately before it strikes against the hanger;
FIG. 9 is a side view of the filter plate feed member, showing the state in which the front pawl is raised, catches the hanger and is feeding the filter plate backward;
FIG. 10 is a side view of the filter-plate-feeding member, showing the state in which the filter-plate-feeding member is retracted, the rear pawl is pressed down by a pawl depressor of a movable head, and the filter plates returned are being against the movable head;
FIG. 11 is a side view of the filter-plate-feeding member, showing the state in which the member is advanced to the front end of the filter press and slots of the front and rear paws each have changed in position by rotation of a changeover lever;
FIG. 12 is an explanatory view illustrative of the control mechanism of the reversible in the filter press of FIG. 1, showing the state in which the rotation of the motor is changed over from positive to negative rotation; and
FIG. 13 is a view similar to the explanatory view illustrative of the control mechanism of the reversible motor, showing the
state if rotation of the motor being changed over from positive to negative rotation.

The filter press of the invention shown in FIGS. 1 and 2 comprises a first head 1, a movable head 2, a rear head 3, a pair of side bars 4 disposed on the right and left sides, and a plurality of filter plates. The first head 1 and the rear head 3 include stands 6 and 7. The rear head 3 includes an oil pressure cylinder 8 incorporating a piston and the end of the rod 9 of the piston is movable to the movable head 2. The movable head 2 is provided on each of the right and left sides with one roller 10, which is received on the surface of each of the side bars 4 to slidably support the movable head 2 thereon. In the middle of the first head 1 is provided a liquid inlet 11 and in the corners of the upper right and lower left ends thereof is formed a filter liquid outlet 12 (FIG. 2). On the right and left sides of filter plates 5 are mounted hangers 13, which are placed respectively on the surfaces of the side bars 4 to suspend the filter plates 5 so as to be slidable thereon.

Downwardly of a train of right and left hangers 13 and outwardly of the right and left side bars are spanned a parallel pair of endless driving chains 15 each having one filter-plate-feeding member 14 on the upper side between front and rear chain wheels 16 and 17.

To the stand 6 of the first head 1 is attached a receptacle 19 through pivot 18 in a swingable and forwardly projecting manner, and above the receptacle 19 is fixed a reversible motor 20 and its reduction gears 21 for driving the endless chains 15. The outer side of the receptacle 19 is disposed spring receptacle plate 22 with a small space provided therebetween and it is fixed to the stand 1 together with support members 23 disposed on both sides of the plate 22. A rod 25 having a flange 24 at its lower end extends through the spring receptacle plate 22 and is supported thereon, and a coiled spring 26 compressing the upper side and a coiled spring 28 compressed to a lower side each having a different direction of coiling are fitted over the rod 25. The upper and lower ends of the upper side compressing coiled spring 26 are supported respectively on the receptacle 20 and the spring receptacle plate 22, and those of the lower side compressing coiled spring 27 are supported respectively on the spring receptacle plate 22 and the flange 24 of the rod 25. A power transmitted between a main driving chain wheel 26 fixed to the shaft of the reduction gears 21 and a driven chain wheel 30 fixed to the middle portion of the length of the shaft 29 of a front chain wheel 16 of an endless driving chain 15, and the power of a motor 20 is transmitted to the endless driving chain 15 through those transmitting means. Forwarily of the first head 1 and slightly spacedly therefrom is disposed a bracket 32 in side-by-side relation with the driven chain wheel 30 and, as shown in FIGS. 12, 13, and 12, to the bracket 32 are swingably fitted by pins 37 and 38 the upper ends of levers 35 and 36 having respectively idle chain wheels 33 and 34 at the lower ends, said idle chain wheels being in mesh with the front and rear stretches of the driving chain 31 from outside. A pin 39 for fitting a spring thereto is provided on the bracket 32 between the front and rear levers 34 and 36, and with the spring tension springs 40 and 41 are interposed respectively between the pin 39 and the front lever 35 and the pin 39 and the rear lever 36 for urging the idle chain wheels 33 and 34 to normally bear against the power transmission chain 31. The bracket 32 is provided with limit switches 42 and 43 for giving signals for positive and negative rotation of the motor 20 with which the levers 35 and 36 come into contact at their lower ends, when swung inwardly.

As shown in detail in FIGS. 3 through 7, the filter-plate-feeding member 14 comprises a rectangular block 44, square rotdrive slide block 46 fitted slidably into a long groove 45 formed longitudinally on the upper inside of said rectangular block 44, a front and rear symmetrical pair of paws 49 and 50 respectively fastened to the pins 47 and 48 protruding outwardly from the front and rear sides of said slide block 46, said pins 47 and 48 being fixed as fulcrums, and a changeover lever 52 fitted swingably by a pivot 51 to a block 44 and inserted at its upper end 52a from below into an inverted trapezoidal cut-away portion 53 formed in the center of the slide block 46 and extending at its lower end 52b downwardly of the block 44 through a curved portion 52c below the block 44. A stepped portion 54 is formed on the inner surface of the block 44 including a groove 45, a cover plate 55 of the groove 45 is applied to the stepped portion 54 and secured to the block 44. On the underside of the slide block 46 is formed, as shown in FIGS. 3 and 7, conical recesses 117 and 118 for slip prevention at specified intervals forwardly and rearwardly from each other, and through hole 119 formed in either of said conical recesses and extending from the underside of the block 44 to the groove 45 is adapted to receive therein a nonslip ball 121 supported by a coiled spring 120 for pushing up. The through hole 119 is provided on its lower side with a female thread 122, in which a bolt 123 is screwed to support the coiled spring 120. A front paw 49 is formed in the area from the middle to the rear half thereof with a transverse slot 56 and a rear paw 50 is formed in the area from the middle to the front half thereof with a transverse slot 57, and the front pin 47 of a slide block 46 and the rear pin 48 of a slide block 46 are fitted respectively into the slot 56 of the front paw 49 and the slot 57 of the rear paw 50, said paws 49 and 50 being adapted to swing respectively around the pins 47 and 48 serving as fulcrums. Guides 58 and 59 for swinging the paws 49 and 50 are respectively and integrally provided at the front and rear ends of the outside of the block 44, and further at the lower ends of the guides 58 and 59 are formed stopper 60 and 61 for defining the lower limit of rotation of the paws 49 and 50. Spring fitting pieces 62 and 63 that extend downwardly are secured by set screws 64 and 65 to the outside of the stoppers 60 and 61, and helical tension springs 70 and 71 are spaced respectively between the pins 66 and 67 provided at the lower ends of the paws 49 and 50 and those pins 66 and 67 provided at the lower ends of the spring fitting pieces 62 and 63. In the center of the lower end of the outside of the block 44 is provided a projected portion 72 for receiving a pivot 51, and further on both lateral sides of the projected portion 72 are provided projected portions 73 and 74 slightly less projected than the projected portion 72. On the outside of the lower end portions of the ends 49a and 50a of the paws 49 and 50 are formed recesses 75 and 76, and between said recesses and the projected portions 73 and 74 are disposed regulating pieces 79 and 80 having respectively slots 77 and 78 formed therein for preventing the paws 49 and 50 from rotating to a position higher than is necessary, the upper ends of said regulating pieces are rotatably mounted by stop pins 81 and 82, the paws 49 and 50 and the lower ends thereof are mounted by stop pins 83 and 84 to the projected portions 73 and 74 through slots 77 and 78. Forwardly and rearwardly of the underside of the block 44 are disposed rollers 85 and 86, which are received into a grooved roller guide rail 87 formed on the outside of a side bar 4. To the front and rear sides of the block 44 are secured projecting inwardly arms 88 and 89, and projections 90 and 91 are provided on the underside of the inner ends 88a and 89a of the arms 88 and 89, and the projections 90 and 91 are loosely fitted in a grooved lower guide rail 124 formed in the side bar 4 upwardly of the rear end of the rail 87. On the upper side of the inner ends 88a and 89a of the arms 88 and 89 are formed grooves 92 and 93, which are loosely fitted over the projected rail 95 fitted to the underside of angle bar 94 secured in an inverted L-shape in section to the side bar 4. One double-headed bolt 96 is passed through the inner end 88a of the arm 88 and the inner end 89a of the arm 89 is secured with double nuts 97 and 98, and both ends of the double nuts are respectively secured into threaded holes 101 and 102 of chain fittings 99 and 100 and secured with nuts 103 and 104. At the ends of chain fittings 99 and 100 are formed grooves 105 and 106, and links 15a and 15b at both ends of an endless driving chain 15 are respectively fitted into the grooves 105 and 106, and secured with bolts 107 and 108 to the fittings 99 and 100. On the lower portion of the outside of the side bar 4 are disposed chain guide rollers 109 at regular spaces.
As shown in FIG. 1, pawl depressors 110 and 111 equal in length to the hangers 13 of filter plates 5 are disposed on each side of a first head 1 and a movable head 2. The pawl depressor 110 of the first head 1 is formed slightly larger in width and the changeover lever 52 of a filter-plate-feeding member 14 is rotated, the pawl depressor may depress a front pawl 49 to fall. The front and rear sides of pawl depressor 111 of the movable head 2 are formed with inclined surfaces 111a so as to make the pawls 49 and 50 pass freely under the front and rear sides of the depressor 111 when the filter-plate-feeding member 14 passes thereunder. On the front and rear portions of the side bar 4 are provided projections 112 and 113 for rotation of the changeover lever 52. On the front and rear portions of a roller guide rail 87 are disposed limit switches 114 and 115 for stopping a motor 20, said switches being adapted to come into contact with the filter-plate-feeding member 14 when rotation of the changeover lever 52 is over. The front limit switch 114 performs also the function of pushing of an oil cylinder 8. On the rear portion of the upper side of the side bar 4 is disposed a limit switch 116 for a dual purpose of stopping the oil cylinder 8 and effecting positive rotation of the motor 20 in order to make it possible for the switch 116 to come into contact with the end of the movable head 2 that has been retreated.

The operation of this apparatus work in the following manner. In order to remove the cakes stuck to filter plates after the operation of pressing is over, the filter plates must be successively returned to their normal positions one by one. First, this operation will be described. FIG. 1 shows a state in which a piston rod 9 has been pushed out by an oil cylinder 8, and pressing has been operated at a stroke by a movable head 2. A filter-plate-feeding member 14 is shown moved backward. From this state on, first a hand-operated switch is closed, whereby the movable head 2 is moved backward by means of an oil cylinder 8. When the movable head 2 strikes against a limit switch 116, it is brought to a halt by the signal of the switch 116, and then a reversible motor 20 is rotated positively to turn chain wheels 16 and 17 in a counterclockwise direction. Then, in accordance with the travelling of an endless driving chain 15, a filter plate member 14 moves forward. When the member 14 reaches the movable head 2, pawls 49 and 50 sink along and pass under theinclined surfaces 11a of a pawl depressor 111 against the action of tension springs 64 and 65. Then, the pawls 49 and 50 move further forward, and when they reach the hanger 13 of the filter plate 5 in the first position from the rear side, the front pawl 49 passes under the hanger 13 but the rear pawl 50 strikes against the rear side of the hanger 13. FIG. 8 shows a state immediately before this state. Accordingly, the filter-plate-feeding member 14 is not allowed to move further than that and stops there. However, as the chain wheel 34 still continues with its positive rotation, it is eventually braked to a halt. While a main driving chain wheel 28 is urged to be rotated in a counterclockwise direction by the motor 20, a driven chain wheel 30 and a front chain wheel 16 of an endless driving chain 15, because of the tension produced on the upper stretch of the endless chain 15 by stop of the feeding member 14, work on the prevention of said counterclockwise rotation. As a result, upward tension is produced on the front stretch of an endless power transmission chain 31, and causes a reciprocator 22 to rotate upward with a pivot 18 as a fulcrum. Then, the rear stretch of the endless power transmission chain 31 becomes subjected to tension so that, when the chain wheel 34 urged into contact with the chain 31 and, in turn, a rear lever 36 are caused to rotate inwardly by urging of a tension spring 41, thereby to bring the lower end of the lever 36 into contact with a limit switch 43 (FIG. 12). The reversible motor 20 is reversely rotated by the signals of the switch 43, the chain wheels 36 and 37 are rotated counterclockwise, and the hanger 13 is effected in the direction in which an endless driving chain 15 travels, whereby the filter-plate-feeding member 14 is moved backward. At this time, as a front pawl 49 has been returned to its normal position by the action of a tension spring 70, it catches the hanger 13 of the filter plate 5 in the first position from the rear side, and moves the filter plate 5 backward (FIG. 9). And a rear pawl 50 sinks under the pawl depressor 111 of the movable head 2 that has already finished retracting (FIG. 10). When the filter plate 5 strikes against the movable head 2, it is not allowed to retract further, and hence a filter-plate-feeding member 14 stops at the place to which it is moved. An in consequence, tension is now produced on the lower stretch of the endless driving chain 15, and from the same reason as described above, the rear stretch of the endless driving chain 31 is placed under upward tension, and a front lever 35 is rotated inwards and the lower end of the lever 35 is brought into contact with a limit switch 42 (FIG. 13). Changeover from negative to positive rotation is effected by this signals of the switch 42 in the direction of rotation of a reversi-ble motor 20, whereby the endless driving chain 15 is moved counterclockwise and the filter-plate-feeding member 14 starts moving forward again, and if at this time a rear pawl 50 were immediately raised, it would catch the hanger 13 of the filter plate 5 that has been moved backward and would return it to its original position. But as clearly shown in FIG. 10, in 48 i.e. a fulcrum is positioned at the rear end of a transverse slot 57 and a pawl depressor 111 depresses the pawl 50, and the pawl 50 remain sunken until the filter-plate-feeding member 14 passes under the hanger 13 of the retreated filter plate 5 first in position from the rear, and after the member 14 has passed therethrough, then for the first time the pawl 50 is raised and functions as the aforementioned stop. From this time on, the function of the depressor 111 is performed by the hanger 13 of the filter plate 5 that has been retreated. In this manner, the filter-plate-feeding member 14 reciprocates back and forth, thereby separating the filter plates 5 from one another one by one in succession, feeding them backward, and in the meanwhile removing the cakes staying therebetween.

Even after all the filter plates 5 have been retreated, the filter-plate-feeding member 14 still moves forward by a changeover in the direction of rotation of the motor 20, until it strikes against a pawl depressor 109 and stops. As soon as it stops, the member 14 comes into contact with a limit switch 114 and the reversible motor 20 is brought to a stop by the signals of the switch 114. Accordingly, the aforesaid limit switch 43 does not operate. Next, by the signal of the limit switch 114, an oil cylinder 8 is operated and a movable head 2 is moved forward. When oil pressure is increased after pressing is over, a switch for pressure is operated to bring the reversible motor 20 into rotation and thereby to retract the filter-plate-feeding member 14. And then the member 14 comes into contact with a rear limit switch 115 and is brought to a stop. In this manner one cycle of press filtering operation is completed.

Now, a description has been made of the embodiment shown as above by way of example with reference to the case in which a group of filter plates that has been retreated was collectively moved backward by a movable head, and in the description that follows reference will be made to the case in which a group of filter plates that has been retreated is moved forward one by one. When all the filter plates have been retreated, the filter-plate-feeding member 14, as described, is moved forward, abuts against a front pawl depressor 109, and stops. At this time the fulcums of pawls 49 and 50 of the filter-plate-feeding member 14 are changed over in such a manner that, when the filter plate member 14 is moved forward, a changeover lever 52 extending thereunder abuts against a projection 112 positioned on the front portion of a side bar 4, and because the member 14 is moved still further, the changeover lever 52, as shown in FIG. 11, is rotated at its projected lower end 52b rearwardly to a position symmetrical with respect to the original position of the end 52b. As a result, the upper end 52a of the changeover lever 52 is swung in a reverse direction, and a slide block 46 is thereby pushed to move backward inside a long groove 45. In accordance with this action, the pins 47 and 48 of the slide block 46 move respectively in slots 56 and 57, and the relation the pins 47 and 48 have with the slots 56 and 57, as clearly shown in FIG. 11, has completely changed in position from that which they
show they have with each other in FIGS. 8 through 10. Accordingly, when the filter-plate-feeding member 14 is moved backward and the front pawl 49 strikes against a hanger 13 of the filter plate 5 first in position from the front side and thereby the front pawl 49 changes its movement in the forward direction, a hanger 13 second in position from the front, because a pin 48 is positioned at the front of the slot 57, is deprived of its power to depress a rear pawl 50, and when the filter-plate-feeding member 14 changes its direction and starts moving forward, the pawl 50 is immediately raised, catches the hanger 13, and feeds it forwardly of the first filter plate 5. It will need no particular mention that further operation for feeding filter plates is exactly the same as the aforementioned backward feeding of the filter plates. After all the filter plates have been fed forward, a filter-plate-feeding member 14 is retreated, a changeover lever 52 of the member 14 is returned to its normal position by the projection 113 formed on the rear portion of a side bar 4, and the relation of pins 47 and 48 in position with the respective slots 56 and 57 of the front and rear pawls 49 and 50 is returned to its original relation thereby feeding the filter plates backward.

As apparent from the description so far given, the mechanism of the apparatus of the invention is such that all the filter plates are automatically separated and moved from their respective pressing positions one by one and that moreover if required, it also is made possible to separate and move each filter plate one by one from the position to which they have been retreated toward a head.

It should be understood that the embodiment described and shown in only illustrative of an application of the principle of the invention and that many other changes and modifications could be suggested by those skilled in the art without departing from the scope and spirit of the invention.

What we claim is:
1. A filter press comprising a fixed first head, a fixed rear head, a movable head disposed therebetween, a plurality of filter plates arranged in side-by-side relation in a row between said first head and said movable head and having on both sides thereof hangers protruding horizontally and suspended by said hangers slidably on both side bars spaced between both sides of said first head and both sides of said rear head, and filter-plate-feeding members having a pair of pawls capable of reciprocating back and forth below both sides of said train of filter plates and capable of being freely raised, said pair of pawls being adapted to make one pawl thereof pass under the hanger of a filter and catch the same thereby to feed the filter plate and adapted to make the other pawl thereof abut against the hanger of the filter plate thereby to bring said filter-plate-feeding member to a stop.
2. A filter press as claimed in claim 1 in which the filter-plate-feeding members are fitted to endless chains moved by a reversible motor in either direction and reciprocated back and forth by movement of said endless chains under both sides of said train of filter plates.
3. A filter press as claimed in claim 1 in which the filter-plate-feeding members have rollers on the front and rear portions of the lower ends thereof and are thereby adapted to travel on the guide rails respectively provided on side bars.
4. A filter press as claimed in claim 1 in which the pair of pawls of the filter-plate-feeding members are normally urged by springs to be raised to a height at which to abut against the hanger of the filter plate.
5. A filter press as claimed in claim 1 in which the pair of pawls of the filter-plate-feeding members are raised aslant toward the centers of the filter-plate-feeding members and placed in symmetrical relation.
6. A filter press comprising a fixed first head, a fixed rear head, a movable head disposed between said heads, a plurality of filter plates disposed in side-by-side relation in a row between said first head and said movable head and having on both sides thereof hangers protruding horizontally from both sides thereof and suspended by said hangers slidably on both side bars spaced between both sides of said first head and both sides of said rear head, and filter-plate-feeding members having a pair of pawls reciprocating back and forth below both sides of said train of filter plates, said first head and said movable head being respectively provided with pawl depressors, said pawl depressors being equal in length to the hangers of the filter plates and adapted to be positioned such that the space between the pawl depressors and the next adjacent filter plates, during pressing, becomes equal to the respective spaces between the hangers of other filter plates, said pair of pawls being fitted by pins to the filter-plate-feeding members so as to be freely raised and rotatable, one pawl of said pair passing under the hanger of a filter plate and catching the same to feed the filter plate, the other pawl thereof being adapted to abut against the hanger of the filter plate so as to bring said filter-plate-feeding members to a stop, and adapted to change the positions of pins with respect to said both pawls.
7. A filter press as claimed in claim 6 in which said pair of pawls are respectively provided with transverse slots, pins that serve respectively as fulcrums are slidably fitted into said slots, the pins of feed pawls are interposed in the middle between the hanger of the filter plate to be fed in the state of a stop pawl abutting against the hanger of the filter plate and the hanger of the filter plate to be fed next, the pin of the stop pawl, in the state of the filter plate having been fed, is positioned nearer to the feeding side than the hanger of the filter plate fed and the pawl depressor of the movable head or first head that had been retreated previous to said filter plate or the hanger of the filter plate that had been fed previous to said filter plate.
8. A filter press as claimed in claim 6 in which the pawl depressor of the movable head is tapered on the front and rear surfaces thereof toward the lower end thereof.
9. A filter press comprising a fixed first head, a fixed rear head, a movable head disposed therebetween, a plurality of filter plates arranged in side-by-side relation in a row between said first head and said movable head and having on both sides thereof hangers protruding horizontally from both sides thereof and suspended by said hanger slidably on both side bars spaced between both sides of said first head and both sides of said rear head, endless chains disposed parallelly on both sides of said train of filter plates and having one filter-plate-feeding member, a symmetrical pair of filter plates being fitted to the filter-plate-feeding member so as to be freely raised and which are urged by springs to be normally raised to abut against the hanger of the filter plate, and a reversible motor adapted to drive said endless chains in either direction by changegover of rotation of the motor, said first head and said movable head being respectively provided with pawl depressors, said pawl depressors being equal in length to the hangers of the filter plates and adapted to be positioned such that the space between the pawl depressors and the next adjacent filter plates, during depression, becomes equal to the respective spaces between the hangers of other filter plates, said filter-plate-feeding members being longitudinally provided with long grooves into each of which a slide block is slidably fitted, each said slide block having in the front and rear portions thereof pins respectively protruding horizontally from the front and rear portions thereof, the front pin of said pins being fitted into the transverse slot formed in the rear half of a front pawl and the rear pin thereof being fitted into the transverse slot formed in the front half of a rear pawl, the upper end of a changegover lever swingably fitted by a pivot to said filter-plate-feeding member being inserted into the notch formed in the center of said slide block.
10. A filter press as claimed in claim 9 in which conical recesses for the prevention of slip are formed at specified intervals on the front and rear portions of the underside of the slide block and adapted to receive into either thereof a nonslip ball supported by a coiled spring.
11. A filter press comprising a fixed first head, a fixed rear head, a movable head disposed therebetween, a plurality of filter plates arranged in side-by-side relation in a row between said first head and said movable head and having on both sides
thereof hangers protruding horizontally from both sides thereof and suspended by said hangers slidably on both side bars spanning between both sides of said first head and both sides of said rear head, endless chains disposed parallelly on both sides of said train of filter plates and having each one filter-feeding member, a symmetrical pair of paddles fitted to the filter-plate-feeding member so as to be freely raised and which are urged by springs to be normally raised to abut against the hanger of the filter plate, and a reversible motor adapted to drive said endless chains in either direction by change of rotation of the motor, said first and said movable head being respectively provided with pawl depressors, said pawl depressors being equal in length to the hangers of the filter plates and adapted to be positioned such that the space between the pawl depressors and the next adjacent filter plates, during pressing, becomes equal to the respective spaces between the hangers of other filter plates, said filter-plate-feeding member being horizontally provided with long grooves into each of which a slide block is slidably fitted, said each side block having on the front and rear portions thereof pins respectively protruding horizontally from the front and rear portions thereof, the front pin of said pins being fitted into the transverse slot formed in the rear half of a front pawl and the rear pin of said pins being fitted into the transverse slot formed in the front half of a rear pawl, the upper end of a changeover lever swingably fitted by a pivot to said filter-plate-feeding member being inserted to the notch formed in the center of said slide block, a projection against which the projected lower end of said changeover lever abuts, when said filter-plate-feeding member is moved on, being formed on the front and rear portions of the outside of each side bar.

12. A filter press comprising a fixed first head, a fixed rear head, a movable head disposed therebetween, a plurality of filter plates arranged in side-by-side relation in a row between said first head and said movable head end having on both sides thereof hangers protruding horizontally from both sides thereof and suspended by said hangers slidably on both side bars spanning between both sides of said first head and both sides of said rear head, endless chains disposed parallelly on both sides of said train of filter plates and having each one filter-plate-feeding member, a symmetrical pair of paddles fitted to said filter-plate-feeding member so as to be freely raised and which are urged by springs to be normally raised to abut against the hanger of the filter plate, and a reversible motor adapted to drive said endless chains and a control mechanism for a motor adapted to give signs for positive or negative rotation of the reversible motor by the tension of the endless chains, said tension being produced by the stop of the endless chains due to the prevention of the filter-plate-feeding member from movement by striking of the filter-plate-feeding member against an obstacle.

13. A filter press as claimed in claim 12 in which the motor control mechanism comprises an endless power transmission chain that transmit power to endless driving chains each having a filter-plate-feeding member, driven chain wheels of said endless power transmission chain fixed to the same shaft as each front chain wheel of said endless driving chains, main driving chain wheel attracted in the direction of said driven chain wheel by the tension produced in said endless driving chains, idle chain wheels pressed from outside into contact with said endless power transmission chain by springs fitted to swingable levers, and switches for giving signs for changeover of the direction of rotation of a reversible motor, said switches being adapted for operation by said swingable levers being brought into contact therewith by the lever being swung by that slack of said endless power transmission chain which is produced when said main driving chain wheel is attracted in the direction of said driven chain wheel.

14. A filter press comprising a fixed first head, a fixed rear head, a movable head disposed therebetween, a plurality of filter plates arranged in side-by-side relation in a row between said first head and said movable head and having on both sides thereof hangers protruding horizontally from both sides thereof and suspended by said hangers slidably on both side bars spanning between both sides of said first head and both sides of said rear head, endless chains disposed parallelly on both sides of said train of filter plates and having each one filter-feeding member, a symmetrical pair of paddles fitted to said filter-plate-feeding member so as to be freely raised and which are urged by springs to be normally raised to abut against the hanger of the filter plate, and a reversible motor adapted to drive said endless chains, and a control mechanism for a motor adapted to give signs for positive or negative rotation of the reversible motor by the tension of the endless chain, said tension being produced by the stop of the endless chains due to the prevention of the filter-plate-feeding member from movement by striking of the filter-plate-feeding member against an obstacle, said first head and said movable head being respectively provided with pawl depressors, said pawl depressors being equal in length to the hangers of the filter plates and adapted to be positioned such that the space between the pawl depressors and the next adjacent filter plates, during pressing, becomes equal to the respective spaces between the hangers of other filter plates, said filter-plate-feeding member being longitudinally provided with long grooves into each of which a slide block is slidably fitted, said slide block having in the front and rear portions thereof pins respectively protruding horizontally from the front and rear portions thereof, the front pin of said pins being fitted into the transverse slot formed in the rear half of a front pawl and the rear pin of said pins being fitted into the transverse slot formed in the front half of a rear pawl, the upper end of a changeover lever swingably fitted by a pivot to said filter plate feeding member being inserted into the notch formed in the center of said slide block, a projection against which the projected lower end of said changeover lever abuts, when said filter-plate-feeding member is moved on, being formed on the front and rear portions of the outside of each side bar.