

Nov. 30, 1943.

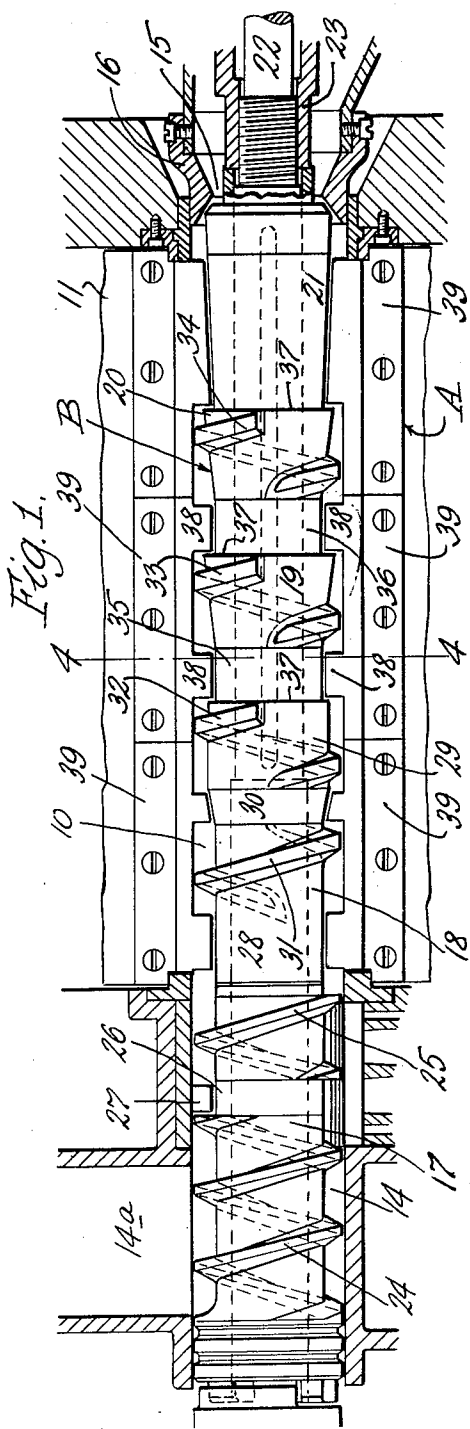
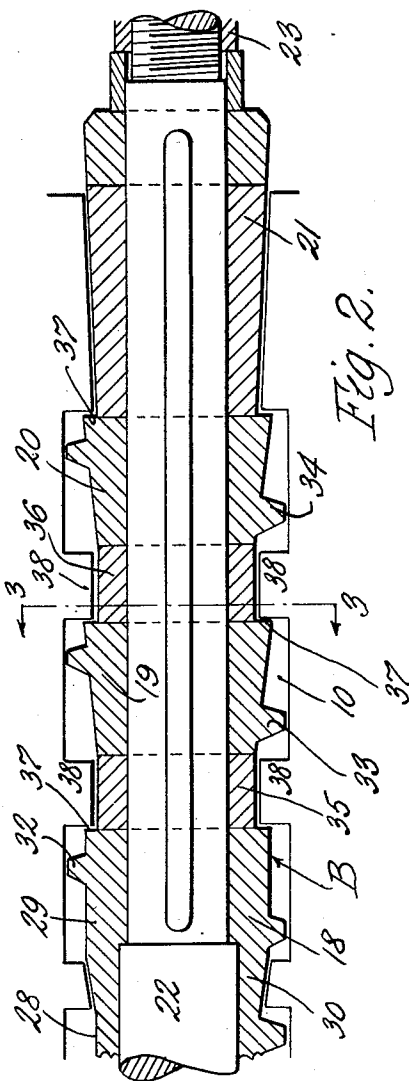
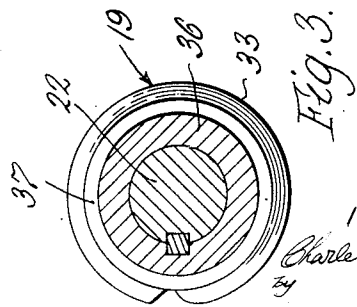
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2,335,819

LIQUID EXPRESSING PRESS

Filed June 12, 1942

2 Sheets-Sheet 1



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Fig. 5.

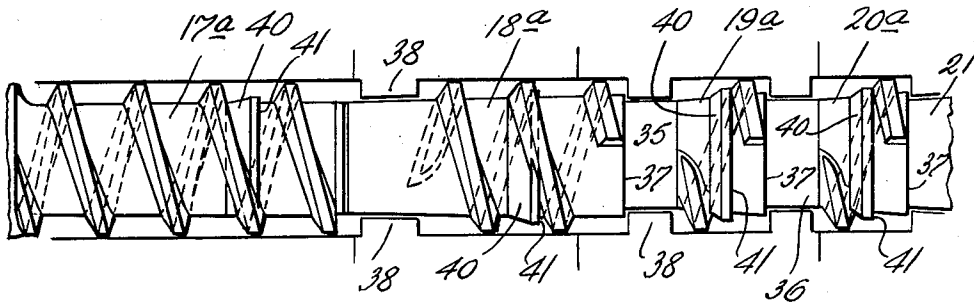
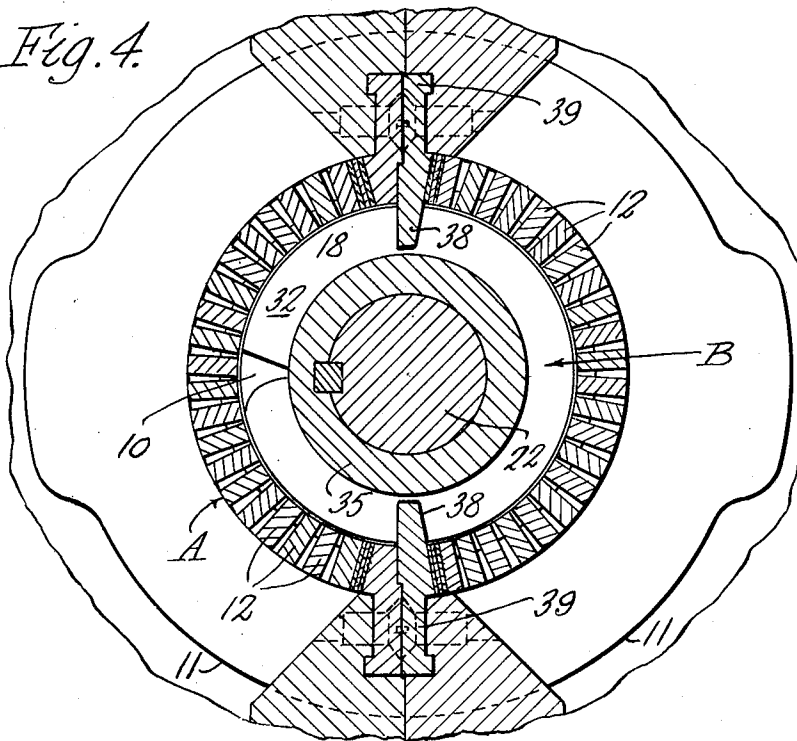


Fig. 4.



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UNITED STATES PATENT OFFICE

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LIQUID EXPRESSING PRESS

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15 Claims. (Cl. 100—48)

This invention relates to improvements in oil or liquid expressing presses of the continuous type in which, as such presses are commonly constructed, the oil bearing or other material containing liquid is fed more or less continuously into a cage or barrel through which the solid material is forced and expelled through a restricted discharge opening by one or more axial worms or screws rotating in the cage, whereby the material is subjected to pressure and the oil or liquid in the material is expressed therefrom and escapes through fine openings or perforations in the walls of the cage.

In the operation of such presses, the material becomes more compact and the pressure thereon should increase as it progresses through the cage under the action of the worms until, in the pressing of some materials, high pressures amounting at times to as much as five or six thousand pounds per square inch, are reached. The material enters the cage in a relatively loose mass or non-compact condition and its bulk is reduced more and more as it is subjected to pressure and gives up its liquid during its progress through the cage, the amount of reduction in the bulk or mass of material depending largely upon the liquid content thereof. Materials having a high liquid content give up their liquid more readily and at lower pressures than materials having a lower liquid content, i. e., in which the proportion of liquid is less compared with the fibrous or solid content of the material.

Therefore, various attempts have been made heretofore to design or construct the pressure worm assembly or means of such presses so as to maintain or progressively increase the pressure on the material as it is advanced through the cage toward the discharge and its mass or volume is progressively reduced, in order to obtain proper performance and efficient operation of the press. With such considerations in view, the presses have been provided with a plurality of worm flights arranged in succession axially in the cage and separated or interrupted by intervening spaces, with means, such for example, as fixed parts projecting radially inward from the cage walls, acting on the material in these spaces to prevent rotation of the material in the cage with the worm flights; and also the progressive worm flights, or successive portions of the pressure worm means have been relatively changed in one way or another with said end in view of maintaining or progressively increasing the pressure on the material as it is advanced through the

cage and progressively decreases in mass or volume.

One object of my invention is to produce a pressure worm means or assembly of novel and improved construction or arrangement which will improve the performance and increase the efficiency of presses of the type mentioned. Another object is to provide an improved worm assembly for such presses which is of practical, desirable and economical construction.

With the above and other objects and advantages in view, which will hereinafter appear, preferred embodiments of my invention, disclosed in the accompanying drawings, are hereinafter described and the novel features of the invention are set forth in the appended claims.

In said drawings:

Fig. 1 is a fragmentary, longitudinal, sectional elevation of a liquid expressing press provided with a pressure worm means or assembly embodying my invention, showing the worm assembly in elevation.

Fig. 2 is a view showing the worm assembly in longitudinal section and the relation of the breaker or knife bars thereto.

Fig. 3 is a transverse section of the worm assembly on line 3—3, Fig. 2.

Fig. 4 is a transverse sectional elevation, enlarged on line 4—4, Fig. 1.

Fig. 5 is a view similar to Fig. 2, showing a pressure worm assembly or means of slightly modified form embodying the invention.

Referring first to the embodiment of the invention shown in Figs. 1-4, the press comprises a cage or barrel A forming a cylindrical pressure chamber 10 in which the pressure worm means or assembly (designated B as a whole) is axially arranged. In these presses as commonly constructed, the cage is stationary and the pressure worm assembly is rotated therein by suitable drive means, and such construction is herein disclosed, but insofar as the present improvements are concerned, it is immaterial whether the pressure or discharge worm or worms, or the cage is arranged to rotate.

The cage may be of any suitable construction and, as illustrated in the drawings, it is of known construction, comprising two semi-cylindrical main body portions or halves 11 (divided longitudinally on a diametrical, axial plane) which are rigidly but separably bolted together about and support a circular series of longitudinal drainage bars 12 that are separated by narrow spaces or slits forming escape openings or perforations for the expressed liquid. The material is fed into

one end of the cage, preferably through a suitable feed chamber 14 axially aligned with the cage and provided with an inlet or feed opening 14a, and the worm assembly compresses the material and advances it lengthwise in the cage, forcing or expelling the compressed solid material or cake out through a suitable discharge opening 15 at the opposite end of the cage. The area of the discharge opening may be varied or regulated as required, as by the usual adjustable cone or regulating device 16.

The worm assembly, as shown in this embodiment of the invention, comprises a plurality or series of worms arranged in succession in the press, including a feed worm 17, located in the feed chamber 14, and followed in order by a combination pressure and discharge worm 18, two discharge worms 19 and 20, and a tapered discharge sleeve 21 after the last discharge worm 20. These successive worms and discharge sleeve 21 are shown surrounding a drive shaft 22 which extends axially through the feed chamber and cage. The feed worm may be arranged to rotate about the shaft 22 and be suitably driven by known means at a higher speed than the succeeding pressure or discharge worms, which latter, together with the discharge sleeve 21, may be keyed or splined to the shaft and rigidly secured thereon to rotate with the shaft, as by a nut 23 screwed on the shaft, which may be suitably driven to rotate the pressure and discharge worms 18, 19 and 20 at a lower rate of speed than the feed worm 17. The feed worm may be of known or any suitable form, but as shown, comprises a cylindrical body provided with two worm flights 24 and 25, which are separated or interrupted by a gap or space 26 into which a lug or projection 27 fixed on the cage extends for preventing or impeding rotation of the material in the cage with the worm.

The body of the combined pressure and discharge worm 18 shown has small and larger cylindrical portions 28 and 29 respectively at its inlet and discharge ends connected by an intermediate tapering or conical portion 30, the smaller portion of the body being provided with a worm flight 31 and the larger portion with a worm flight 32, which worm flights are spaced apart or separated by a gap at the conical, intermediate portion of the worm body. Preferably, the small inlet-end of this worm has substantially the same diameter as the adjacent discharge end of the feed worm.

Each of the two discharge worms 19 and 20 has a worm flight (respectively designated 33 and 34) on a tapering or frusto conical body, which increases in diameter toward the discharge end of the worm. These two worms may be alike and of the same dimensions, and are spaced from the combined pressure and discharge worm 18 and from each other by spacing sleeves or collars 35 and 36 splined or secured on the shaft 22 to rotate with the worms. Said sleeves or collars are of smaller diameter than the large discharge ends of the pressure and discharge worm 18 and of the two discharge worms 19 and 20, and preferably, the sleeves are cylindrical and of substantially the same diameter as the smaller ends of the worms 18, 19 and 20. Thus, the bodies of the worms 18, 19 and 20 form annular shoulders 37 at their discharge ends which project outwardly beyond the spacing sleeves and face toward the discharge end of the cage. The several worm flights of the worm assembly, it will be seen, are thus interrupted or separated by gaps

or spaces, formed by the spacing sleeves, in which space means, such as projections 38 on knife or breaker bars 39 fixed in the cage, are provided to engage the material and prevent or retard its rotation in the cage with the worms.

The pressure worm assembly thus comprises successive worm flights which are spaced apart or interrupted by intervening gaps or spaces in which means act to obstruct rotation of the material in the cage, and at the discharge end of each of the worm flights 32, 33 and 34 is formed an annular projection or shoulder 37 which acts to prevent backward or retrograde movement of material in the cage toward its inlet end under the influence of the pressure on the material beyond the shoulder or toward the cage discharge.

As shown and thus described, the pressure worm assembly is built up of separate-piece or separately formed worms 18, 19 and 20, final discharge sleeve 21 and spacing sleeves 35 and 36, assembled and secured on the shaft 22, which construction is preferable from the standpoint of facility and economy of manufacture, but insofar as their functions and operation are concerned, the described worm bodies and flights and spacing and discharge sleeves may all be considered as portions of a structure made in one or more parts, and the claims are not intended to be limited to the separate piece, built-up construction, except where such is specifically recited in the claims.

Since the body of each of the worms 18, 19 and 20 is larger in diameter at its discharge end than at its inlet end, the annular space in said cage around said bodies, and which is occupied by the material, decreases in capacity toward the discharge end portion of each worm, and is increased or is of larger capacity just beyond the discharge end or shoulder 37 of each worm. Similarly, the space decreases around the discharge sleeve 21 towards the discharge opening of the cage. Thus, the worm assembly acts to force the material through a succession of spaces of decreasing capacity and, in effect, subjects the material to pressure in successive stages, and at the entrance or large end of each such space is an outwardly projecting, annular shoulder or obstruction 37 which acts to maintain the pressure and prevent loss of pressure by escape of the material backwardly toward the inlet end of the cage.

The effect of this construction or relative arrangement of parts is that the sleeves being smaller in diameter than the discharge ends of the bodies of the discharge worms, the larger diameter of the discharge ends of the discharge worms act, not only to give the material excessive squeezes as it passes over these larger sections of the worm bodies, but also the discharge ends of the worms being larger in diameter than the sleeves, they form obstructions or baffles which prevent the material under pressure from working back towards the feed end of the cage, thereby helping to build up pressure and overcome the resistance at the discharge end of the cage, or tendency of the material to back up in the cage on account of the higher pressure at the discharge end of the cage.

The embodiment of the invention, shown in Fig. 5, is substantially as described above except that the feed worm 17a and combined worm 18a each has one continuous or uninterrupted worm flight, instead of two spaced-apart flights, and each of said worms, and also each of the discharge worms 19a and 20a is provided inter-

mediate of or about midway between the ends of its worm flight with a tapered or frusto-conical, peripheral enlargement or collar 40 which projects outwardly from the worm body and forms an abrupt, outwardly projecting shoulder 41 on the worm body facing toward the discharge end of the cage. These collars augment or supplement the squeezing and obstructing action of the enlarged ends and shoulders 37 of the worms which function as above explained in connection with the first described embodiment of the invention. Thus, the collars 40 still further increase the pressure on the material and the efficiency of the press.

I claim as my invention:

1. In a fluid expressing press comprising a cage having apertured side walls and a pressure worm assembly therein, one of which rotates for compressing and moving material in the cage and through a discharge opening thereof, an improved pressure worm assembly including a worm having a projecting peripheral worm flight and plain flightless sleeves preceding and succeeding said worm, the body of said worm increasing in diameter towards its discharge end from a diameter approximately the same as said preceding sleeve to a diameter at its discharge end larger than that of said succeeding sleeve, thereby forming with said following sleeve a projecting abrupt annular shoulder which faces toward said discharge opening.

2. In a fluid expressing press comprising a cage having apertured side walls and a pressure worm assembly therein, one of which rotates for compressing and moving material in the cage and through a discharge opening thereof, an improved pressure worm assembly including successive spaced apart worm flights projecting from the peripheries of body portions each of which is of larger diameter at its discharge end than at its opposite end, and a plain flightless sleeve-like portion which precedes each said worm body portion, said sleeve-like portion each being of substantially the same diameter as the small end of the first of said worm body portions and of smaller diameter than the discharge end of the worm body portion whereby the larger discharge end of the worm body portion forms a projecting annular shoulder that faces towards the discharge opening.

3. In a fluid expressing press comprising a cage having apertured side walls and a pressure worm assembly therein, one of which rotates for compressing and moving material in the cage and through a discharge opening thereof, an improved pressure worm assembly including successive spaced apart worms having bodies of substantially like diameter, each of which worm bodies increases in diameter towards its discharge end, and a plain flightless sleeve between said worms which is of approximately the same diameter as the small ends of said worm bodies and is of smaller diameter than the large ends of the worm bodies whereby the larger discharge end of the preceding worm body forms a projecting annular shoulder that faces towards the discharge opening.

4. In a fluid expressing press comprising a cage having apertured side walls and a pressure worm assembly therein, one of which rotates for compressing and moving material in the cage and through a discharge opening thereof, an improved pressure worm assembly including successive spaced apart worms having bodies of substantially like diameter, each of which worm bodies increases

in diameter towards its discharge end, a plain flightless sleeve between said worms which is of approximately the same diameter as the small ends of said worm bodies and is of smaller diameter than the large ends of the worm bodies whereby the larger discharge end of the preceding worm body forms a projecting annular shoulder that faces towards the discharge opening, and a discharge sleeve which follows the last worm, the end of said discharge sleeve nearest to the worm being of smaller diameter than the discharge end of said worm body and said sleeve increasing in diameter towards its discharge end.

5. In a fluid expressing press comprising a cage having apertured side walls and a pressure worm assembly therein, one of which rotates for compressing and moving material in the cage and through a discharge opening thereof, an improved pressure worm assembly including a combination worm succeeded by spaced apart discharge worms and spacing flightless sleeve-like parts between adjacent worms, said combination worm having body portions of different diameter provided with worm flights and an intervening frusto-conical body portion, the discharge end of the body of each of said several worms being of larger diameter than the adjacent end of the sleeve-like part following the worm and the opposite end of the body of each of said discharge worms having a diameter approximately the same as the preceding sleeve-like part.

6. A pressure worm assembly in an expressing press according to claim 5, in which said spaced discharge worms are of like diameter and have bodies which increase in diameter toward their discharge ends.

7. A pressure worm assembly in an expressing press according to claim 5, in which said spaced discharge worms are of like diameter and like pitch and have bodies which increase in diameter towards their discharge ends.

8. A pressure worm assembly in an expressing press according to claim 1, in which the body of said worm is provided intermediate of the ends of said worm flight with a projecting peripheral shoulder that faces towards said discharge opening.

9. A pressure worm assembly in an expressing press according to claim 2, in which the body of each worm is provided intermediate of the ends of said worm flight with a projecting peripheral shoulder that faces towards said discharge opening.

10. A pressure worm assembly in an expressing press according to claim 3, in which the body of each worm is provided intermediate of the ends of said worm flight with a projecting peripheral shoulder that faces towards said discharge opening.

11. In a fluid expressing press comprising a cage and a pressure worm assembly therein, one of which rotates for compressing and moving material in the cage and through a discharge opening thereof, an improved pressure worm assembly including a combination worm succeeded by spaced apart discharge worms and plain flightless spacing sleeve-like parts between adjacent worms, said combination worm having body portions of different diameters with an intervening frusto-conical body portion and being provided with a worm flight, the discharge end of each of said worms being of larger diameter than the adjacent end of the sleeve-like part following the worm, and each of said spaced discharge worms being provided intermediate of the ends of its flight

with a projecting peripheral shoulder that faces towards said discharge opening.

12. In a fluid expressing press comprising a cage having apertured side walls, and a pressure worm assembly which rotates therein for compressing and moving material along in the cage and through a discharge opening thereof, the improvement which consists in a rotary worm assembly including successive spaced worms each having a body which increases in diameter towards its discharge end and a peripheral worm flight projecting from said body, and a plain flightless sleeve which succeeds each said worm and is of smaller external diameter than the large discharge end of the body of the worm which it succeeds but is approximately the same diameter as the smaller feed end of the succeeding worm body, the discharge end of each said worm body forming with the adjacent sleeve an abrupt continuous annular shoulder which faces toward said discharge opening, and the press having means obstructing rotation of the material in the spaces surrounding said sleeves.

13. In a fluid expressing press comprising a cage having apertured side walls, and a pressure worm assembly which rotates therein for compressing and moving material along in the cage and through a discharge opening thereof, the improvement which consists in a rotary worm assembly including successive spaced worms each having a body which increases in diameter towards its discharge end and a peripheral worm flight projecting from said body, and a plain flightless sleeve which succeeds each said worm and has a cylindrical periphery of substantially the same diameter as the smallest diameter of the body of the adjacent worm, the discharge end of each said worm body being of larger diameter than and forming with the adjacent sleeve an abrupt continuous annular shoulder which faces toward said discharge opening, and the press cage having internal projections obstructing rotation of the material in the spaces surrounding said sleeves.

14. In a fluid expressing press comprising a cage having apertured side walls, and a pressure worm assembly which rotates therein for compressing and moving material along in the cage and through a discharge opening thereof, the improvement which consists in a rotary worm assembly including successive spaced worms each having a body which increases in diameter towards its discharge end and a peripheral worm flight projecting from said body, and a plain flightless sleeve which succeeds each said worm, said worms being alike in size and form and said sleeves having cylindrical peripheries of substantially the same diameter as the smallest body diameter of said worms, the discharge end of each said worm body being of larger diameter than and forming with the adjacent sleeve an abrupt continuous annular shoulder which faces toward said discharge opening, and the press having means obstructing rotation of the material in the spaces surrounding said sleeves.

15. In a fluid expressing press comprising a cage having apertured side walls, a pressure worm assembly which rotates therein for compressing and moving material along in the cage and through a discharge opening thereof, and means for opposing rotation of the material in the cage, an improved worm assembly including successive spaced apart worm flights projecting from the peripheries of worm bodies each of which is of larger diameter at its discharge end than at its opposite end, and plain flightless sleeves preceding and following each said worm, each said sleeve being of approximately the same diameter as the small end of the worm body which it precedes and of smaller diameter than the discharge end of the worm which it follows, whereby the discharge end of each worm body forms an annular shoulder that projects out beyond the periphery of the following sleeve and faces toward the discharge opening.

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