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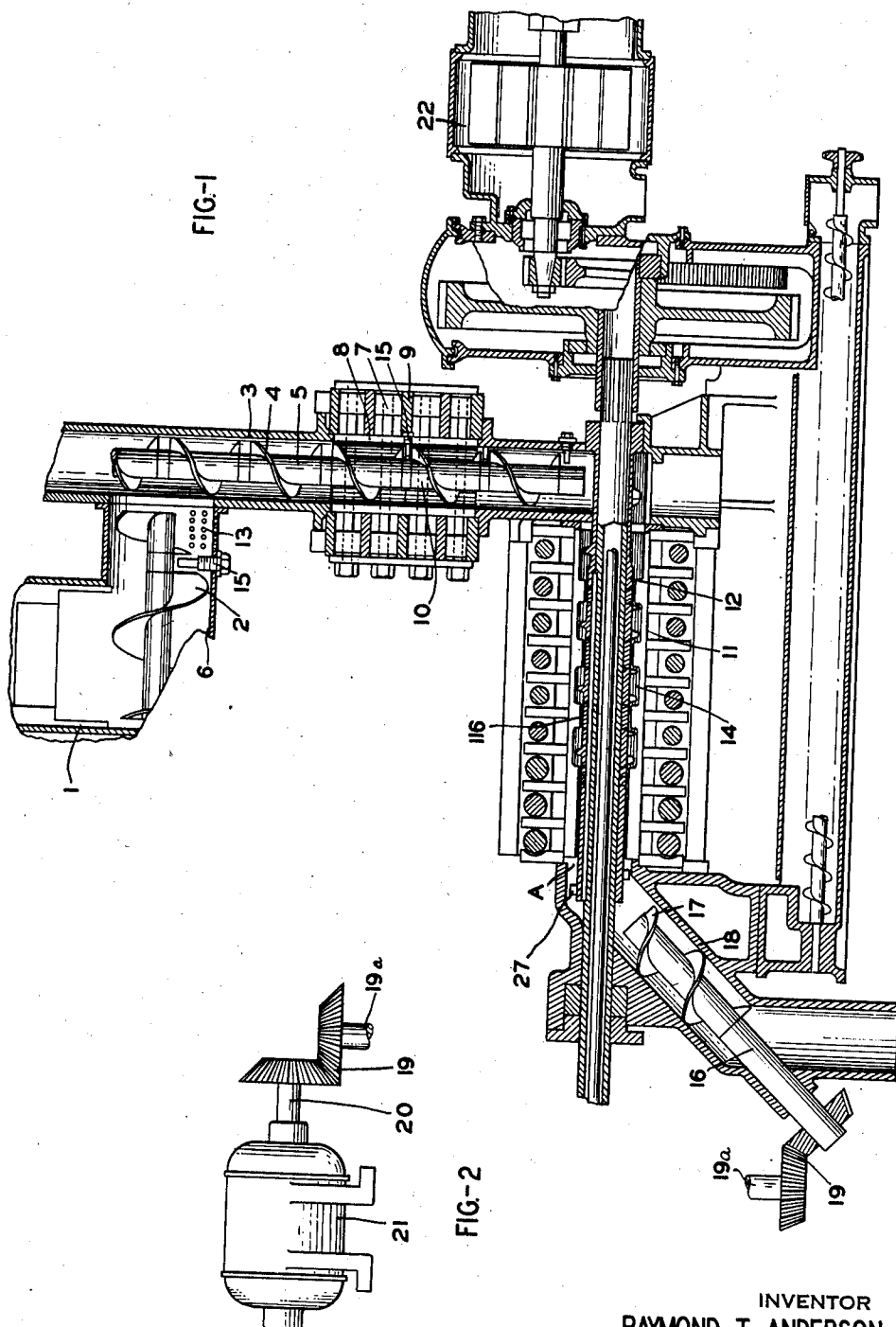
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VARIABLE CHOKE MECHANISM FOR EXPELLER PRESSES

Filed Jan. 26, 1940

2 Sheets-Sheet 1



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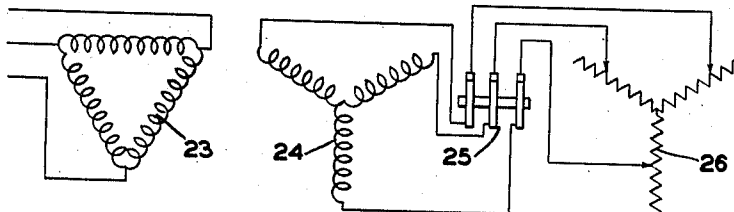
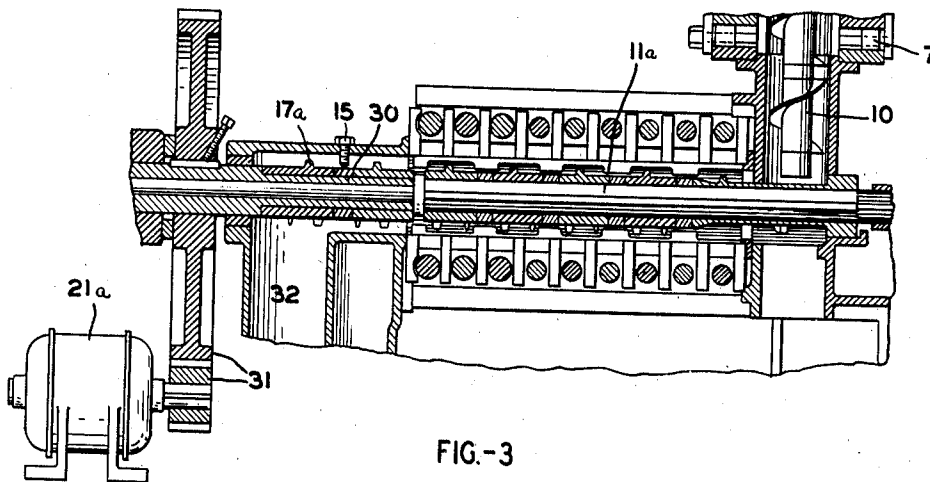
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UNITED STATES PATENT OFFICE

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VARIABLE CHOKE MECHANISM FOR
EXPPELLER PRESSES

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Application January 26, 1940, Serial No. 315,660

4 Claims. (Cl. 100—48)

This invention relates to expeller presses of the worm type, such as are used for expressing oil from proteinaceous, oleaginous material, of either vegetable or animal origin. Presses of this kind are employed, for example, in the extraction of oil from cotton seed, copra, cracklings, or the like.

In such presses the outlet from the oil expressing chamber or channel is usually more or less restricted and is frequently adjustable as to size so as to retard the discharge of the more or less solid cake in accordance with the desired results, restriction of the outlet building up, backwardly through the press and against the advancing stream of material being processed, that compression which is necessary not only to expel the oil but also to prevent the formation of cavities in the mass or any release of pressure which might permit reabsorption of the oil by the cake before it is drained off or otherwise separated.

One object of the present invention is to provide an improved form of choke for a press of this kind, and more particularly one whose choking effect conveniently may be varied or adjusted, while the press is in operation, for the purpose of adapting the press to widely differing materials or to variations in the characteristics or conditions of any particular material being processed, or to secure any desirable ultimate oil expressing or expelling effect.

Another object of the invention is to provide an improved choke for a press of this kind, which choke itself is of worm or screw form and thereby inherently, and no matter what its form or proportion or its relation to the barrel, may produce variable choking effects in response to variations in its speed of rotation, or possibly more accurately, in response to variations in the relative speeds of rotation of the worms of the choke itself and of the last oil expelling unit of the press.

Still another object of the invention is to provide an improved choke of this kind whose driving means may be associated with the press driving means for automatic control of both, so that the machine as a whole, when once set or adjusted to selected standardized conditions or results, automatically accommodates itself to variations in the characteristics or conditions of the material being processed, to the end of maintaining uniform extracting effects without attention by the operator.

Further objects of the invention are in part obvious and in part will appear more in detail hereinafter.

In the drawings Fig. 1 represents a longitudinal sectional elevation through one form of press embodying the invention; Fig. 2 is a detail view, corresponding to Fig. 1, and illustrating the driving mechanism for the choke worm; Fig. 3 is

another view, corresponding to Fig. 1, and illustrating still another embodiment of the invention; and Fig. 4 is a wiring diagram.

Referring now to the drawings, since the present invention relates primarily to the choke or choking mechanism, to the control and adjustment thereof, and to the utilization of choke adjustment or effect for the purpose of controlling the operation of the expressing effects in earlier stages of the press, the particular construction and arrangement of the screw press itself is not essential and requires no extended description. In other words, any form of continuous screw press such as has been used for the extraction of oil from proteinaceous oleaginous materials of either animal or vegetable origin may be employed for this invention.

The press shown in Fig. 1, generally speaking, is of the general type illustrated and described in my prior application for Press and method of operating the same, filed June 24, 1938, Serial No. 215,683, to which reference may be had for a more complete description if desirable or necessary.

The material to be processed, according to its nature or kind, is usually subjected to a conditioning process to more or less standardize it so that all material going through the press on a given run will have substantially the same characteristics. Particularly is that true as to the degree of cooking (if cooking is desirable), the temperature and the moisture content. Material to be processed, preconditioned as described, is delivered or supplied to one or a plurality of expressing worms, the flight or flights of which rotate in foraminous barrels, through the openings or interstices of which the extracted oil is expelled or discharged. As the material moves along through the press, from its inlet to its outlet, the pressure applied to the material is gradually increased, preferably also without any diminution of pressure at any time until the outlet is reached. That is to say, the pressure is built up progressively by stages in any suitable manner. That may be accomplished, for example, in a continuous screw press, by gradually increasing the external diameter of the shaft supporting the worm flights, by increasing the thickness or size of the vane of the worm flight itself, by gradually reducing the internal diameter of the foraminous barrel which surrounds the worm, by gradually, or by steps, reducing the pitch or degree of inclination of the worm flight, or by other suitable means to the same end. All such means gradually reduces, toward the outlet of the press, the unit of volume per unit of length of the worm shaft available to receive, hold, and conduct the material to be processed. By crowding it along in a more or less gradually constricted channel, the pressure

applied to the material increases and its bulk decreases, always with due allowance for the volume of the oil actually expelled from the barrel.

In the form shown in Fig. 1, the preconditioned material, after leaving the conditioner shown conventionally at 1, is supplied by a worm 2 to a feed hopper 3 in which rotates a worm 4 on a shaft 5. The barrel 6 in which the worm 2 rotates may be foraminous so that some oil expulsion occurs here, reducing the task in succeeding stages.

Beyond the feed hopper 3, the barrel of which may be imperforate, the channel for the material continues through a feed press marked generally 7, having a perforate or foraminous barrel 8 mounted in a suitable supporting cage 9, and in which barrel rotate the longitudinally spaced flights 10 of the expressing worm. In this feed press, by due constriction of the channel in the manner before described, the material is subjected to a further increase in pressure, resulting in the expulsion of more oil as the result of the application of increased pressure.

From the feed press 7 the material being processed, and still under pressure, with a part of the oil removed therefrom, is discharged into the feeding or inlet end of a main press 11, where it encounters the material-advancing and pressure increasing effect of a series of longitudinally spaced worm flights 12. As in the feed press, the worm flights here advance the material, increase the pressure thereon and expel further oil, which is discharged through the openings of the foraminous barrel.

Wherever it is desirable to cause expulsion of oil through the barrel at any stage of advance of the material, the barrel is made perforate or foraminous, either by the provision of simple openings through the barrel wall, as at 13 in the barrel 6, or the barrel may be made, for example, of closely spaced longitudinally extending parallel heavy bars, as indicated at 14, in the main press 11 and feed press 7. In the main press, for example, the barrel is of the bar form described and the narrow slots forming the perforations extend across the receiving end portion of the main press and clear through said press right up to the discharge point indicated generally at A, Fig. 1. Also, where the barrel is of foraminous form suitable means is provided for in any manner preventing rotation of the material with the flights of the worm shaft, such as the stop abutments shown in the form of heavy screws, as at 15 in the feed press, or the knives 116 forming similar stop abutments in the main press.

As described in my prior application referred to, by rotating each worm or worm section at a speed suitably related to the speed of rotation of the worm or worm section which precedes it, with due regard for constriction of the material conveying passage in any of the ways before described, the press so far described, as a whole, may be so operated that each worm or worm section supplies material to the following worm or worm section as fast as the latter will accept and advance it, thus not only building up or gradually increasing the pressure upon the material toward the outlet end of the press, but maintaining that pressure without diminution at any time and avoiding any possible reabsorption by the cake of the oil after the latter has been expelled in liquid form.

In the present press, however, operating as described, one important factor in controlling

the expressing worms and their effect upon the material is the choke or choking device, which is here of special form. Instead of consisting of several parts, such as bars, adjustable to various positions to more or less restrict the outlet opening, and stationary during press operation, the choking mechanism here includes a member which is movable during press operation, to wit, one or more worm flights rotating in a barrel by means capable of adjustment to vary the speed of rotation. This choking worm is located in the discharge passage beyond the terminal of the final expressing worm and its foraminous barrel, that is, beyond the point A in Fig. 1. The axis of the choking worm may coincide with the axis of the final expressing worm, as will later appear, or may intersect said axis at any suitable angle. With either arrangement the worm or screw may consist of two or more flights with stop abutments 15 located in the spaces between flights to enhance the resistance to flow, as shown in Fig. 3. Fig. 1 shows an arrangement in which the axis of the choking worm intersects the axis of the final expressing worm of the main press at an obtuse angle, say 135°. The expressing worm here comprises a shaft 16 carrying a single worm flight 17 and extending through a wall of the casing (preferably suitably packed) to the outside thereof for connection to an operating drive mechanism to be described.

Since no expression of oil from the cake is intended to take place beyond the outlet A, for the reason that when the cake passes this point the oil content has already been reduced to the desirable low value, the barrel 18 in which the choking worm rotates is imperforate.

Assuming the press in operation with the shafts of the preliminary press, feed press and main press all rotating and with material moving along to and through the outlet, it is quite clear that if the choking worm 16, 17 is permitted to remain stationary the helical passage along and between the flights of the worm is so tortuous that with the internal surface of the barrel its wall surfaces offer very great resistance to travel of the cake, so much as to probably entirely block its advance. As a result the cake would become a solid immovable mass in the zone of the choking worm and form a plug stopping up the press and ultimately causing it to cease operation. As a result, it is necessary to reduce the friction through the channel of the choking worm by rotating said worm in the proper direction to produce and promote advance of the material, but nevertheless at a rate of speed sufficient to produce and maintain the maximum pressure to which the material should be subjected at the outlet, to thereby create and build up pressure through the press clear back to the feed opening of the first expressing element thereof, such as the preliminary press 2.

The driver for the choke worm therefore preferably is one which runs at a selected constant speed within a certain speed range, but which is provided with means for manually varying the speed within that range. Obviously, by rotating the choking worm at different speeds, according to variations in the density of the material being processed, particularly by the time it reaches the choking device, it is possible to set or adjust the press to meet any desirable conditions or requirements. Adjustment of the speed of worm rotation to any desired value within reasonable limits may be secured manually by suitable speed changing mechanism, such as a Reeves drive,

but for purposes of illustration, the drawings show the shaft of the worm 16 connected by bevel gearing, represented generally at 19, and an intermediate shaft 19a, to the shaft 20 of a variable speed D. C. electric motor 21 provided with adjustable resistance coils (not shown) by means of which its speed may be manually adjusted to the desired value.

Assuming the choke worm to be driven in the manner described, such as by a variable speed D. C. motor with manually adjustable resistance coils, it is clear that the controller for said resistance coils may be set to a definite position which will produce rotation of the choke worm at a definite speed; that such speed determines, evaluates or standardizes the choking effect of the worm, or, in other words, its resistance or impedance to the flow of cake through or along the worm to the final outlet; and that at any particular controller position the press in one sense operates as though the cake were being crowded continually through a fixed orifice of uniform unvarying size with the load resistance at the choke maintained uniform. The uniform effect at the choke may be taken advantage of, and in this invention is taken advantage of, as a means for controlling operation of the main press driver, which may be of any suitable type and character adapted to automatically accommodate itself to its required duty. In the arrangement shown in Fig. 1, the motor 22 is an alternating current slip ring motor, the wiring diagram of which is illustrated in Fig. 4. As shown, said motor is provided with delta connected stator windings 23 which cooperate with a Y-connected rotor winding 24 connected through slip rings 25 to manually adjustable resistance coils 26 also Y-connected. This motor 22 inherently has the ability to automatically accommodate itself to conditions at the choke and particularly to automatically adjust its own speed for the purpose of maintaining uniform torque. As a consequence, it rotates the worm of the main press at a rate of speed which not only completes expressing of the oil from the material undergoing treatment, but also delivers the cake to the choke worm just as fast as the latter will accept and pass the cake to the final outlet, as will be readily understood.

Likewise, the feeding press 7 may be driven by its own motor, of similar slip ring type, so as to feed material to the main press as fast as the latter will accept it, automatically accommodating its speed to the duty required. Or, the feed press 7 may be driven by the same motor 22 through a slip clutch connection, such as described in Anderson Patent 1,971,632, granted August 28, 1934, for Feeding mechanism for presses.

Of course, in the arrangement shown in Fig. 1, the direction of travel or movement of the cake changes at the point A, or just beyond it, where it moves into the barrel of the inclined choking worm. To assist in conforming the material to its new channel the extreme end of the worm shaft of the main press may be provided with one or more breakers 27, which are simple projections rotating with the worm shaft and tending to churn or break up the cake and prevent it from becoming packed or jammed.

Fig. 3 illustrates another arrangement in which the choke worm flight 17a rotates on the same axis as the axis of the worm or screw 11a of the main press, worm flight 17a being in the form of a screw carried by a sleeve 30 ro-

tating on the shaft of the main worm and driven by gearing 31 from the motor 21a, similar in construction and manner and method of control to the motor 21. In this form the material passes along from the main press to the choke worm 30, whose speed is selected in accordance with the density of cake to be obtained. As it moves along with the worm, it finally reaches a channel 32 leading to a suitable discharge point.

With both arrangements described the speed of rotation of the choke worm determines or evaluates the choking or resistance effect at the press outlet. In each case the speed of rotation of the choke worm may be manually set or adjusted at any value by regulation of the controller for the worm driver, and when the speed has once been set the choke worm will continue to rotate at that speed. The choke worm may also serve as a controller for the next worm preceding it, to-wit, the worm of the main press, and the latter in turn may control its predecessor worm, such as the worm of the feeding press. The net result of the construction is to gradually apply an increased compression to the material being processed from the time it leaves the conditioner clear to the discharge of the cake from the press, the oil having been removed gradually during progress of the material through the press. Conditions are maintained uniform throughout the press with production of maximum efficiency and a uniform and high quality product.

What I claim is:

1. A continuous press of the character described, comprising an expressing worm, a choking screw cooperating therewith, and operating means for said worm and screw arranged to cause the speed of one thereof to control the speed of the other and thereby maintain uniform load conditions throughout a period of operation.

2. A continuous press of the character described, comprising an expressing worm, a choking screw cooperating therewith, means for rotating one thereof at substantially uniform speed, and variable speed rotating means for the other thereof, whereby the speed of the latter may be accommodated to the speed of the former, for the maintenance of uniform load conditions throughout a selected period of operation.

3. A continuous screw press, comprising an expressing worm, a foraminous barrel therefor, a choke worm, means for rotating said choke worm at a predetermined speed to produce a desired choking effect, and operating means for the expressing worm the speed of said operating means varying in response to changes in the resistance of said choke worm to travel of the material being processed.

4. A continuous press of the character described including a main press and a choking device, an expressing worm for advancing material through said main press and delivering it to said choking device, a choke worm for advancing material through said choking device, uniform torque driving means for said main press worm, driving means for said choke worm capable of adjustment to operate at a desirable substantial constant speed, and means for adjusting the rotational rate of said choke worm in a manner to retard to a desirable degree discharge from said continuous press to thereby build up and maintain pressure upon the material being processed.

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