Feb. 13, 1945. C. B. UPTON 2,369,192

LIQUID EXPRESSING PRESS

Filed July 28, 1942 2 Sheets-Sheet 1

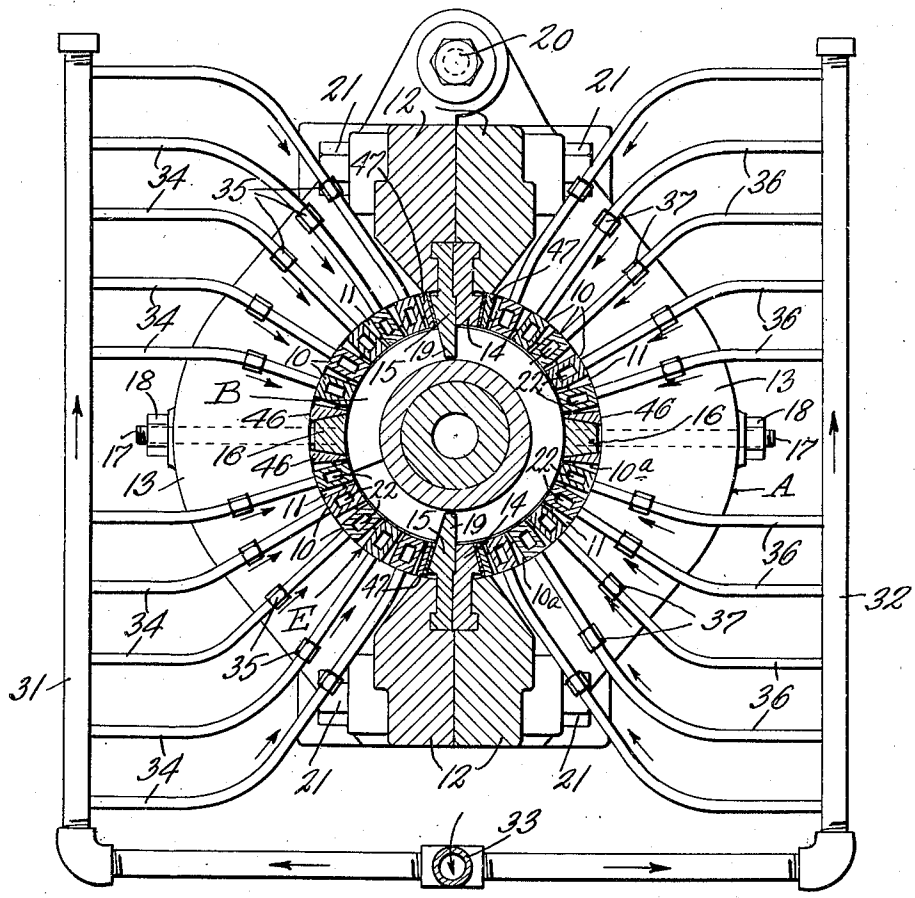


Fig. 1

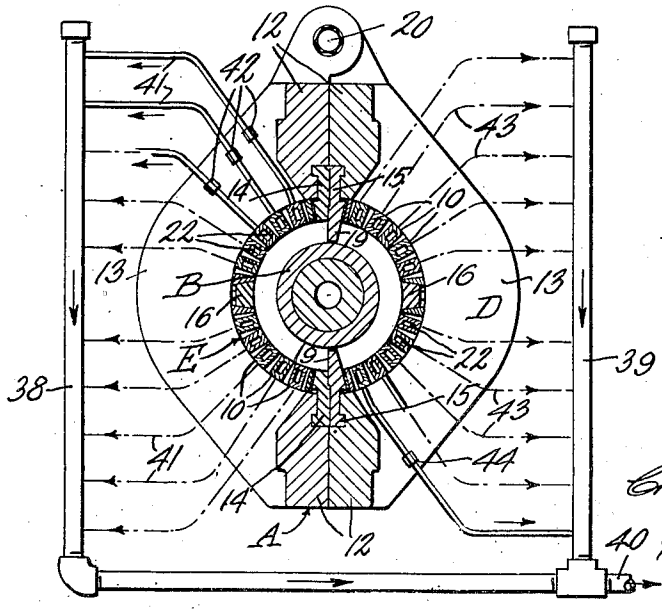


Fig. 2.

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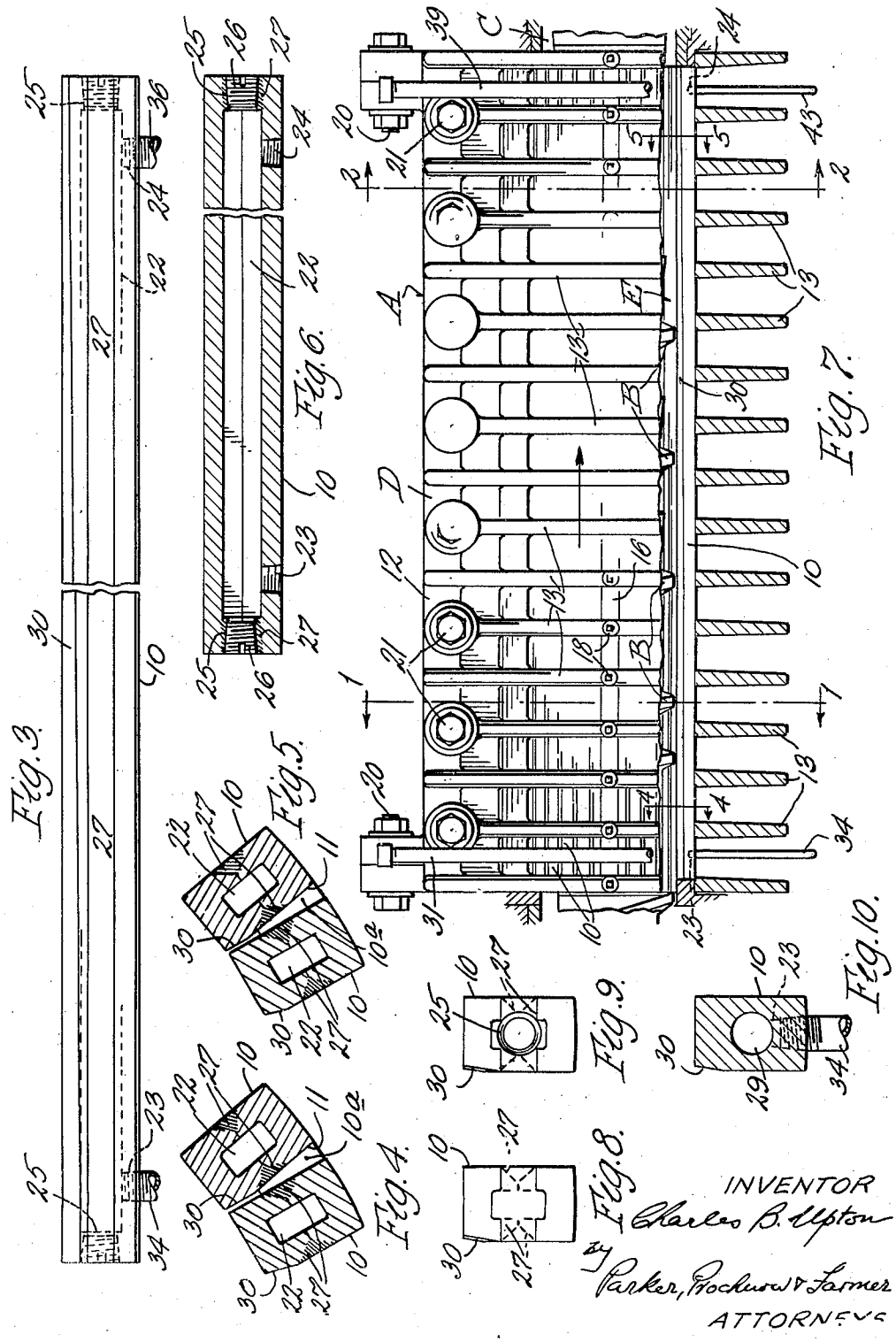


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

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2,369,192

LIQUID EXPRESSING PRESS

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Application July 28, 1942, Serial No. 452,611

10 Claims. (Cl. 100—50)

This invention relates to improvements in mechanical or screw presses of that type, used for expressing oils and other liquids from materials, which comprise a cage or barrel and means, such as axial screws rotating in the cage, that force the material through the cage and expel it through a more or less restricted discharge opening in the cage, thereby creating pressure by which the liquid is squeezed from the material and escapes through fine screen openings in the cage walls.

Very high pressures are required for expressing the liquids from some materials, for instance, for expressing the oil from some oil bearing materials, and while the screen openings or perforations for the escape of the liquid have to be very minute in order to effect proper screening of the liquid from the solid matter, nevertheless the cage lining or screen which provides the liquid escape openings, has to be of a strong construction to withstand the high pressures to which it is subjected in use, and even so, the screens or linings become worn or damaged and have to be renewed in whole or in part more or less frequently. Therefore, it is preferred practice to construct the cages of such presses with a strong outer skeleton body or frame which supports and reinforces an annular perforate lining or screen formed by separate screen bars which are arranged lengthwise of the cage and are suitably spaced apart or separated to provide very narrow slits or spaces between the bars that form the drainage or escape openings for the expressed liquid. These liquid escape slits usually have to be very narrow, for instance, they may vary from say three-thousandths of an inch to fifteen-thousandths of an inch more or less in width, depending upon the character of the material being pressed or the pressures to which it is subjected. Because of their extreme narrowness it is not mechanically feasible or economical to machine or form the screening slits of the requisite uniformity and perfection in a solid wall or part forming the body or lining of the cage, and this is an important reason for building the lining or screen of the separate spaced screen bars. Separate, independently assembled and removable screen bars are also employed because they enable the removal or replacement of one or more bars in case of local wear, damage or deformity in the screen, and so make it possible to repair or restore a cage screen to proper operative condition without the expense of replacing a whole cage or cage lining.

In the use of presses of this type, it is also highly important or necessary in pressing some materials to provide cooling or temperature varying means for reducing, altering or regulating the temperature of the material during the pressing thereof in order to obtain proper efficiency of operation and insure the required quality of the product. Heretofore, such presses have been equipped with means for cooling or heating the cage or the material therein with a view of obtaining the temperature in the cage required to obtain a particular desired result or performance. For this purpose, cages have been provided with channels or passages located within or associated with the cage body outwardly beyond the cage screen, through which channels a cooling or temperature changing medium is circulated, but such previous constructions have been found not to give the amount of cooling required for the proper pressing or treating of some oil bearing or other materials for which the presses are designed. For instance, in a construction in which the cage had separate spaced screen bars within a reinforcing skeleton frame or body, and the cooling or heating channels were formed within said frame or body exteriorly of the lining or screen bars, the heat conductivity from the screen bars through the cage body to the temperature changing medium was not sufficiently rapid or adequate, for reasons which will be explained later, to give the cooling or heating required for proper expressing of liquids from some materials.

One object of my invention is to provide a novel cage construction for presses of the sort mentioned in which the circulating channels for the temperature changing medium are provided in the lining or screen bars themselves, which are in direct contact with the material being pressed, thereby greatly increasing the heat exchange efficiency of the cage.

Another object of the invention is to provide lining or screen bars for such press cages of improved novel construction which will result in economy and simplicity in the construction and assemblage of the cage, and also in a simplification and improved performance of the press cooling or heating means or system.

Further objects and advantages of the invention will appear from the following specification of certain preferred embodiments of the invention, shown in the accompanying drawings, and the novel features of the invention are set forth in the appended claims.

In said drawings:

Fig. 1 is a transverse, sectional elevation, on

an enlarged scale on the plane of line 1—1, Fig. 7, of a press cage embodying the invention.

Fig. 2 is a similar transverse, sectional elevation thereof on the plane of line 2—2, Fig. 7.

Fig. 3 is a broken side elevation of one of the screen bars of one construction, detached.

Figs. 4 and 5 are enlarged, transverse sections on lines 4—4 and 5—5 respectively, Fig. 7, each showing two adjacent screen bars.

Fig. 6 shows one of the screen bars in longitudinal section, a portion thereof being broken out.

Fig. 7 is a side elevation, partly in longitudinal section, of the press cage.

Figs. 8 and 9 each shows an elevation of the end of one of the screen bars, Fig. 8 showing the same before and Fig. 9, after making a tapped plug hole therein.

Fig. 10 is a transverse section of a screen bar of modified construction.

Referring to the drawings, and particularly to Figs. 1, 2 and 7. A represents the cage or barrel of a press and B indicates worms or screws fixed on a shaft extending axially through the cage and, which by rotation, act to force material lengthwise through the cage and extrude or expel the solid material through the discharge opening C at one end of the cage. It is usual in presses of this type to provide an adjustable cone or means (not shown) for more or less restricting the area of the discharge opening, as may be required to effect the resistance to the discharge of the solid material necessary to create the expressing pressure on the material in the cage. The cage comprises the usual strong outer skeleton frame, body or structure D having openings between its component parts and an inner annular lining or screen E which forms the peripheral wall of the pressing chamber and is formed by a plurality of separate screen bars 10 arranged longitudinally within the cage frame or body D and separated by intervening narrow spaces or slits 11 which form the drainage or escape apertures for the oil or liquid expressed from the material being pressed in the cage.

In the embodiment of the invention illustrated in the drawings, the outer cage frame is made in two halves divided on a diametrical axial plane of the cage, each section consisting of a single, integral steel casting comprising strong, rigid, longitudinal bars 12 at opposite sides of the section and strong spaced ribs 13 of approximately semi-circular form which extend transversely from one to the other of and connect the two side bars 12. The screen bars 10 with intervening spacing wedges or devices 10a between them are secured in place in each cage frame section at the inner, concaved side thereof, between longitudinal center or abutment bars 14 and 15 fixed to the side bars 12 of the frame section, and longitudinal clamping or wedge bars 16 which are disposed between groups of the screen bars and are adapted to be adjusted, as by screw stems 17 and nuts 18 for clamping the drainage bars between the fixed and adjustable holding bars. One of the abutment bars, as 15, at each of the opposite sides of the cage, as shown, may be provided with inwardly projecting portions 19, which constitute breaker bars for opposing rotation of the material being pressed in the cage. The two halves or sections of the frame may be hinged, as on hinge bolts or shafts 20 on the press frame extending through lugs at the end portions of adjacent sides of the two sections, to facilitate opening up the cage, and the two sections are firmly secured together to complete the cage, as by transverse bolts 21 extending through bolt holes in each section and screwed into threaded holes in the opposite section.

As thus far described, the cage is not substantially different from a construction commonly employed in presses of this type. Except as regards the improvements now to be explained, the cage may be of the described or other suitable construction.

The screen bars are of novel construction, as follows: Preferably the screen bars 10 extend the full length of the cage, and each bar, which is shown to be of generally rectangular cross sectional shape and of greater radial depth than width or thickness, is made with a longitudinal channel or duct 22 that extends lengthwise in the bar substantially from end to end thereof, and is adapted to be joined at its opposite ends with pipes or other suitable connections for causing a cooling or temperature changing medium to circulate through the bar lengthwise thereof for practically its full length. As shown, the bar is provided near one end with an inlet port 23 and near the opposite end with an outlet port 24 for the temperature changing medium, these ports being shown as screw threaded holes in the outer edge or side of the bar for the attachment of the medium circulating connections. The bar is also preferably provided in its ends with axial threaded holes 25 closed by screw plugs 26 which can be removed to facilitate removal from the channel of any scale or deposit which may accumulate therein.

A practical and economical method of making the circulating channels 22 in the screen bars, which are relatively long and narrow, is illustrated in Figs. 3–5. As here shown, each bar is made in two halves in each of which one-half of the channel can be readily machined. After the halves are machined, they may be welded together, as by welds 27 filling grooves formed in the outer sides and the ends of the bars by the bevelled edges of the channeled halves. When the halves have been thus welded together, which leaves the bar with closed, welded ends, as illustrated in Fig. 8, the holes 25 (shown in Figs. 6 and 9) for the screw plugs 26 can be made in the ends of the bar. Instead of thus making the bars of the preformed halves welded together, as just explained, the channels can be formed, if preferred, by drilling solid bars to make the cylindrical channel bores 29 therein, as illustrated in Fig. 10.

Each screen bar is also preferably bevelled at one side thereof, at its inner edge or corner, thus providing a bevelled face 30. This bevel, instead of being made of uniform width and depth throughout its length, is preferably tapered so as to decrease in width and depth lengthwise of the bar in the direction from the feed end of the cage towards the discharge end thereof, to thereby leave a narrow slit or space between each two adjacent screen bars which gradually decreases in width from the feed end of the cage toward the discharge end thereof. The purpose of this will more fully appear presently. The several screen bars are preferably of like thickness and of uniform thickness from end to end, but, as stated, the bevel 30 gradually increases in depth from one end to the other of the bar. For example, the bevel may increase in depth about ten thousandths of an inch from end to end of the bar, so that if the width of the slit between the bevel face of one bar and the adjacent face of the next

bar is, for instance, five thousandths of an inch at one end of the screen, its width at the opposite end of the screen will be fifteen thousandths of an inch, with the slit gradually increasing in width from end to end of the screen. Thus, with screen bars of like and uniform thickness and uniformly spaced apart from end to end of the screen, the slits between the bars will increase gradually in width lengthwise of the screen. These figures are merely illustrative. The screen bars may be bevelled and spaced apart in the cage so as to give any required width and taper of the drainage slits between the bars. The screen bars may be made in rights and lefts, with the bevelled edges at opposite sides of different bars. As shown in Fig. 1, this enables the bars to be arranged in one quadrant of the cage with the bevelled edges facing one way, whereas the bars in the next quadrant may be arranged with the bevelled edges facing the opposite way. Such arrangement gives the same number of drainage slits between the bars in each quadrant of the cage, whereas, if all of the bars in the cage were arranged with their bevelled edges facing in the same direction, there would be one less drainage slit in one quadrant of the cage than in the next.

In the operation of these presses, the material is less compact in the feed or inlet end of the cage than in the discharge end, and the material gives up its liquid more freely or under less pressure in the feed end than in the discharge end, the pressure on the material increasing from the feed end towards the discharge end. Therefore, it has been the practice to make the cage screens in successive sections lengthwise of the cage and space the screen bars differently in the different sections, so as to get spaces between the bars which are widest at the feed end section and are of successively decreased widths in the successive sections toward the discharge end of the cage. This meant that the wedge spacers between the bars in each section had to be of a different thickness and with faces of different angularity from those in each of the other sections. By employing screen bars formed with the tapered bevels described, the bars can be spaced apart uniformly from end to end by means of wedge spacers of like thickness and like wedge taper used throughout the length of the screen or cage, the wedge spacers being of suitable thickness to give the minimum required width of the slits between the bars at the discharge end of the cage, and the tapered bevels of the bars causing the slits between the inner edges of the screen bars to increase gradually in width from the discharge end toward the feed end of the cage. Thus, the required effective width of the slits at each portion of the cage is obtained, as for example, slits increasing in width from five thousandths of an inch at the discharge end of the cage to fifteen thousandths of an inch at the feed end of the cage.

The channels or ducts of the screen bars are joined with suitable connections or piping for circulating the heat exchange medium lengthwise through the several screen bars. The means shown in the drawings for this purpose comprises inlet manifolds **31** and **32** arranged at opposite sides of one end of the cage and connected to a common supply pipe **33**. The manifold **31** is connected by inlet pipes **34** and unions **35** with the inlet ports **23** in one end of the several screen bars at one side of the cage, and the other inlet manifold **32** is similarly connected by inlet pipes **36** and unions **37** with the inlet ports **23** at the corresponding ends of the several screen bars at the opposite side of the cage. Similarly, outlet manifolds **38** and **39** are shown at opposite sides of the cage and connected to a common discharge pipe **40**. The manifold **38** is connected by outlet pipes **41** and unions **42** with the outlet ports **24** at the opposite ends of the several screen bars at one side of the cage, and the other outlet manifold **39** is connected by outlet pipes **43** and unions **44** with the outlet ports **24** of the several screen bars at the opposite side of the cage. By such connections, the cooling or heating medium is admitted to the corresponding ends of the channels in the several screen bars and flows lengthwise through all of the bars to the discharge connections. The circulating connections can be arranged, if desired, so that the medium is admitted to the screen bars near the discharge end of the cage, where the highest temperatures exist, and is discharged from the bars near the feed end of the cage.

While the screen bars provided with the circulating channels for the heat exchange medium could be made in short lengths and arranged in successive sections in the cage in the manner that solid screen bars have been heretofore arranged, as before mentioned, such an arrangement would necessitate circulating connections for opposite ends of the bars in each of the several screen sections, which would greatly increase the number of connections and add to the complication of the circulating system. By forming the screen bars with the tapered bevels as described, the necessity for such a multiplicity or complication of circulating connections is avoided, because, as explained, the bars can be made the full length of the cage and give the necessary increasing width of the drainage slits between the bars at the different portions lengthwise of the cage, and it is only necessary to have circulating connections at opposite ends of a single set of bars. Drainage slits which taper or decrease in width lengthwise of the cage could be obtained, of course, by employing screen bars of full cage length which taper or increase in thickness lengthwise, but bars of such form would have to be spaced apart by wedge spacers which are of different thicknesses and having faces of different angularity at different portions lengthwise of the bars. Furthermore, the filler bars **46** (see Fig. 1), which are used between the screen bars and their securing wedge or clamping bars, and the shim bars **47** used between the screen bars and the abutment bars of the cage for clamping the screen bars in place in the cage would have to be of different shape or thicknesses at different portions lengthwise of the screen or cage, thus greatly complicating the assemblage of the parts of the cage. These complications are obviated by the use of the described full length bars with the tapered bevelled edges.

The heat exchange, cooling or heating efficiency of the described construction, in which the circulating channels for the heat exchange medium are formed directly in the screen bars themselves, is many times greater than that obtained by previous constructions, in which the circulating channels are formed in the cage body or portions of the cage which are disposed outwardly beyond the screen or lining bars, as will be apparent from the following:

Assuming, by way of example, a cage such as herein disclosed, having 20 screen bars 44 inches long and ¾" thick lining a cage body having 16 ribs, each 1" thick, against which the screen

bars bear, there would be at best 240 sq. in. of contact area between the screen bars and ribs for conducting heat from material being pressed to the temperature changing medium if the circulating channels were located in the cage ribs or otherwise outside of the screen bars. On the other hand, in the improved construction described, the screen bars would have 660 sq. in., or nearly three times as large an area, in direct contact with the material from which the heat would be conducted to the temperature changing medium directly and by the shortest path through the relatively thin metal walls of the screen bars themselves to the temperature changing medium. But, in addition, in the old constructions the effective heat conduction from the screen bars to the cage ribs would be far less because there is not a perfect metal to metal contact throughout the stated area between the bars and ribs, since the expressed oil or liquids work into the joints between the bars and ribs, and furthermore, because the usual screen bars have had flat outer sides engaging the curved inner faces of the ribs, which gives a very small area of contacting surface between these parts. Thus, the effective heat transfer from the material to the temperature changing medium in the improved construction of this application would be many times greater than the three times larger conduction area above indicated in the improved construction over previous constructions.

It will be noted with reference to the construction of the screen bars having the tapered bevel of the edges for drainage, that increasing the depth of the bevel would result in increasing the width of the drainage space between the bars, and the tapered bevel the full length of the bar makes it possible to use spacers of one size or thickness throughout the full length of the bars. All the spacers used with these tapered bevel bars are of the same thickness, and the drainage spacing between the bars is regulated by the tapered bevel and not by varying the thicknesses of the spacers between the bars. The tapered bevel the full length of the bar makes it possible to use spacers of one size or thickness, and still secure drainage slots of any width desired, by changing the tapered bevel on the bar itself. This, of course, makes a very easy assembly.

I claim as my invention:

1. In a liquid expressing press having a cage which forms the pressing chamber and comprises an outer reinforcing frame, and an annular screen lining said frame composed of separate longitudinal screen bars which are detachably secured in said frame in closely spaced side by side relation to form narrow escape slits for the expressed liquid between the bars, the improved construction in which each of said bars comprises two longitudinal sections at least one of which is channel shaped in cross section and which are disposed edge to edge forming an internal channel extending lengthwise in said bar, and welds permanently connecting said sections, and connections are provided at opposite end portions of said screen bars for circulating a temperature changing medium through said channels.

2. In a liquid expressing press having a cage which forms the pressing chamber and comprises an outer reinforcing frame, and an annular screen lining said frame composed of longitudinal screen bars spaced apart to form narrow escape slits for the expressed liquid between the bars, the improved construction in which each of said screen bars has a side thereof at the inner edge of the bar bevelled and said bevel gradually increases in depth lengthwise of the bar, thereby forming slits between the screen bars which taper lengthwise of the cage.

3. In a liquid expressing press having a cage which forms the pressing chamber and comprises an outer reinforcing frame, and an annular screen lining said frame composed of longitudinal screen bars spaced apart to form narrow escape slits for the expressed liquid between the bars, the improved construction in which each of said screen bars extends approximately the full length of the cage and has a side thereof at the inner edge of the bar bevelled and said bevel gradually increases in depth lengthwise of the bar, thereby forming slits between the screen bars which taper lengthwise of the cage.

4. In a liquid expressing press having a cage which forms the pressing chamber and comprises an outer reinforcing frame, and an annular screen lining said frame composed of separate longitudinal screen bars secured in said frame in closely spaced side by side relation to form narrow escape slits for the expressed liquid between the bars, the improved construction in which each of said screen bars has a side thereof at the inner edge of the bar bevelled and said bevel gradually increases in depth lengthwise of the bar, thereby forming liquid escape slits between the screen bars which taper lengthwise of the cage, each of said screen bars has a channel extending lengthwise therein, and connections are provided for circulating a temperature changing medium through said channels.

5. In a liquid expressing press having a cage which forms the pressing chamber and comprises an outer reinforcing frame, and an annular screen lining said frame composed of separate longitudinal screen bars secured in said frame in closely spaced side by side relation to form narrow escape slits for the expressed liquid between the bars, the improved construction in which each of said screen bars extends approximately the full length of the cage and has a side thereof at the inner edge of the bar bevelled, and said bevel gradually increases in depth from end to end of the bar, thereby forming slits between the bars which taper lengthwise of the cage, and each of said screen bars has a channel extending lengthwise therein, and connections are provided for circulating a heat exchange medium through said channels.

6. In a liquid expressing press having a cage which forms the pressing chamber and comprises an outer reinforcing frame, and an annular screen lining said frame composed of longitudinal screen bars spaced apart to form narrow escape slits for the expressed liquid between the bars, the improved construction in which said screen bars extend approximately the full length of the cage and are separated by spacing members of uniform thickness disposed at intervals lengthwise of the bars and each of which bars is of uniform thickness from end to end throughout the major portion of its radial depth but has a side thereof at the inner edge of the bar bevelled, which bevel gradually increases in depth lengthwise of the bar, thereby forming liquid escape slits between the bars which taper lengthwise of the cage.

7. In a liquid expressing press having a cage which forms the pressing chamber and comprises an outer reinforcing frame, and an annular screen lining said frame composed of longitudinal screen bars spaced apart to form narrow escape slits for the expressed liquid between the bars, the im-

proved construction in which said screen bars extend approximately the full length of the cage and are separated by spacing members of uniform thickness disposed at intervals lengthwise of the bars and each of which bars is of uniform thickness from end to end throughout the major portion of its radial depth but has a side thereof at the inner edge of the bar bevelled, which bevel gradually increases in depth lengthwise of the bar, thereby forming liquid escape slits between the bars which taper lengthwise of the cage, each of said screen bars having an internal channel extending lengthwise thereof, and connections are provided for circulating a temperature changing medium through said channels.

8. In a continuous liquid expressing press of that type which comprises a cage forming a pressing chamber, and a pressure screw that compresses and moves material along in the pressing chamber and forces solid material out through an end discharge opening thereof, and in which said cage comprises an outer reinforcing frame and an annular screen that lines said frame and is composed of numerous separate longitudinal screen bars removably secured in said frame in closely spaced side by side relation to form between them narrow slits for the escape of liquid expressed from the material, that improvement in the construction of the press cage in which said outer reinforcing frame includes sections which are relatively movable for assembling and removing said screen bars, said several separate screen bars have internal circulating channels extending lengthwise therein approximately from end to end of the bars, and connections are provided for circulating a temperature changing medium through said bar channels, which connections include relatively movable parts enabling the assembling and removal of said screen bars.

9. The improvement in a continuous expressing press as set forth in claim 8, in which said channelled screen bars extend approximately the full length of the cage screen, and said circulating connections include inlet and outlet manifolds with branches separably coupled to the several screen bar channels.

10. In a continuous liquid expressing press of that type which comprises a cage forming a pressing chamber, and a pressure screw that compresses and moves material along in the pressing chamber and forces solid material out through an end discharge opening thereof, and in which said cage comprises an outer reinforcing frame and an annular screen that lines said frame and is composed of numerous separate longitudinal screen bars secured in said frame in closely spaced side by side relation to form between them narrow slits for the escape of liquid expressed from the material, that improvement in the construction of the press cage in which said several separate screen bars extend approximately the full length of the cage screen, said liquid escape slits taper continuously from end to end thereof lengthwise of the screen, said screen bars have channels extending lengthwise therein, and connections are provided for circulating a temperature changing medium through said channels.

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