

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

An Extrusion Filter

We, USINE DE WECKER S.a.r.l. of Wecker, Luxembourg, a Luxembourg Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to an extrusion filter for example for the extraction of oil from palm fruits. It is desirable for the press to be capable of general application to extracting liquid from wet solids. It is known to provide a press having a pair of worm spindles equipped with contrary handed threads and adapted to rotate in opposite directions in a strainer. It is also known to provide between the solids discharge end of the press and the nearest threads on the spindles a threadless pressure-chamber. Within this threadless pressure-chamber press-cones, movable in and out of the solids discharge opening, can be installed to regulate the solids discharge in accordance with the different qualities of the specific goods to be handled.

Such double-worm-spindle-presses have disadvantages e.g. within the threadless pressure-chamber unavoidable changes of pressure occur so that the residual liquid content of the discharged solids changes continuously. Furthermore, the said liquid content may vary radially across the discharge outlet.

An object of the invention is to provide a press in which at least one of these disadvantages is reduced.

Accordingly the invention includes an extrusion press filter for the extraction of liquids from wet solids and including a perforated tubular strainer member, two worms, each worm rotatably mounted in the strainer member, this strainer member having a discharge passage for solids, which passage is varied in width by means of two axially movable press-cones, this perforated tubular strainer member enclosing a pressure chamber in which the

worms rotate, each worm having a threaded part and an unthreaded spindle part, which extends through the discharge passage and through the pressure chamber between the end of the threaded part and the discharge passage, the discharge passage being defined between a diverging wall at one end of the pressure chamber and the diverging surfaces of the two press-cones, whose axial movement thereby varies the passage width and the pressure in the pressure chamber.

The filter may have a hydraulic cylinder having a piston connected with the movable press-cones, and an accumulator containing a liquid and means for adjusting the pressure above the surface of the liquid, the accumulator being connected by a pipe to the cylinder on the side of the piston remote from the press-cones.

The invention is described by two different examples with reference to the accompanying drawings in which:—

Figure 1 shows a longitudinal vertical section through a double-worm-spindle-press according to the invention and the insert in Figure 1 shows the details of the accumulator 16, shown diagrammatically in the main part of Figure 1;

Figure 2 is a horizontal longitudinal section of the press according to Figure 1;

Figure 3 shows another example of the invention in view similar to Figure 1;

Figure 3a shows a view similar to Figure 2 of the press of Figure 3;

Figure 4 shows a longitudinal section of a part of Figure 3 in magnified scale;

Figure 5 is a longitudinal view of the strainer tube part of the press and the shaping tools for forming it;

Figures 6 and 7 show end views of the objects shown in Figure 5 before and during the first shaping step;

Figure 8 shows an end view of the tube

and the spreading tools after the first shaping step;

Figure 9 shows a similar sectional view to Figure 8 showing the shaping tools used in the second shaping step before compression;

Figure 10 shows an end view of the finished strainer tube.

The press consists of two worm spindles 1 and 2, which rotate in a strainer tube 3.

The worm spindles 1 and 2 have oppositely handed threads and are rotated in opposite directions. The strainer wall is perforated to let the liquids, which have been squeezed out of the solid ingredients by pressure, drain off. Between the solids discharge outlet 4 at the end of the strainer 3 and the last threads 5 of the worm spindles 1 and 2, there is a screwless pressure-chamber 6. The residual solid fractions of the handled goods are pressed out of this pressure-chamber through the outlet 4, in which the press-cones 7, movable in and out, are installed. In the example shown in the drawing the outlet 4 widens outwardly, and press-cones 7 are movable axially into the outlet to vary the pressure in chamber 6 and hence the residual liquid content of the discharged solids.

The press-cones 7 are mounted on the ends of hollow shafts 9 which are concentric to and outside worm-spindle shafts 8 and are axially slidable therealong. In Figures 1, 2 the shafts 9 extend back to respective connections with a common regulating piston 10, which glides back and forth in an hydraulic cylinder 11. The ends of the hydraulic cylinder 11 communicate with hydraulic fluid pipes 13a, 13b and these pipes communicate through regulation valves 14 with the hydraulic pump 12. Depending on the opened position of one valve 14 and the closed position of the other regulation valve 14, the fluid from pump 12 is delivered to either side of the regulating piston 10.

Hence the shafts 9 move the press-cones 7 into or out of the outlet to vary the liquid content of the discharged solid material.

It is important to achieve a constant pressure in the pressure-chamber 6 so as to obtain a uniformity in the pressed material. For this purpose a compensation appliance is installed, which regulates, depending on pressure, the adjusting appliance 9 to 14. The compensation of pressure is produced by replacing the previously used rigid adjustment of the regulating piston, which is a known hydraulic system, by a flexible system. The effect of compensation is increased by the fact that besides the flexibility there is an elastic effect.

In the described example of Figure 1, the left hand end of the hydraulic cylinder 11 of the regulating piston 10, which moves both the axially adjustable press-cones, is connected by a pipe 15 with the accumulator 16. Above the liquid surface 17, which varies in level in

the accumulator 16, is an air-cushion 18 having an adjustable pressure. In practice (see the insert in Figure 1), the accumulator 16 houses a compensating piston 20, which oscillates in a compensation cylinder 19, with liquid surface 17 touching the lower face of piston 20. This compensation piston 20 is connected by a rod 21 with a piston 22, movable in another cylindrical part of accumulator 16, and air-cushion 18 is formed above piston 22.

The diameters of the compensating piston 20 and the air-piston 22 are different, which provides a pressure magnification effect, and the magnified pressure transmitted to cylinder 11, leftwards of piston 10 is applied to the press-cones 7 and opposes the pressure of treated material in chamber 6.

In the described example of design in Figure 1, a compressor 23 produces the necessary pressure in the air-cushion above the air-piston 22.

In the pipe 26 between the air-cushion 18 and the accumulator 23 a pressure regulator 24 and a valve 25 are installed. When the valve 25 is closed the weight of air within the air-cushion is constant. This has the consequence that pressure changes in the pressure chamber 6 are compensated by movements of cones 7 to restore the balance of forces urging cones 7 left and right. The air-cushion 18 in practice varies comparatively little in pressure and imparts resilience of movement to cones 7. Whenever the pressure required to be maintained within the pressure chamber 6 should be changed, it suffices to change accordingly the pressure in the air-cushion 18. This can be attained by a proportional adjustment of the pressure regulator 24 and by an opening of the valve 25. This has the consequence, that the press-cones 7 move in response to the changed pressure in the air-cushion 18 and thus produce a changed pressure in the pressure-chamber 6. Thus the regulating appliances 16 to 26 with the regulating piston 10 serve with adjusting appliance 9 to 14 to set in motion the press-cones 7.

According to the embodiment of the Figures 3 and 4 the pressure compensation movement of cones 7 is effected by a pair of spring pillars incorporating several springs.

Within each spring pillar the single springs are arranged so that they operate in parallel to urge cones 7 to the right, and are independent and separated from each other, bearing against the fixed casing and against the movable shaft 9 of the press-cone 7. The pillar casing enclosing springs 27 comprises two or more cylindrical cases 28, 29. Figure 4 shows casing 28 threadedly adjustable on fixed casing 29, whereby the shaft 9 and cone 7 is moved axially until springs 27 are compressed as pressure in chamber 6 resists further movement.

Pressure in the pressure chamber 6 is proportional to the total compression forces

exerted by all springs 27. Changes of pressure in the pressure chamber 6 are compensated by resulting movements of cones 7 as springs 27 adjust their compression to restore balance of forces. To adjust the pressure in chamber 6 to any required level, it is sufficient to screw case 28 axially along case 29.

It is a further feature of the invention to perforate the tube walls of the unthreaded parts of worm spindles 8 in chamber 6. These perforations form an additional drain outlet for liquid expressed from material in the inner parts of chamber 6. Thus the separation of the liquid particles from the solid parts in the pressure chamber 6 is going on not only within its outside zones but also within the inner zones. It has been shown to be practical to drain off this liquid out of the hollow worm spindles 8 through drains 30 at the outward ends of spindles 8 into a container 31.

Outwardly divergent walls 32 surrounding the solids discharge outlet diverge outwards similarly to the cones 7 so that the solids discharge passage between walls 32 and cones 7 has a cross-section which increases in area along its length although, if desired, an alternative arrangement could be provided where the cross-section remains uniform. Such a design of the outlet has the advantage that the goods, separated from their liquid particles, are flowing through the outlet 4 with regular velocity. Thus a more homogeneous pressure distribution is achieved in the pressure chamber 6.

It has been shown to be practical that the threads of the worm spindles 1 and 2 have a decreasing axial pitch, in the direction of pressing. This construction of the threads produces a higher pressure in the pressure chamber 6 with the result that there is an improvement in the separation of the solid from the liquid particles in the goods to be handled.

The strainer tube 3, which encloses both worm spindles 1 and 2, is shaped out of a single piece of circular section tube 33. An appliance for the shaping of such a tube 33 to form strainer 3 consists of a pair of stretching tools 34, which are diverged from each other by spreading tools 38, and a pair of compressing tools 39. The stretching tools 34 have outwards facing shaping segments with curved faces 35, which correspond in shape and size to the corresponding portions 36 of the formed tube 33. The stretching tools 34 have such a length, that both their ends 37 extend out of a length of tube which is slipped over tools 34 to be shaped.

These ends 37 of the stretching tools 34 are formed with cam surfaces which are acted on by spreading tools 38 causing tools 34 to move apart. Between the ends 37 of tools 34 compressing tools 39 are driven towards each other to compress tube 33 in a direction perpendicular to the movement of tools 34 and

their configuration 40 corresponds to the central portions of the finished tube strainer 3 (Figure 10).

Figure 5 shows a longitudinal view of tube 33, into which the stretching tools 34 are inserted and from which their ends extend, and shows also the spreading tools 38 before there working action on the ends 37 of the stretching tools. Figure 6 shows an end view of the described objects on Figure 5 in longitudinal view. Figure 7 shows a similar end view with the spreading tools having partly completed their inward movement, acting on the ends 37 of the stretching tools 34 to force tools 34 apart to stretch tube 33. Thus the shaping segments 35 of the stretching tools 34 come in contact with the inner wall of the tube 33. On completion of the outward movement of the stretching tools 34 the tube 33 is stretched to assume the oval form, shown in Figure 8. Figure 9 shows schematically the oval stretched tube 33 in section I—I of Figure 5 before its finished configuration. For the last operation contrary movable compressing tools 39 are constructed, which operate from the outside on that part of the tube 33 to be shaped, which is situated between the now separated tools 34. These compressing tools 39 have a shaping form 40, which is appropriate to the shape required in the part of the strainer 3 between its worm spindle casings 36. From this finishing press operation, by means of the contrary movable compressing tools 39, the finished form of the strainer 3 results as it is shown in end view on Figure 10. It is useful for the stretching tools 34 to have rotatable rollers 41 or equivalent means mounted on the axial edges of their shaping segments 35. These rollers 41 extend slightly from the curved surfaces 35 and assist the tube 33 to slide over the axial edges thereof during the stretching process, shown in Figure 8, and the compressing process, shown in Figure 9. The wall of the tube 33 is thereby stressed less than if rollers 41 were not used. This effect may be enhanced by positively driving rollers 41.

It is desirable that a sheet metal is punched before its shaping to a tube, which forms the strainer 33. Such punching produces cylindrical holes in the flat sheet metal. The bending of the sheet metal to a tube 33 has the consequence, that the punched in holes 42 widen conically from the inside to the outside. In this inexpensive way a strainer is formed with openings 42, which make possible a reasonable passage of the separated liquids such as oil, water etc. or similar fluids. The holes may vary in diameter in step fashion, portions 43 on the inner wall of the strainer 3 being cylindrical and each running into a greater cylindrical boring 44 on the outer circumference. It is also possible to form the borings and punchings in the strainer 3 cylindrical throughout the whole wall.

WHAT WE CLAIM IS:—

1. An extrusion press filter for the extrac-
tion of liquids from wet solids and including
a perforated tubular strainer member, two
5 worms each worm rotatably mounted in the
strainer member, this strainer member having
a discharge passage for solids, which passage
is varied in width by means of two axially
movable press-cones, this perforated tubular
10 strainer member enclosing a pressure cham-
ber in which the worms rotate, each worm
having a threaded part and an unthreaded
spindle part, which extends through the dis-
charge passage and through the pressure
15 chamber between the end of the threaded
part and the discharge passage, and the dis-
charge passage being defined between a di-
verging wall at one end of the pressure
chamber and the diverging surface(s) of the
20 two press-cones, whose axial movement there-
by varies the passage width and the pressure
in the pressure chamber.
2. A press filter as claimed in claim 1
and including a hydraulic cylinder having a
25 piston connected with the movable press-
cones, and an accumulator containing a liquid
and means for adjusting the pressure above the
surface of the liquid, the accumulator being
connected by a pipe to the cylinder on the
30 side of the piston remote from the press-
cones.
3. A press filter according to claim 2, in
which the accumulator comprises two axially
adjacent cylinders of different diameter, a
35 compensating piston resting on the liquid sur-
face in the lower cylinder and being connected
by a rod to an air piston whose upper surface

is exposed to variable air pressure in the upper
cylinder, the different diameters of the com-
pensating piston and the air piston resulting
in an amplification of the air pressure being
transmitted to the hydraulic cylinder to urge
the press-cones axially towards the discharge
passage. 40

4. A press filter according to claim 3 in-
cluding a compressor or the like for supplying
air pressure to the upper cylinder, a pressure
regulator connected to the upper cylinder by
an air pipe for adjusting this air pressure and
a valve located in the air pipe to maintain a
predetermined pressure in the pressure cham-
ber. 45

5. A press filter according to any one of
claims 2 to 4, wherein the hydraulic cylinder
and accumulator are adapted to move the
press-cones to their required position as well
as to compensate for pressure variations in
the pressure chamber during operation of the
press. 55

6. A press filter according to claim 1 60
wherein each press-cone is connected to a
spring pillar comprising a number of springs
so arranged that the compressive force of each
spring is added together.

7. A press filter according to any of claims 65
1 to 6, wherein the tubular strainer member
is shaped out of a single section of tube.

8. An extrusion press filter substantially
as hereinbefore described with reference to
and as shown in the accompanying drawings. 70

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