

March 10, 1959

F. M. VAN TILLO

2,876,697

PRESS FOR SEPARATING MATERIAL

Filed Jan. 26, 1956

3 Sheets-Sheet 1

FIG. 1

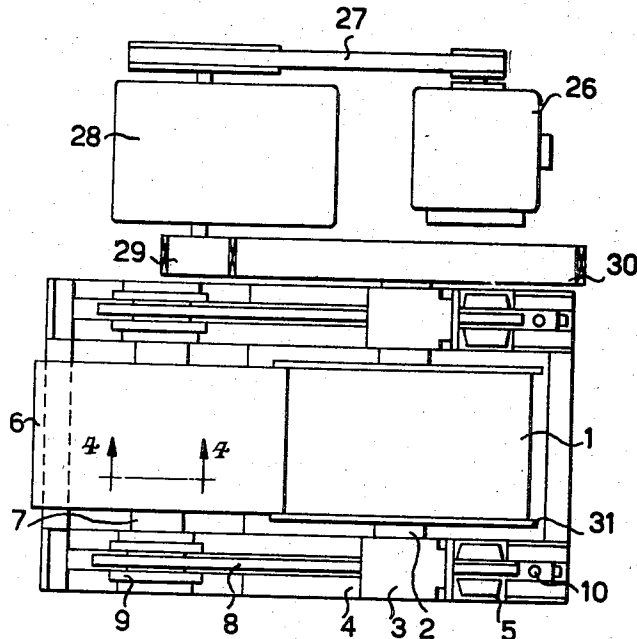
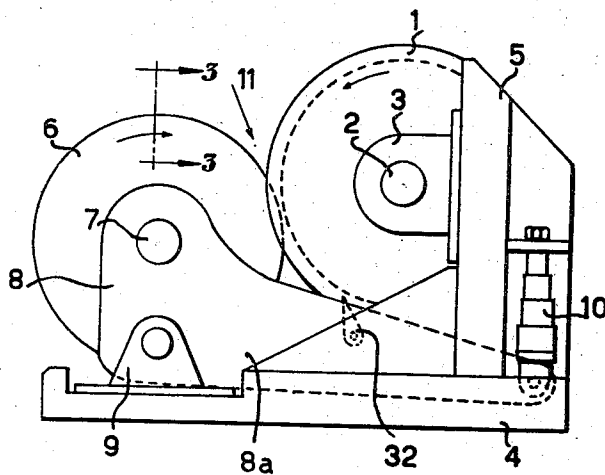


FIG. 2



Inventor
Franciscus M. Van Tillo
By Cushman, Darby & Cushman
Attorneys

March 10, 1959

F. M. VAN TILLO

2,876,697

PRESS FOR SEPARATING MATERIAL

Filed Jan. 26, 1956

3 Sheets-Sheet 3

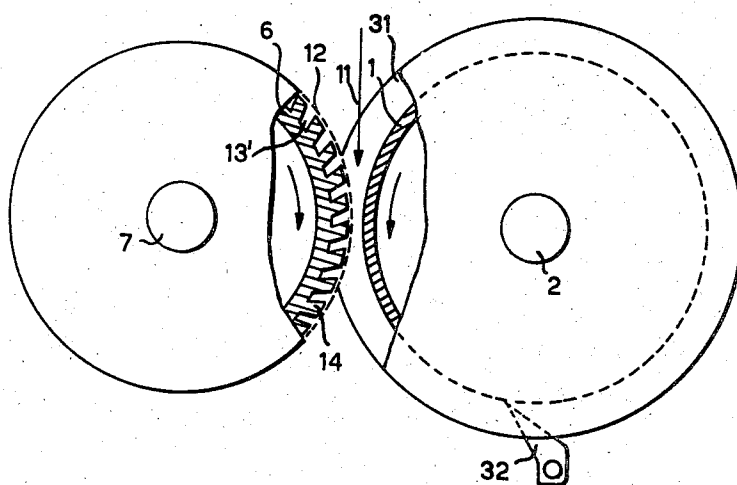


FIG. 7

Inventor
Franciscus M. Van Tillo
By *Cushman, Darby & Cushman*
attorneys

1

2,876,697

PRESS FOR SEPARATING MATERIAL

Franciscus M. Van Tillo, Treebeek, Netherlands, assignor
to Stamicarbon N. V., Heerlen, Netherlands

Application January 26, 1956, Serial No. 561,513

11 Claims. (Cl. 100—121)

The present invention relates to roller presses and, more particularly, to improvements in roller presses of the type for separating liquid from finely divided solid material, such as coal slurry or the like, by compression of the material.

In the past, liquid, such as water, was expressed from a coal slurry by such conventional means as suction filters. When using suction filters, the moisture content of the slurry was reduced only to about 25% and, consequently, the slurry had to be subsequently subjected to another drying treatment at a thermal drying plant. The energy consumption with this conventional method of expressing liquid from a slurry is high and the plant for accomplishing this method is costly and occupies a large space. Further, the maintenance cost for maintaining such an operation is high and the thermal treatment of the finely divided solid material such as coal is often injurious to the properties of the material; for example, in the treatment of coal where the coal is to be used in the production of coke and gas.

Recent efforts have been made to separate liquid from a finely divided solid material by utilizing a roller press comprising two rollers driven in opposite directions and having their roller surfaces formed as screens for allowing the passage of the liquid pressed out of the slurry. The screens for such prior roller presses were formed by spaced parallel bars extending perpendicularly across grooves or closely spaced channels provided in the body of the rollers. Since the bars forming the screen provided the outer surface of the rollers of the press, the pressure of the slurry on the bars at the nip or pressure zone of the rollers would tend to rock the bars in such a way as to strain or break their connection with supporting bars fixed to the body of the rollers.

Therefore, an object of the present invention is to provide a roller press for use in separating liquid from finely divided solid materials by compression which comprises two cooperating rollers having a screen constructed on the surface of the rollers in such a manner that the screen will not be affected by the passing of solid material through the nip or pressure zone of the rollers.

Another object of the present invention is to provide a roller press having coacting rollers for compressing a slurry to remove liquid from a finely divided solid material, the rollers having screens through which the liquid is expressed and the screens being arranged on the rollers in such a manner that there are projections on the rollers outwardly of the screens.

Still another object of the present invention is to provide a roller press for expressing liquid from a slurry wherein there is little or no relative movement in a tangential direction between the solid material of the slurry and the screens of the roller press when the material is passing through the rollers.

A further object of the present invention is to provide liquid traps in the rollers of a roller press for preventing liquid escaping back into the pressed solid material and

2

holding the liquid until such time that the liquid will fall clear of the solid material.

Still another object of the present invention is to provide a roller press with coacting rollers arranged with respect to each other that material passing between the rollers will hold to the periphery of one of the rollers while liquid is expressed through the other roller away from the position where the material is removed from the first roller.

These and other objects of the invention will appear more clearly in the specification, claims and drawings in which:

Figure 1 is a plan view of a roller press constructed in accordance with the present invention;

Figure 2 is a side elevational view of the roller press disclosed in Figure 1;

Figure 3 is an enlarged fragmentary sectional view taken on the line 3—3 of Figure 2;

Figure 4 is an enlarged fragmentary sectional view taken on the line 4—4 of Figure 1;

Figure 5 is a view similar to Figure 3 but showing a modified form of construction;

Figure 6 is a view similar to Figure 4 but showing the modified construction of Figure 5; and

Figure 7 is a fragmentary end view, partly in section, of rollers of another modified construction of the press.

Referring to Figures 1 through 4 inclusive, the roller press of the present invention includes a roller 1 mounted for rotation on a horizontal shaft 2 supported in suitable bearings 3 fastened to columns 5 of a base or frame 4. The base 4 is also provided with upstanding lugs 9 which pivotally support brackets 8. A second roller 6 carried by a shaft 7 is supported for rotation between the brackets 8. Integral with each of the brackets 8 are lever arms 8a which extend over the base and have their free ends depressed by springs 10. The force with which the springs 10 act against the arms 8a may be adjusted to any predetermined force, depending on the material from which it is desired to express a liquid. Of course, weights or hydraulic cylinders could be utilized in place of springs 10.

As will be evident from Figure 2, the springs 10 urge the free ends of levers 8a downwardly so that the bracket 8 is pivoted in a clockwise direction about its pivotal connection to the lugs 9. Consequently, the roller 6 is urged against the roller 1 with a predetermined force as determined by the springs 10.

Rollers 1 and 6 have substantially the same diameter but it will be noted that the horizontal axis of rotation of the roller 6 is slightly below the horizontal axis of rotation of the roller 1. In other words, the axis of rotation of rollers 1 and 6 are vertically and horizontally spaced from each other, the purpose of this arrangement being discussed more fully later in the specification.

Roller 1 is positively driven by an electric motor 26 through a driving belt 27, a gear box 28 and the gears 29 and 30. On the other hand, roller 6 is an idler roller and is driven by the material passing between the nip of the coacting rollers. The direction of rotation of the rollers is indicated by the arrows in Figure 2 of the drawings and the slurry or other material to be pressed is fed to the rollers at 11 in any suitable manner. As will be discussed in more detail later in the specification, the liquid is expressed from the slurry in one direction while the solid pressed material is passed between the rollers and is removed in a different direction away from the expressed liquid.

In more detail, roller 1, which is cylindrically shaped and has a solid peripheral surface, is provided with radially extending end flanges 31, the end flanges being of such size as to slightly overlap the ends of roller 6.

3

Since roller 1 is positioned slightly higher than roller 6 and is provided with end flanges 1, the compressed solid material leaving the nip or pressure zone of the coating rollers will tend to remain or cling to the roller 1 and, thus, leaves the nip of the rollers at a slight angle to the vertical. A scraper 32 supported on the base 4 is adapted to remove the compressed solid from the roller 1 at a horizontal distance from the pressure zone as shown in Figure 2.

The peripheral surface of roller 1 may be provided with circumferential grooves (not shown) to assist the roller 1 in dragging the material to be pressed between the rollers of the press. Roller 6, which, as previously explained, is an idler roller and is rotated by the material passing between it and the roller 1 is provided with a screening surface 12 for allowing the expressed liquid to be passed away from the compressed solid. In more detail, the provision of a screening surface 12 on the roller 6, in addition to the arrangement of the roller 1 in such a manner as to cause the compressed solid material to cling thereto, aids in the separation of the liquid from the solid material in that the down-flowing liquid cannot be reabsorbed in the solid material. Suitable hoppers (not shown) are provided under each of the rollers 1 and 6 for collecting the compressed solid material and expressed liquid respectively.

The details of the screening surface 12 of the roller 6 are disclosed in Figures 3 and 4. It will be noted that the roller 6 is provided on its periphery with a plurality of transversely extending adjacent drainage channels 13 which are provided for collecting liquid expressed from the slurry or the like. Adjacent channels 13 are separated by a portion of the body of the roller as indicated at 14. A plurality of radially extending bores 15 are provided in the body portion of the roller and communicate with each of the channels 13, the bore carrying away the excess liquid collected in the channels. The screening surface 12 of roller 6 is formed by a plurality of parallel screen bars 16 curved in planes normal to the roller axis and supported directly on the cylindrical surface of the body portion of the roller. The bars 16 extend over the drainage channels 13 and are separated from each other by narrow slots. To prevent the slots between the bars 16 from being obstructed, the bars are tapered in cross-section so that the wider of their parallel faces forms the outer screen surface.

Screen bars 16 are retained against body portions 14 which separate one drainage channel 13 from another, by means of transversely extending retaining bars 17. Bars 17, which extend across the outer face of the screen bars 16 and provide projections on the periphery of the roller 6, are retained in place on the roller by marginal clamping portions 18 which are secured to the roller body by bolts 20.

The screening surface 12 is made up of a plurality of individual sections. To accomplish this, the periphery of the body portion of roller 6 is provided with spaced transverse recesses 21 which are adapted to receive transversely extending end connecting pieces 19. The end connecting pieces 19 are fastened to the recesses by means of the bolts 22 and each of the end connecting pieces 19 is adapted to receive the ends of adjacent sections of the screen bars 16. Moreover, the screen area 12 is also divided widthwise of roller 6 into two parts by blocks 23 placed in drainage channels 13. The blocks 23 cooperate with the previously mentioned marginal clamping portions 18 to secure the retaining bars 17 in place.

A modified arrangement of the screen roller 1 is disclosed in Figures 5 and 6. In this construction, the screen bars 16' forming the screen 12' are mounted parallel with the axis of the roller and, therefore, parallel with the drainage channels 13. Screen bars 16' are

4

supported on the cylindrically curved outer supporting faces of arcuate-shaped supporting bars. The body portions 14 of roller 6 which divide adjacent drainage channels 13 are provided with circumferentially extending grooves in their outer ends to receive the arcuate-shaped supporting bars 24 as best shown in Figure 6. Screen bars 16' are supported on the bars 24 by arcuate-shaped retaining bars 17'. The screen shown in Figures 5 and 6 is built up in sections similar to the screen disclosed in Figures 3 and 4, but in this modification, the retaining bars 17' are curved and run perpendicularly to the drainage channels 13 and between the end connecting pieces 19, whereas the screen bars 16' are straight and run parallel with the drainage channels and extend between the blocks 23 and the outer marginal clamping pieces 18.

The portions 14 of the body of the roller 6 which are positioned between adjacent channels are chamfered as indicated at 25 away from the screen 12' so as to avoid clogging of the slots between the screen bars which overlie the portions 14.

Inasmuch as adjacent drainage channels 13 are partitioned off between portions 14 of the roller body, then if the channels in the pressure zone are connected to the vacuum zone (not shown) for sucking off liquid, little air will be aspirated from the outside.

In order to further assist in preventing reabsorption of water by the slurry leaving the pressure zone, the drainage channels in the roller having the screen may be formed as shown in Figure 7 so that they retain or trap any water contained therein until they have passed some distance horizontally from the pressure zone. As will be understood from Figure 7, the roller 6 may be provided with channels 13' which have side walls that are set at an angle of approximately 30° to the radial planes extending from the axis of the roller through the edges of the mouth of the channel. The bottoms of the channel are set normal to the aforementioned radial planes.

When the channel 13' has passed through the pressure zone, the lowermost point in the channel will be near the bottom of the channel so that liquid collects therein and will not flow toward the screen 12 until the channel has passed through an angle of approximately 30° beyond the pressure zone. When the channel 13' has passed through an angle of approximately 30°, the channel 13' will then be completely clear of the roller 1 and of the solid material clinging to that roller between the flanges 31 and, consequently, there is no risk of the liquid flowing into contact with the solid material. The angled side wall of the channel also reduces the speed at which the liquid will tend to flow towards the screen 12 because of the adhesion resulting from the surface tension caused by the sharp angle of the side walls of the channel of this embodiment. The adhesion of the side walls is less if the channel is of rectangular section, as disclosed in Figures 4 and 6. The angle of inclination of the leading side walls of the channels 13' may vary between 15° and 45° to accomplish the aforementioned results. Further, it is within the scope of the invention to provide channels 13' which are dovetail in section.

The operation of the roller press is briefly as follows: A slurry containing a finely divided solid material and a liquid is fed between the presser rollers 1 and 6 as indicated at 11. The roller 1, which is positively driven and which may have grooves on its exterior surface, conveys the material between the nip of the rollers and the movement of the material causes the roller 6 to rotate. Since the roller 6 is provided with a screen overlying water traps such as channels 13, the water is expressed through the screen into the channels and is conveyed away from the solid material. By having the screen mounted directly on the body of the roller 6 and overlying the channels 13, the retaining bars 17 will protrude above the surface of the screen 12. Consequently, the bars 16 of the screen 12 will not receive the full

5

force of the pressure of the material as it passes through the nip of the rollers and will not rock on their supports. On the contrary, the supporting bars 17 will take most of the load and will also aid in the feed of material to be pressed into the gap between the rollers resulting in a higher working capacity for the press. Radial flanges 31 are provided on the ends of the positively driven roller 1 and overlap a portion of the ends of the idler roller 6. The flanges 31 assist in retaining or causing the solid material to cling to the roller 1 after it passes from the pressure zone and until such time that it is scraped off by the scraper 32. By having the axis of the positively driven roller located slightly above the axis of the roller 1, the solid pressed material will leave the nip of the rollers in a path inclined slightly away from the vertical and, thus, the chance of the pressed material reabsorbing the liquid expressed therefrom is further reduced.

The apparatus described above is suitable for expressing liquid from both filter slurry and froth flotation slurry coming from a coal preparation plant and having a water content of about 50%. An example of this operation is as follows:

Example

Filter slurry with a moisture content of 25% was treated on a slurry press according to the present invention, the roller press having the following dimensions:

roller diameter-----	mm--	950
roller width-----	mm--	700
roller speed-----	revs. per minute--	2
electromotor power-----	H. P.--	20

The slurry obtained as a final product had a moisture content of only 11%. The capacity of the plant was 7 metric tons per hour.

The terminology used in the specification is for the purpose of description and not limitation, it being understood that the scope of the invention is defined by the claims.

I claim:

1. In a roller press for use in the treatment of a slurry to separate liquid from finely divided solid material, a pair of cooperating rollers for receiving the slurry between their nip into a pressure zone so as to compress the solid material and express the liquid therefrom, at least one of said rollers comprising a body portion with a plurality of adjacent drainage channels in its periphery for receiving liquid expressed from the solid material, a screen provided on the periphery of said body immediately adjacent said drainage channels, said screen including a plurality of spaced bars defining a bar group, said bars being tapered in cross-section and having parallel faces of different widths, the wider of said parallel faces forming the outer surface of the screen, means to support said screen bars on said body, and retaining bars defining a second bar group, said retaining bars extending transversely across the outer surface of the screen, one of said bar groups having its bars curved about and on the periphery of the body of the roller having the drainage channels and the other of said bar groups having its bars substantially flat, said retaining bars providing projections on said screen and retaining said screen on said supporting means, and said retaining bars also assisting conveyance of the slurry through the nip of said rollers.

2. A roller press of the character described in claim 1 wherein said supporting means for said screen bars is the surface of said body between said drainage channels.

3. A roller press of the character described in claim 1 wherein said supporting means for said screen bars includes supporting bars carried by said body and extending across said drainage channels.

6

4. A roller press of the character described in claim 1 wherein said screen bars are parallel and are cylindrically curved about the periphery of the body of said roller and wherein said supporting means includes the surface of said body between adjacent drainage channels.

5. A roller press of the character described in claim 1 wherein said supporting means includes cylindrically curved supporting bars extending through grooves formed in the body of said roller transversely between adjacent drainage channels, and wherein said screen bars are parallel to each other and extend parallel to the axis of the roller.

6. A roller press of the character described in claim 5 wherein the portions of said body between adjacent drainage channels is chamfered away from said screen to thereby enable the liquid to pass through slots between said screen bars.

7. In a roller press for use in treatment of a slurry to separate liquid from finely divided solid material, a pair of cooperating rotatable rollers for receiving the slurry between their nip, to compress the solid material and express liquid therefrom, one of said rollers having an unperforated peripheral surface, means to positively drive the roller having the unperforated peripheral surface, the other of said rollers comprising a body with a plurality of adjacent drainage channels in its periphery for receiving liquid expressed from said solid material, a screen on the periphery of said body comprising a plurality of spaced bars defining a bar group and between which liquid expressed from the solid material flows to said drainage channels, means to support said screen bars on said body immediately adjacent and over said drainage channels, retaining bars defining another bar group and extending transversely across the outer surfaces of said screen bars for retaining the screen bars on said supporting means, one of said bar groups having its bars curved about and on the periphery of the body of the roller having the drainage channels and the other of said bar groups having its bars substantially flat and means on said first mentioned roller cooperating with said second mentioned roller for assisting solid material emerging from the nip of the rollers to cling to the surface of said first mentioned roller, said last mentioned means including radial flanges carried on the ends of said first mentioned roller and partially overlapping said second mentioned roller.

8. A roller of the character described in claim 7, wherein said second mentioned roller has an axis of rotation slightly lower than the axis of rotation of said first mentioned roller whereby solid material is expressed from the nip of said rollers in a path inclined away from the vertical.

9. A roller press of the character described in claim 7 wherein the surface of the positively driven roller is provided with grooves for advancing the material between the nip of the rollers.

10. A roller press of the character described in claim 7 wherein said drainage channels on the periphery of the second of said rollers are parallel to each other and to the axis of the roller, said drainage channels having side walls therein, the foremost of said side walls with respect to the direction of rotation of the roller being set at an angle to a radial plane drawn from the roller axis through the edge of the channel to thereby provide a water trap for expressed water to prevent the same from escaping back through said screen until the channels have moved sufficiently beyond the nip of said rollers.

11. A roller press of the character described in claim 10 wherein the foremost side wall of each of said channels makes an angle of the order of 15° to 45° with said radial plane.

References Cited in the file of this patent

UNITED STATES PATENTS

714,856	Birkholz	Dec. 2, 1902
958,068	Arbuckle	May 17, 1910
1,153,638	Morris	Sept. 14, 1915

2,308,031

2,538,590

5

614,833

Schmitz Jan. 12, 1943

Polk Jan. 16, 1951

FOREIGN PATENTS

Germany June 19, 1935