No. 773,390. PATENTED OCT. 25, 1904.

H. HENCKE.

DRYING APPARATUS.

APPLICATION FILED FEB. 27, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.

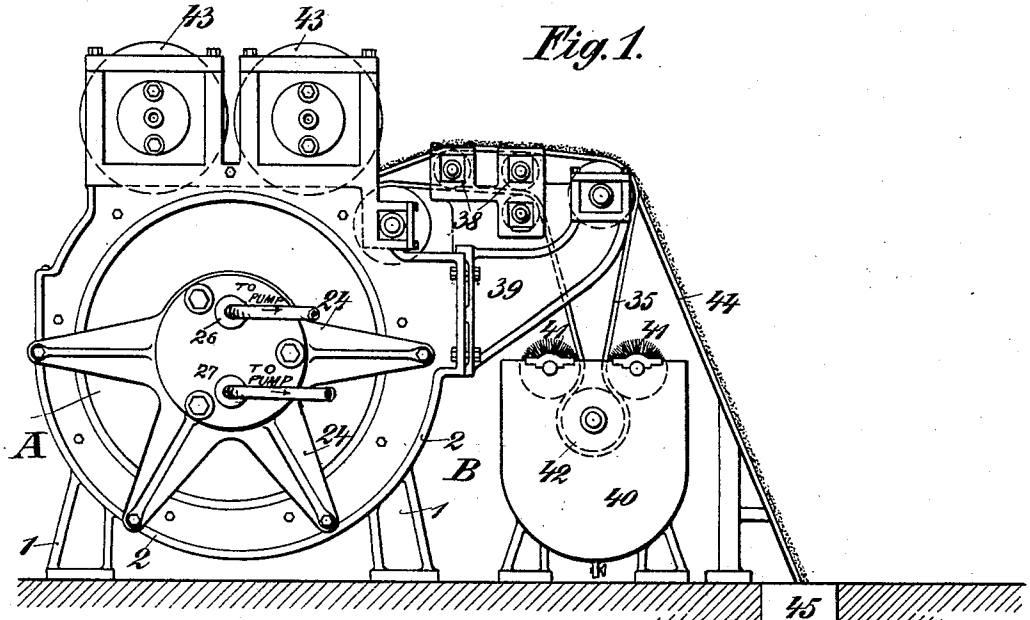


Fig. 8.

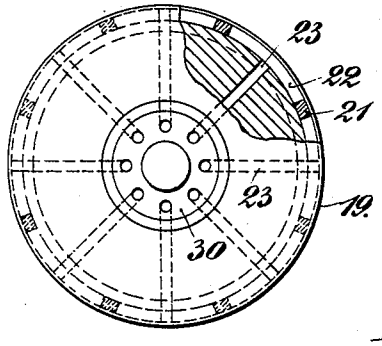
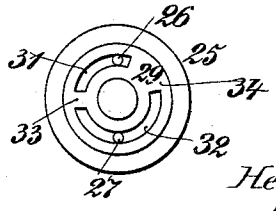


Fig. 7.



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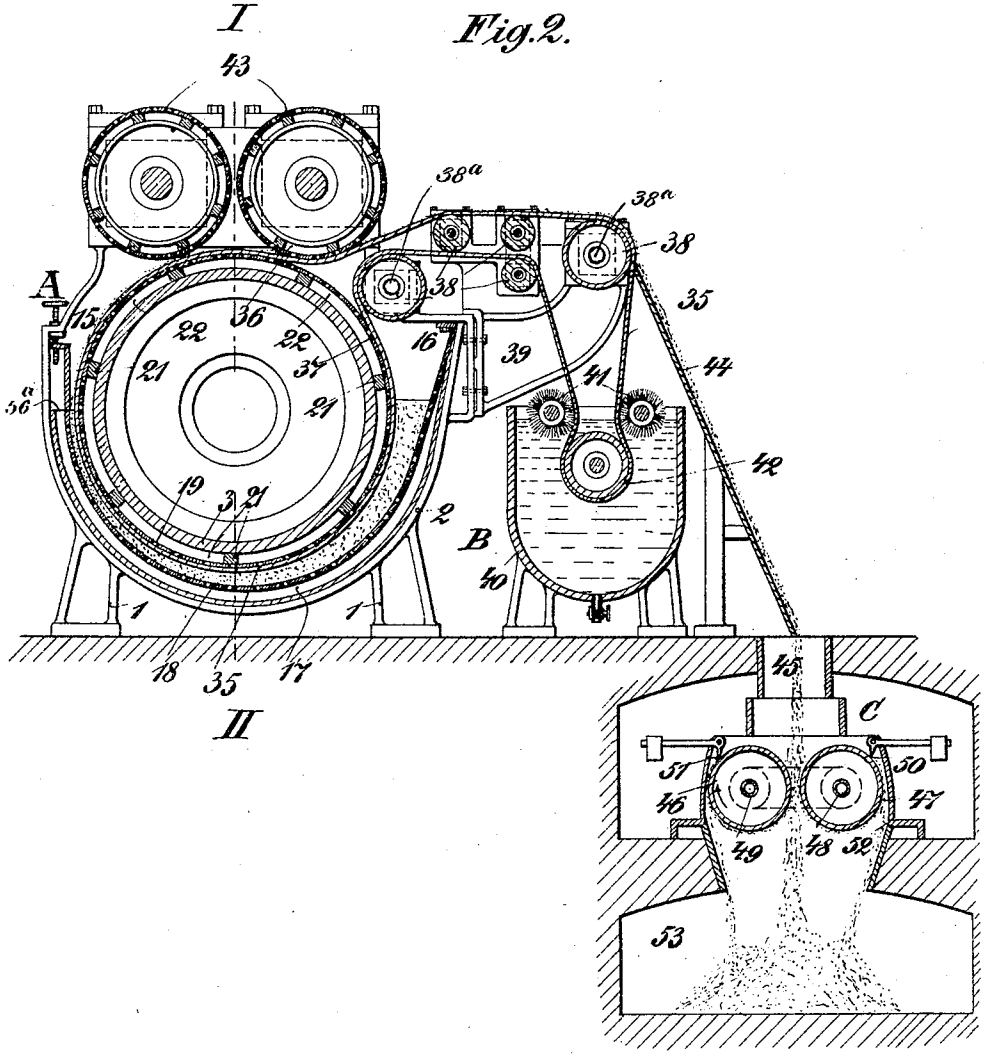
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NO MODEL. 4 SHEETS—SHEET 2

Fig. 2.



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NO MODEL. 4 SHEETS—SHEET 3.

Fig. 3.

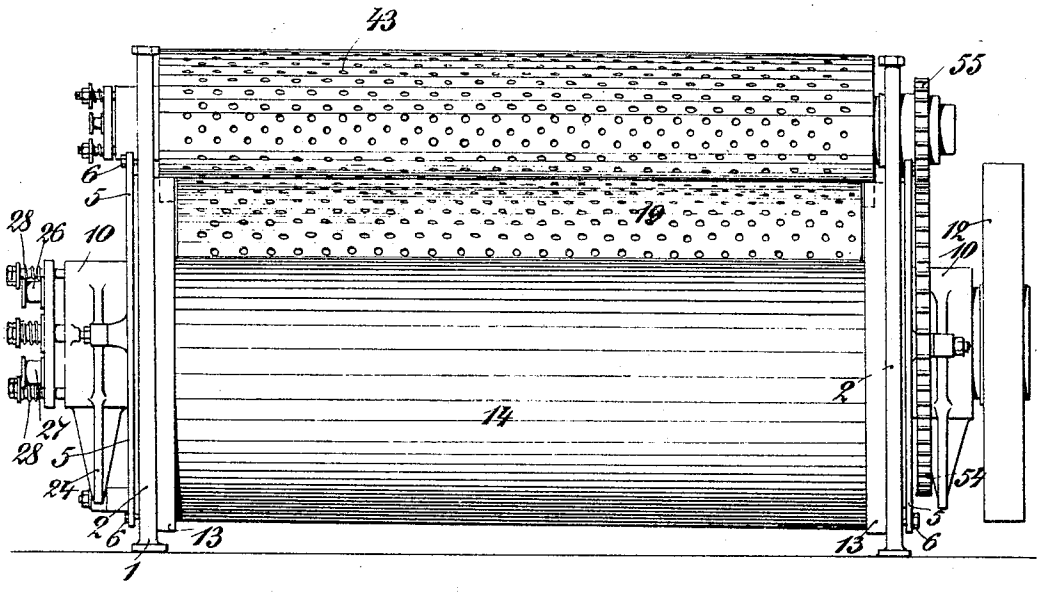
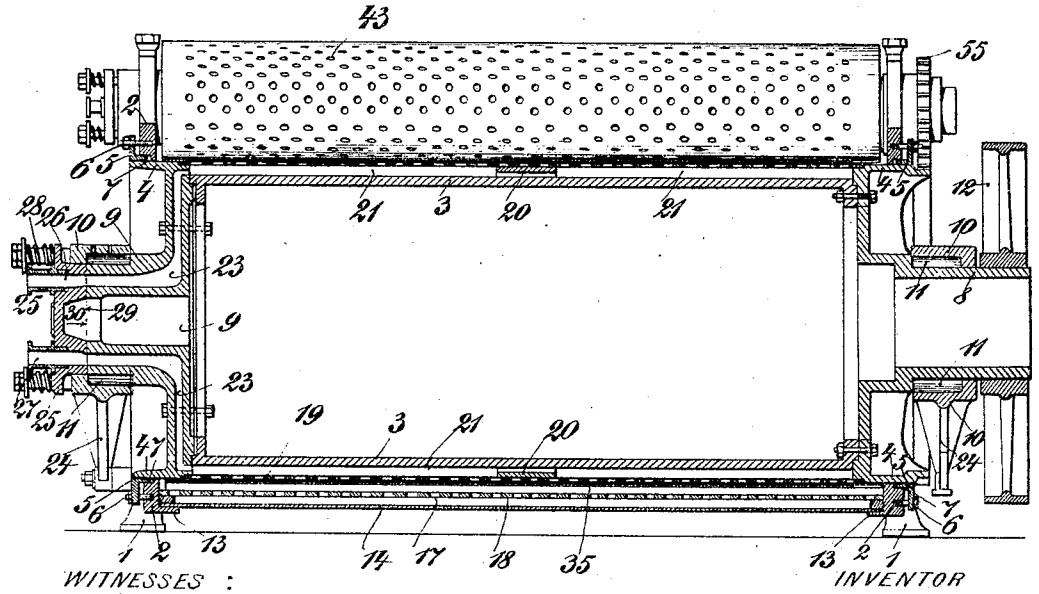


Fig. 4.



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NO MODEL. 4 SHEETS—SHEET 4.

Fig: 5.

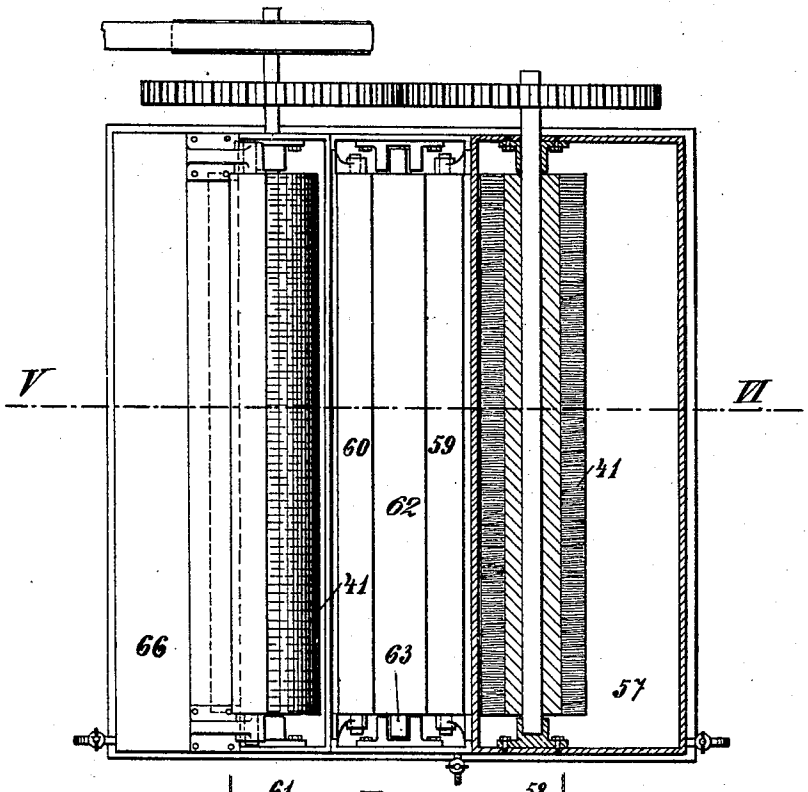
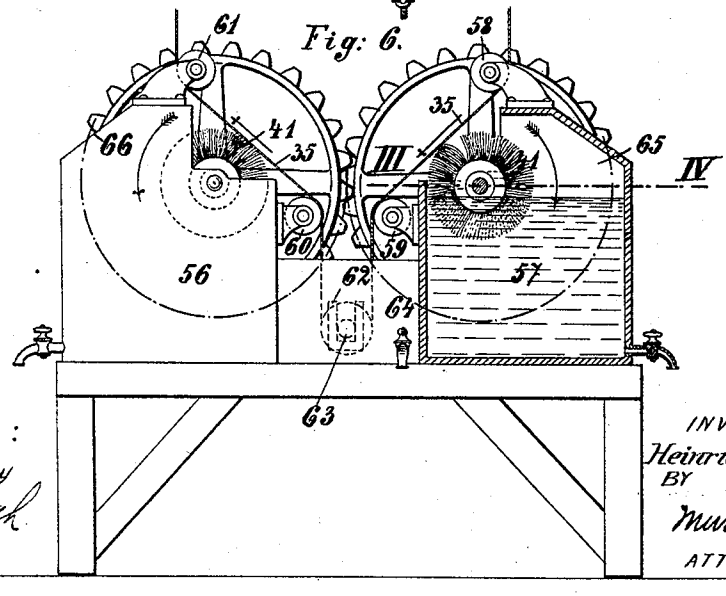


Fig: 6.



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No. 773,390. Patented October 25, 1904.

UNITED STATES PATENT OFFICE.

HEINRICH HENCKE, OF BERLIN, GERMANY.

DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 773,390, dated October 25, 1904.

Application filed February 27, 1903. Serial No. 145,371. (No model.)

To all whom it may concern:

Be it known that I, HEINRICH HENCKE, manager, a citizen of the Empire of Germany, residing at Berlin, Germany, have invented certain new and useful Improvements in Drying Apparatus, of which the following is a specification, reference being had to the accompanying drawings, forming part thereof.

My invention relates to improvements in apparatus for mechanically withdrawing fluid or moisture from matters or materials—for instance, from such materials as remain in breweries, distilleries, starch-manufactories, and the like—and for drying these materials when the fluid or moisture has been withdrawn.

It is known to use apparatuses in which the material to be dried is brought upon an endless transporting-band. In combination with the cylinders and especially with the main drum or main cylinder other rotating drums or rolls are arranged in such a manner that the material transported by the transporting-band is pressed out on its way. It is also known to use in connection with that known apparatus hollow perforated cylinders for sucking off moisture or fluid out of the material.

The present invention relates to improvements in an apparatus of this kind. The vessel or tank and the main cylinder which serves to lead the endless transporting-band through the vessel or tank containing the materials are so arranged that the space between the tank and the drum diminishes in the same direction as the drum rotates. By this arrangement the materials brought upon the endless band will at the same time be pressed within the tank by the pressure of the drum or cylinder. The fluids or water pressed out of the materials enter through the perforated surface of the cylinder or drum or through the perforated bottom of the trough or tank.

The above-described arrangement has the advantage that when the material is brought upon the endless band the water or fluid is pressed out and the material itself is compacted, whereby it better adheres to the transporting-band. Also there are arranged means for the purpose of cleaning the transporting-band and removing the impurities from its meshes before it enters into the trough or tank containing the materials. By this cleaning or washing process the perviousness and roughness of the transporting-band is regenerated and the latter is adapted to take up the material again.

Another feature of the invention is the construction of the cleaning device, whereby the cleaning of the upper surface of the transporting-band is done without the impurities being deposited upon the inner side of the band.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is an elevation of the apparatus; Fig. 2, a longitudinal section. Fig. 3 shows the trough or tank in which the material is contained and the drum shown from the end. Fig. 4 is a section through the line I II in Fig. 2. Fig. 5 is the upper view of another arrangement of the device for cleaning the transporting-band, the right part being a section after III IV of Fig. 6. Fig. 6 shows the apparatus for cleaning the endless band in elevation and partly in section through the line V VI of Fig. 5. Fig. 7 shows the arrangement of the channels in the sucking-heads which effects the connection of the sucking-chambers of the drum with the sucking apparatus. Fig. 8 is an end view of the main drum to show the arrangement of the sucking-channels leading to the sucking-chambers.

As Fig. 1 shows, the apparatus consists of three main parts. The first part A contains the wet material and bears the main drum. The second part B serves for cleaning the transport-band. The third part C serves for finishing the drying process by crushing and heating the material already dried and pressed before.

The part A of the apparatus is shown in Fig. 2 in a section view, in Fig. 3 from the one end, and in Fig. 4 in a longitudinal section. This apparatus is supported by two frames 1 1, arranged at the two ends. These frames support each a ring-shaped part 2. The main cylinder 3 has at its two ends ring-shaped projections 4 4, which are fitted into the

ring-shaped parts 2 2. Packing-rings 5 5 are pressed by screws against the packing material 7, so that the latter is pressed against the ring parts 4 4. The cylinder 3 has also at its two ends the hollow journals 8 and 9. These journals are projecting into bearings, which may be formed by cases 10 10, in which rollers 11 for diminishing the friction may be arranged. The journal 8 supports the pulley 12. Between the frame 1 2 on the one end and the frame 1 2 on the other end of the apparatus the trough or tank is arranged. It consists of a casing 14, which is fixed to these frames or to parts 13 of the latter by screws or the like. As it is shown in Fig. 2 the casing 14 does not surround the drum. It reaches only from the point 15 to the point 16, as shown in Fig. 2. The two points 15 and 16 are preferably situated above the middle of the drum. In the space 17 between the casing 14 and the cylinder 3 another casing 18 is arranged, which is perforated. The cylinder 3 has a perforated shell or casing. For this purpose the cylinder may be surrounded by a perforated casing 19, which is connected to the end parts 4 4 of the cylinder in such a manner that between the perforated casing and the drum 3 a space is formed. For bearing the perforated casing in the middle a ring 20 is arranged. Further, there are provided bars 21, arranged in the longitudinal direction of the cylinder, which bars have also the purpose to bear or support the casing of the cylinder. By these bars 21 the circular space between the cylinder 3 and the perforated casing 19 is divided into sections 22, as shown in Fig. 2. These sections 22 communicate with channels 23 in the hollow journal 9. The arrangement of these channels is shown in the end view of the cylinder, Fig. 8. One of the two bearings 10, which supports the journals 8 and 9 and which is connected with the frame 1 2 by arms 24, supports the sucking-head 25, which has the purpose to connect the channel 23 and the sucking apparatus. In the apparatus shown on the drawings this connection is formed by the two sockets 26 27. The apparatus for sucking off the air and water from the material is not shown in the drawings. The sucking-head is preferably pressed by springs 28 or the like against the hollow journal 9 to get a tight connection of the surfaces 29 and 30, which are sliding one upon the other when the cylinder rotates.

Fig. 7 is an inside view of the sucking-head 25. There are in the sucking-head two channels 31 and 32. These channels are to be connected by sockets with the air-pump or sucking apparatus.

Fig. 8 shows the arrangement of the channels 23. The mouths of these channels form a circle around the axis of the cylinder. The diameter of this circle is as long as the diameter of the circle which is drawn through the middle of the channels 31 and 32 in Fig. 7. Therefore when the journal 9 is revolving the channels 23 pass successively over the channels 31 and 32. Those of the channels 23 which are passing over the intermediate parts 33 or 34 are cut off from the sucking apparatus, while the other channels, 23, are connected by the channels 31 and 32 with the sucking apparatus. The purpose of this arrangement is the following:

The perforated casing 19 of the cylinder 3 is, as Fig. 2 shows, not in its whole periphery surrounded by the transporting-band. The cylinder is not covered from the point 36 to the point 37. For the purpose of preventing air being sucked through the chambers of the perforated casing 19 at the points 36 to 37 the intermediate part 34 is arranged in the sucking-head 25 in such a manner that the sucking-chambers are cut off while they are passing from point 36 to point 37. The intermediate part 33 has the purpose to divide the sucking-chambers into two groups. One of these groups is continually connected with the sucking-socket 26, the other with the socket 27. This arrangement gives the advantage that two different sucking-conduits can be employed, of which the lower is sucking water when the sucking-chambers of the cylinder 3 are passing through the wet material in the trough 14, while the other sucking-chambers are sucking more air from the material than water.

The transporting-band consists of any suitable material—tissue, cloth, or the like—permeable for fluids and is guided by several rolls or cylinders 38 in any suitable manner. These rolls or cylinders are supported by the frame 39. The rolls or cylinders 38 may be hollow and heated by means of steam, heated air, &c., entering the hollow shafts 38^a to facilitate the drying operation. This band 35 further passes through a cleaning device consisting of a tank 40, which is partially filled with water and provided with revolving brushes 41 41, which brush the band and clean it. 42 is a guide-roll for the band, fitted on the tank 40.

Above the drum 3 19 there are fitted one or two revolving cylinders 43. These cylinders may be of any suitable, equal, or different diameter. They press or squeeze the substances to be dried against the band. They also may be used for drying and can be made hollow, and they can be provided with sucking-chambers arranged in the periphery in similar manner as described with regard to the main drum or cylinder 3. The arrangement of such sucking-cylinders has the advantage that the materials transported by the band are at the same time pressed and also dried by sucking off air and fluids from the upper side of the materials taken up by the transporting-band out of the tank or vessel.

44 is a scraper for stripping off the dried material from the transporting-band 35.

45 is an opening through which the dried material coming from the scraper 44 is led to an apparatus C, which serves for crushing and finishing the drying of the material.

The device C consists, preferably, of the hollow drums or cylinders 46 47, which may be heated by any means—for instance, by steam entering by the hollow shafts 48 49. Scrapers 50 51 are provided to strip off the material from the drums 46 47. These drums and the scrapers 50 51 are preferably arranged in a hopper 52, being open at the lower part, so that the finally dried and crushed materials may fall into the chamber or box 53 beneath the casing 52.

The drums or cylinders 43 43 may be driven by means of the gearwork 54 55, together with the main drum, as shown in Figs. 3 and 4. The cleaning device B and the crushing and heating device C may be driven by pulleys or gearwork in usual manner.

The apparatus described works as follows: As soon as the main drum rotates also the other drums and the rolls are rotated, partly by means of the gearwork, partly by means of the transporting-band, which is now in movement. As the space between the perforated bottom 18 and the perforated casing 19 of the drum is gradually converging from the inlet 16 to the outlet 15, the material is compressed on its way through the tank, whereby the fluids or water are forced to pass through the perforated bottom 18 into the tank 14 through the transporting-band 35 and through the perforated casing into the sucking-chambers of the drum 3. The moisture from the space 17 flows off over the surrounding wall at the point 56^a. The arrangement of the sucking-chambers gives the advantage of a better withdrawing of the fluids or water from the substances. By the sucking process the substances are held against the transporting-band 35, and therefore can be better transported. The substances taken up and carried by the transporting-band 35 pass the drums 43 43 and are pressed and dried by them. The dried substances are stripped off from the transporting-band by means of the scraper 44 and fall into channel 45 and jet between the heated rollers 46 47, where the substances are finally crushed or ground. Figs. 5 and 6 show a modification of the device for cleaning and roughing the transporting-band. The brushes 41 41 are arranged in separated tanks 56 and 57. The brushes 41 41 are further so arranged that the transporting-band can pass over the brushes without dipping into the tanks 56 57. For this purpose the brushes 41 41 are supported in the upper part of the tanks so that they partly dip into the water, while with the other part they project out of the tank. The transporting-band 35 passes the brushes preferably in an inclined plane. It is supported by the rolls 58 59 60 61 and the roll 62. The roll 62 serves for stretching the transporting-band 35 by its weight. For this purpose the roll 62 is movable in vertical direction. The journals 63 may be guided by lateral guidances. Between the tanks 56 and 57 may be arranged a further tank, 64, for washing the transporting-band 35, but without brushing the same. The tanks 56 57 may be partly closed in the upper part by the caps 65 66 in order to avoid that the cleaning-water is sprinkled.

The apparatus in Figs. 5 and 6 gives the advantage that the dirt parts or impurities which are scraped off by the brushes cannot be deposited on the inner side of the band 35 and taken away by the latter, as is the case in the construction of the cleaning device shown in Fig. 2. The tank 64 has only the purpose of dissolving the limy material attached to the band; but it does not contain means for scratching off the substances or materials which are pressed into the meshes of the band.

In the tanks 56, 57, and 64 there may be provided means for the inlet and outlet of water in the known manner. The described apparatus can be modified in different manner.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In an apparatus for withdrawing moisture from wet material the combination of a rotating hollow cylinder having its periphery perforated, with a trough or tank, and a perforated curved wall in the trough or tank and spaced therefrom and from the cylinder, the space between the wall and the cylinder converging in the direction of rotation of the cylinder, substantially as described and shown.

2. In an apparatus for withdrawing moisture from wet material the combination of a rotating hollow cylinder having perforated walls, with a trough or tank having a perforated curved wall, the space between the wall and the cylinder converging in the direction of rotation of the cylinder, and an endless transporting-band, substantially as described and shown.

3. In an apparatus for withdrawing moisture from wet material the combination of a main drum consisting of a rotating hollow cylinder having perforated walls, with a trough or tank having a perforated bottom, the space between the bottom and the cylinder diminishing in the direction of rotation of the cylinder, and an endless transporting-band, the said cylinder being provided with means for sucking off air and water from the cylinder, substantially as described and shown.

4. In an apparatus for withdrawing moisture from wet material a main drum in combination with a trough or tank having a perforated wall, the space between the bottom of the trough and the drum converging in the

direction of rotation of the drum, an endless transporting-band, the said main drum consisting in a hollow cylinder with perforated walls, provided with means for sucking off air and water from the cylinder, and counter-pressing drums consisting of hollow cylinders for compressing the material led out of the tank by means of the main cylinder, the counter-pressing cylinders having walls provided with perforations and means for sucking off air and water from the counter-pressing cylinders, substantially as described and shown.

5. In an apparatus for withdrawing moisture from wet material a rotating drum consisting of a hollow cylinder having its periphery perforated, the cylinder being arranged in a trough or tank having a perforated bottom, the space between the wall of the trough and the drum converging in the direction of the rotation of the latter and an endless transporting-band for carrying the compressed material in combination with an apparatus for cleaning and washing the transporting-band consisting of revolving brushes dipping into water-tanks over which the transporting-band is conducted by rollers, substantially as described and shown.

6. An apparatus for withdrawing moisture from materials, comprising a main cylinder, means for removing air and moisture from the cylinder through suction, counter-pressing drums above the main cylinder, the said counter-pressing drums consisting of hollow cylinders with perforated walls, and means for removing air and moisture from said counter-pressing drums, substantially as set forth.

7. An apparatus for withdrawing moisture from materials, comprising a main cylinder having a perforated casing forming the outer surface of the cylinder, a trough or tank in which the main cylinder is arranged to turn, the trough having its wall perforated, and the space between the wall of the trough and the cylinder converging in direction of the rotation of the cylinder, an endless transporting-band passing around the cylinder, means for guiding the same, means for cleaning the transporting-band before it enters the trough or tank, counter-pressing drums located above the main cylinder and between which and the said cylinder the transporting-band passes, and means for sucking off air and water from the main cylinder, substantially as set forth.

8. In an apparatus for withdrawing moisture from wet material, a drum, comprising a cylinder proper, and a perforated casing surrounding the cylinder proper and spaced therefrom, the casing forming the outer surface of the drum, a trough or tank in which the drum is arranged to turn, the space between the wall of the tank and the drum converging in the direction of the rotation of the latter, a transporting-band passing around the drum, the said drum being provided at its ends with journals one of which has channels formed therein, longitudinally-extending bars dividing the space between the cylinder proper and its casing into sections, the said sections communicating with the said channels in the journal and a sucker-head supported by the bearing for said journal and having channels adapted for connection with a sucking apparatus, the said head being held against the said journal and the channels in said head being arranged to connect with the channels in the journal as the cylinder rotates, substantially as set forth.

9. In an apparatus for withdrawing moisture from materials, a cylinder having channels leading out through one journal thereof, said channels being adapted to be connected with a pump, a perforated casing surrounding the cylinder, and longitudinal bars between the cylinder and casing and dividing the space between the said cylinder and casing into sections, said sections communicating with the channels in the journal of the cylinder, substantially as described.

In witness whereof I have hereunto signed my name, this 7th day of February, 1903, in the presence of two subscribing witnesses.

HEINRICH HENCKE.

Witnesses:

HENRY HASPER,

WOLDEMAR HAUPT.