April 15, 1930. H. R. FARNSWORTH 1,754,822

SUCTION TABLE ROLL

Filed March 26, 1928 2 Sheets-Sheet 1

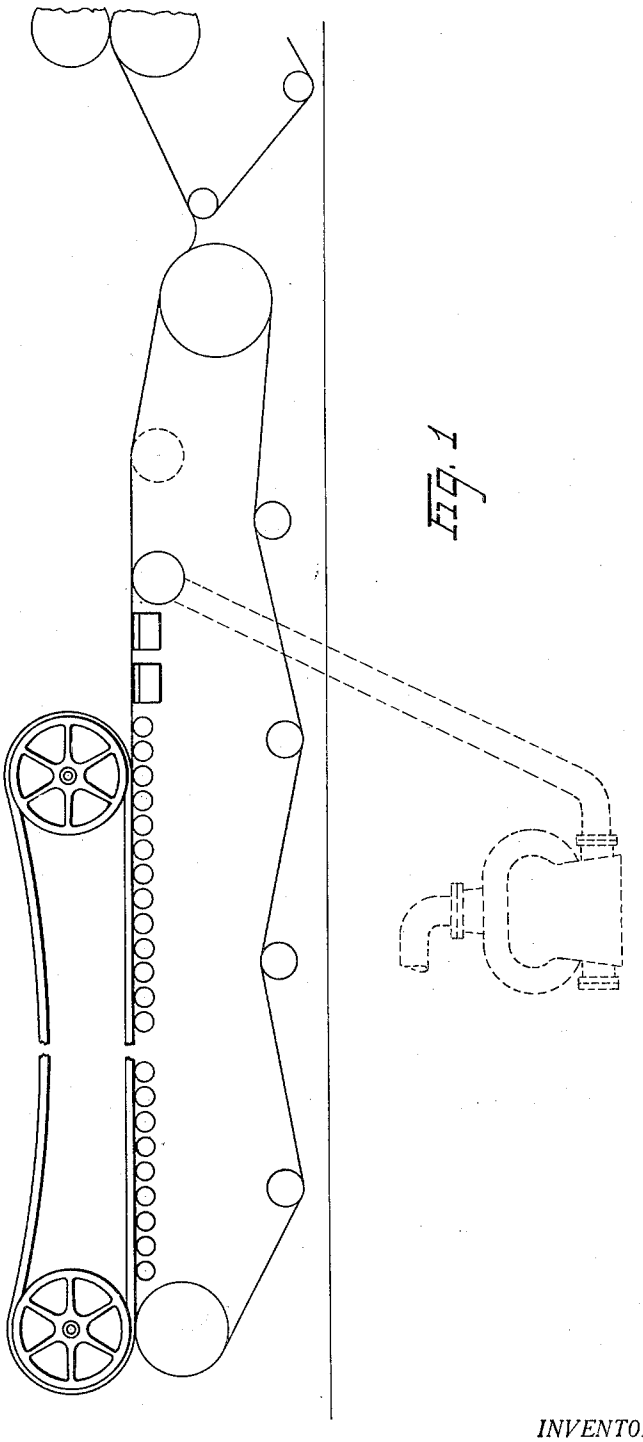


Fig. 1

INVENTOR.

BY Hiland R. Farnsworth
W. S. Babcock
ATTORNEYS.

April 15, 1930. H. R. FARNSWORTH 1,754,822

SUCTION TABLE ROLL

Filed March 26, 1928 2 Sheets-Sheet 2

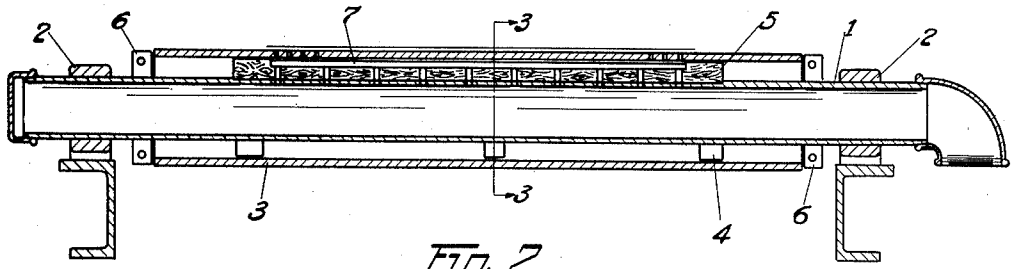


Fig. 2

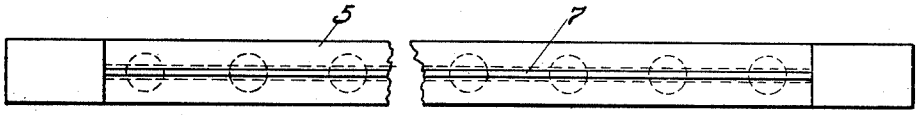


Fig. 4

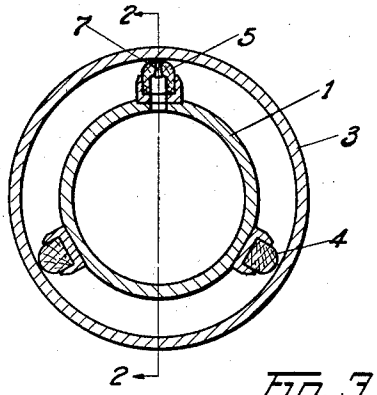


Fig. 3

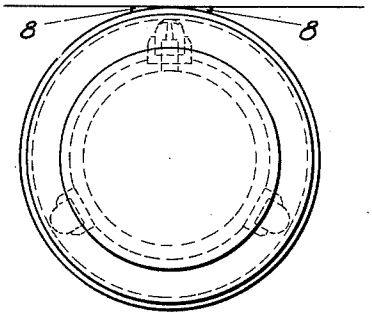


Fig. 6

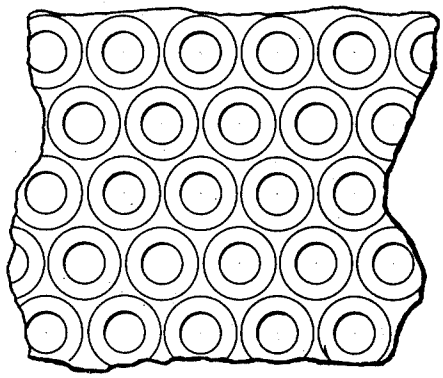


Fig. 5

INVENTOR.

BY Holland R. Farnsworth
N. S. Babcock
ATTORNEYS.

Patented Apr. 15, 1930 1,754,822

UNITED STATES PATENT OFFICE

HILAND R. FARNSWORTH, OF SANDUSKY, OHIO, ASSIGNOR TO THE PAPER & TEXTILE MACHINERY COMPANY, OF SANDUSKY, OHIO

SUCTION TABLE ROLL

Application filed March 26, 1926. Serial No. 264,639.

The present invention relates to suction rolls for paper making machines and more particularly the smaller diameter rolls such as table and guide rolls.

It is not intended to replace the table rolls by such small diameter rolls. They will be retained on their regular positions and operate as usual. It is for comparative diameters and relative positions in the machine that they are referred to.

It will be understood that the invention is to be applied to and used as a part of the regular standard Fourdrinier wet end. Preferably, one or more of the rolls hereinafter described, will be put in the place of and substituted for a corresponding number of flat boxes.

For many years it has been considered that the wet web of pulp on the making wire could be freed from the necessary amount of its water content by pressure only. Such pressure was applied as atmospheric pressure at the flat boxes followed by mechanical pressure at the couches and presses. The atmospheric pressure at the flat boxes was produced by evacuating the flat boxes over which the making wire, with its layer of stock travelled. At this point in the machine, at least up to and partly across the last flat box the stuff or stock has so large a proportion of water that the water acts as a continuous impervious blanket through which air can not pass. Consequently as the box beneath is evacuated the air pressure downwardly from above, on this blanket, will have no counteracting upward pressure from inside the box. So, a part of the water content will be pressed out by air pressure at the suction boxes. The remainder, as far as it is practicable to remove it before passing to the dryers will be taken out at the couches and presses, mostly at the couches. In this connection I would refer to Millspaugh Patent 1,025,822, granted May 7, 1912. This patent discloses in detail the use and operation of the suction roll as a couch. It also discloses fully the operation of removing water by entrainment as contrasted with removal by pressure, and the necessity of uniformity of removal, as well as the need of a positive acting and continuously operating evacuating means capable of maintaining within the roll a high substantially constant or non-pulsating vacuum. It is not thought desirable or really necessary to a clear understanding of the present case to repeat, appreciably, in this case what has been set out in detail in that patent, as to the operation of the vacuum in removing water by entrainment.

In all prior devices the suction roll, when applied to the wet end of the Fourdrinier machine has been substituted for the lower couch. At this point the wire changes from upper to lower run and returns toward the breast roll. It forms a loop which encloses about one half of the surface of the roll. This extended surface gives ample opportunity for vacuum action across the entire suction box area, within the roll while at the same time giving ample surface for friction drive of the suction roll by the making wire. Due to the great and continuous pressure resulting from the vacuum within the roll, the wire is firmly locked or bound to the roll for friction drive.

Where the wire travels in a straight or substantially straight path no such contact is possible. There is no arc of the wire to fit about and coincide with a corresponding arc of the roll shell. Consequently there is no possibility of an extended area through which vacuum may act on the pulp layer.

In view of the facts above set forth, the universal practice has been to use a series of flat boxes between the breast roll and suction couch roll, the number varying, generally from three to five according to the particular circumstances of the case. Under some circumstances less than three or more than five are used.

Suction boxes are stationary and have their suction areas disposed immediately beneath and parallel with the making wire, as is well understood and as will be seen on reference to aforesaid Millspaugh patent. The wire traveling across these suction boxes continuously subjects successive sections to the vacuum action of the boxes. It is in sliding downward contact with the perforated box tops. There is, therfore, a continuous grinding contact of high friction on the wire by the box tops. Necessarily only a low degree of

vacuum is practicable in the vacuum boxes under these circumstances. With a higher vacuum the wire is drawn so tightly against the box that its running will either be stopped or it will be torn in two by the driving mechanism. Necessarily even under the most favorable conditions there is a great frictional drag on the wire and rapid wearing out of the wire by the continual grinding action. Added to these serious objections is the great amount of power which must be used in driving the wire simply for the purpose of overcoming this friction. The main objects of the present invention are to avoid these and other objections and provide a device which will adaquately take the place of the flat box in every respect, while at the same time being capable of use regardless of degree of vacuum—capable of use with either high or low vacuum. A further object is to provide a device which will greatly reduce the power necessary for driving the wire and, through it, the suction roll.

In order to more clearly disclose the construction, operation and use of the invention, reference should be had to the accompanying drawings forming part of the present application. Throughout the several figures of the drawings, like reference characters designate the same parts in the different views.

In the drawings:—

Fig. 1 is a diagrammatic side elevation of the wet end of a Fourdrinier with invention applied.

Fig. 2 is a vertical longitudinal cross section on line 2—2 of Fig. 3, looking in the direction of the arrow, also showing the supports;

Fig. 3 is a lateral vertical cross section on line 3—3 of Fig. 2;

Fig. 4 is a top plan view of the operative suction opening from the suction box of the roll;

Fig. 5 is a top plan view of a fragment of the shell flattened out as a plate to show countersunk and staggered arrangement of perforations.

Fig. 6 is a diagrammatic end view of the invention, with a short section of wire, with water seal indicated in detail.

Referring to the drawings in detail, 1 indicates a cylindrical suction tube closed at one end and adapted to have its opposite end connected to any suitable suction means capable of continuously maintaining a high constant vacuum. This tube is adapted to be made fast, at its opposite ends to the side frame members of the wet end by suitable clamps, collars or the like 2. About this box is revolubly mounted a small diameter suction roll shell 3 which is centralized on tube 1 by spacing blocks 4 and strip 5. The blocks 4 are short, in all directions and act purely as spacers and bearing members for the free running travel of shell 3 about tube 1. The strip 5, on the other hand, while acting as a spacer, also provides a suction passage from the tube 1 to the perforations of the shell 3. Preferably the slot 7 is continuous through strip 3 and acts as a part of and continuation of a corresponding slot through the tube 1.

The slot in tube 1 may be either continuous or interrupted and the strip 5 may be seated on or keyed in the tube 1 at intervals along the slot of the tube, as will be clearly understood. There are, obviously, various ways of securing these parts together in operative relation, only one of which has been illustrated, by way of example.

Within the roll there is, of course, a certain amount of water at all times during operation. With the hard bearing surfaces of the lignum vitæ blocks and strip this acts as a lubricant to give a free running bearing surface, the shell 3 rotating freely about the tube 1 over the engaging surfaces.

Suitable stop collars 6 are provided on the tube 1 at opposite ends of the shell 3 to prevent lengthwise movement of the shell.

The shell 3 is of small diameter, light weight, and has small bearing surfaces well lubricated. Consequently, very little power is required. Suction through the slot 7 will act to create such a difference in pressure between inside of roll and top of wire that the wire will be tightly pressed against the roll face to provide a frictional drive. Very little power will be necessary to revolve the roll, as previously indicated. All drag on the wire and all frictional wear will be completely eliminated, as the contacting roll and wire surfaces will travel freely, at the same rate, and in the same direction. Theoretically, there is only a line contact between the shell and wire. The wire is flexible and carries a considerable load of stock. Necessarily, in practical use, as the wire rests upon the roll it will to a slight extent adapt itself to the curvature, so that the theoretical line-contact will become somewhat enlarged. It will, instead, become a narrow strip from end to end of the roll. The large water content of the stock as it passes over the roll considerably increases the effective width of this contact by capillary attraction. The shallow, substantially triangular spaces between the shell and wire will be kept filled with water or water sealed so that the suction will not be broken, even though the wire is not looped around the roll, as is the case with the suction couch. This water seal is indicated clearly in Fig. 6 at 8. It will be readily understood that such seal is somewhat modified by the moving parts. On the side from which the wire comes, for instance, the approach of the wire and roll will tend to counteract capillarity to a certain extent and slightly shorten the triangle at that side, while the opposite effect will exist on the other side, all as clearly indicated in Fig. 6.

While the invention has been shown as tak-

ing the place of the suction boxes, it is equally clear that it may be substitued for the first guide roll—the one nearest the couch. In that case, as will be readily understood, there will be a slight actual arc of contact between shell and wire as the roll will be in the angle where the wire starts downwardly toward the couch from the horizontal.

As is well known, only a very low vacuum, seven inches or less of mercury, is practically maintained on the flat boxes because of the great frictional drag. With elimination of that drag a vacuum of twenty (20) inches or more may be maintained, making it possible to use one roll to displace several boxes even though the suction area of the roll is greatly reduced relatively to that of the boxes.

In some cases it may be found that the contact betwen roll and wire is not sufficiently certain to rely upon, entirely, for driving the roll. In such cases, the shell may be extended at one end or the other and provided with a pulley face, groved or otherwise to receive any suitable form of belt or other flexible driving means, as indicated in dotted line.

The preferred form of slotted strip 5 is shown in Fig. 3. The tube 1 is longitudinally grooved, with dove-tail groove, the bottom of the groove being either perforated or slotted for communication with the inside of the tube. A metal channel plate shaped to slide into the groove and similarly slotted or perforated receives the strip 5, the outer face of which is slotted its full length for a part of its radial depth. This longitudinal slot communicates by a plurality of short slots or perforations with the openings through the metal channel. Thus the strip may be easily and quickly renewed at any time. The contact surface of this strip, as well as that of each of the blocks 4 is rounded to reduce contact area as much as possible.

It is clear, of course, that antifriction bearings may be used between the tube and shell if desired, but the construction illustrated is the simplest and preferred.

While it has been described with particular reference to use in the wet end of a Fourdrinier in place of the flat boxes or guide roll it will be understod that it may be used as a dummy roll in Fourdriniers and as a drum roll in cylinder machines. It is not thought either necessary or desirable to illustrate either of these latter arrangements as they will be readily understood by any one skilled in the art.

It will be noticed that the openings through strip 5, the channel carrying it, and the wall of tube 1 are of increasing cross sectional area from the outer to the inner ends. This form completely avoids any possibility of clogging of the passages by the fibres of the pulp.

Having described my invention, what I claim and desire to protect by Letters Patent is:

1. A suction roll of the character described comprising a suction tube, a perforate shell revoluble on said tube, an element extending longitudinally of said tube and provided with passages establishing communication between the inside of said tube and the perforations of said shell, said element being in free running contact with said shell.

2. In combination with a pulp carrying web, a suction tube, and a perforate shell revoluble on said tube and disposed tangentially relatively to and in contact with said web.

3. In combination with a pulp carrying web, a suction tube and a perforate shell revoluble on said tube and disposed tangentially relatively to and in contact with said web, and means for maintaining concentric spaced relation between said tube and shell.

4. In combination with a pulp carrying web, a revolubly mounted perforate shell in tangential contact therewith, and a suction tube for drawing water from the pulp on said web through said shell at the line of contact.

5. In combination with a pulp carrying web, a revolubly mounted perforate shell in tangential contact therewith and having a water seal area extending to both sides of said contact, and a suction tube for drawing water from the pulp on said web through said shell at the line of contact within the area of said water seal.

6. A suction roll of the character described comprising a suction tube provided with a longitudinal groove having a plurality of openings communicating with its interior, a strip seated in said groove and provided with passages therethrough and communicating with the aforesaid openings, spacing blocks carried by said tube, and a perforate shell revoluble about said tube and in free running contact with said strip and said blocks.

7. A suction table roll comprising a perforate revoluble shell and a suction tube within said shell and provided with a narrow longitudinal slot in communication with the perforations of said shell.

8. A suction table roll comprising a suction tube provided with a strip having a narrow longitudinal slot, a perforate shell revoluble about said tube and in tangential contact with said strip along said slot.

9. A suction table roll comprising a suction tube provided with radial spacing elements one of which is slotted and a perforate shell revoluble about said tube and in longitudinal contact with said slotted spacing element along the line of the slot therethrough.

Signed at Sandusky, Ohio, this 23rd day of March, 1928.

HILAND R. FARNSWORTH.