Nov. 24, 1925. 1,563,130

M. T. WESTON

PNEUMATIC PRESS ROLL FOR PAPER MACHINES

Filed Aug. 22, 1924 3 Sheets-Sheet 1

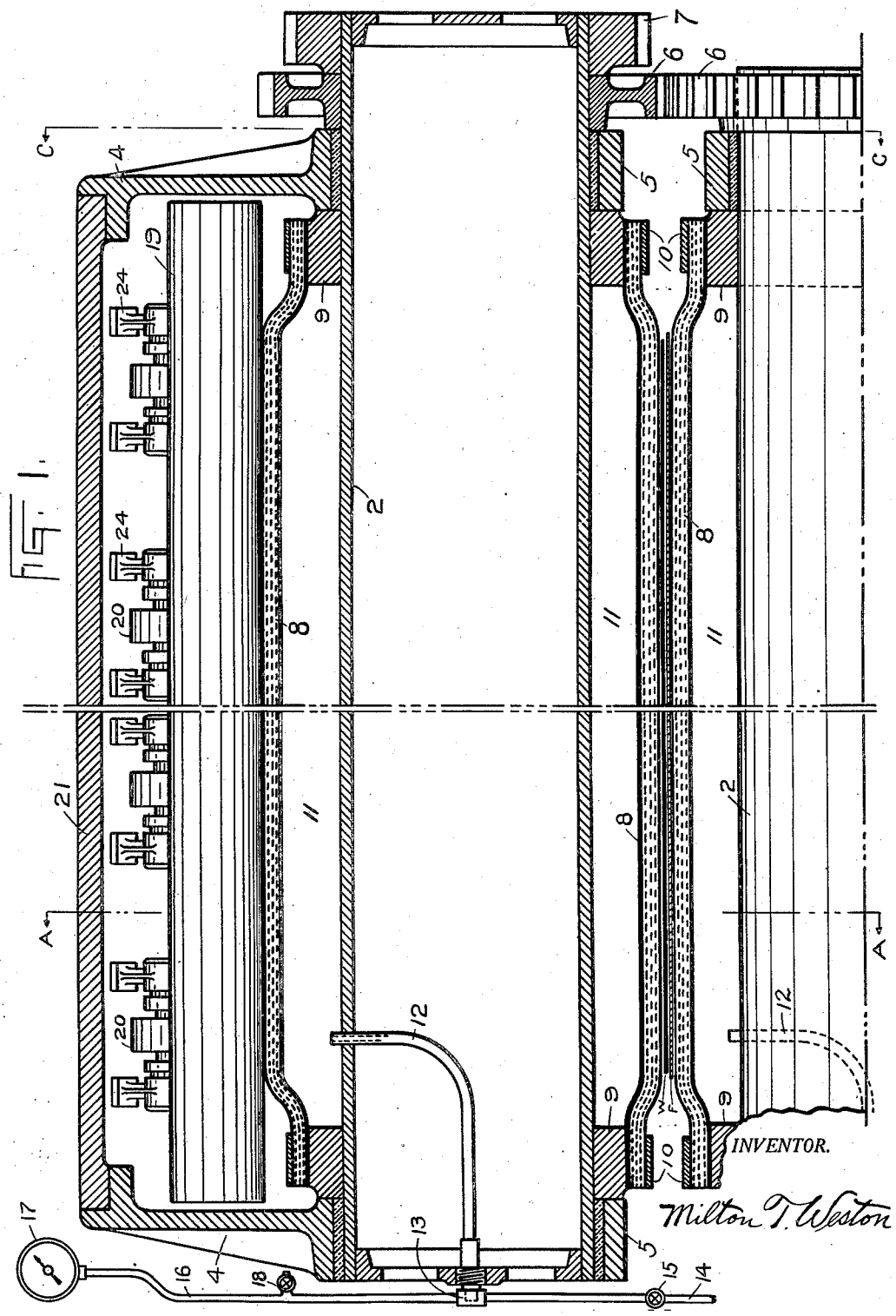


FIG. 1.

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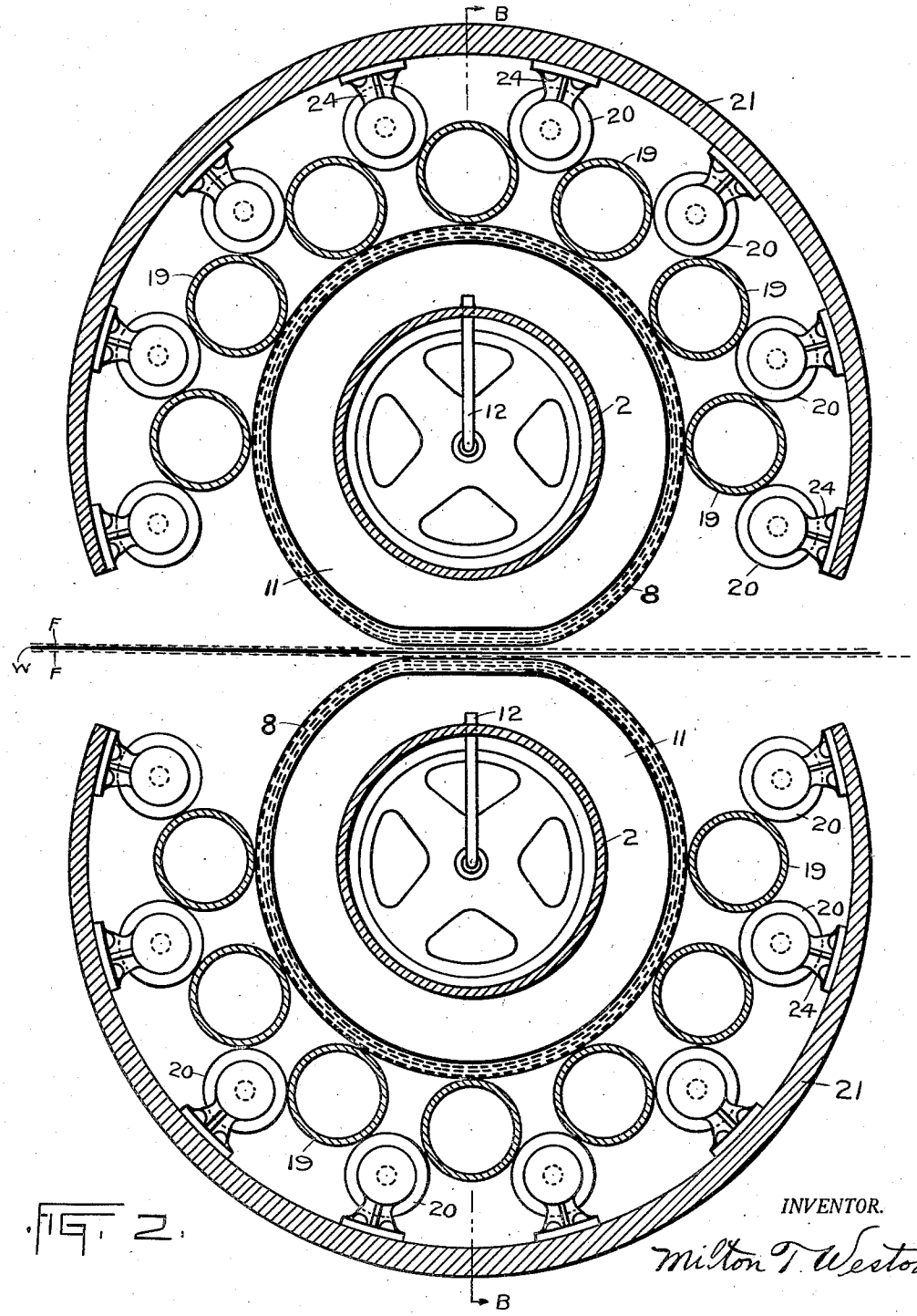


FIG. 2.

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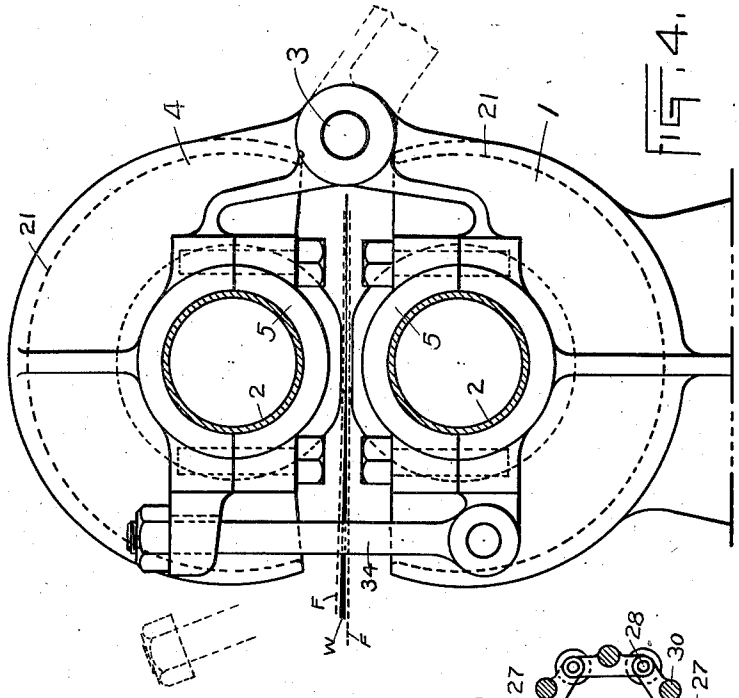


FIG. 4.

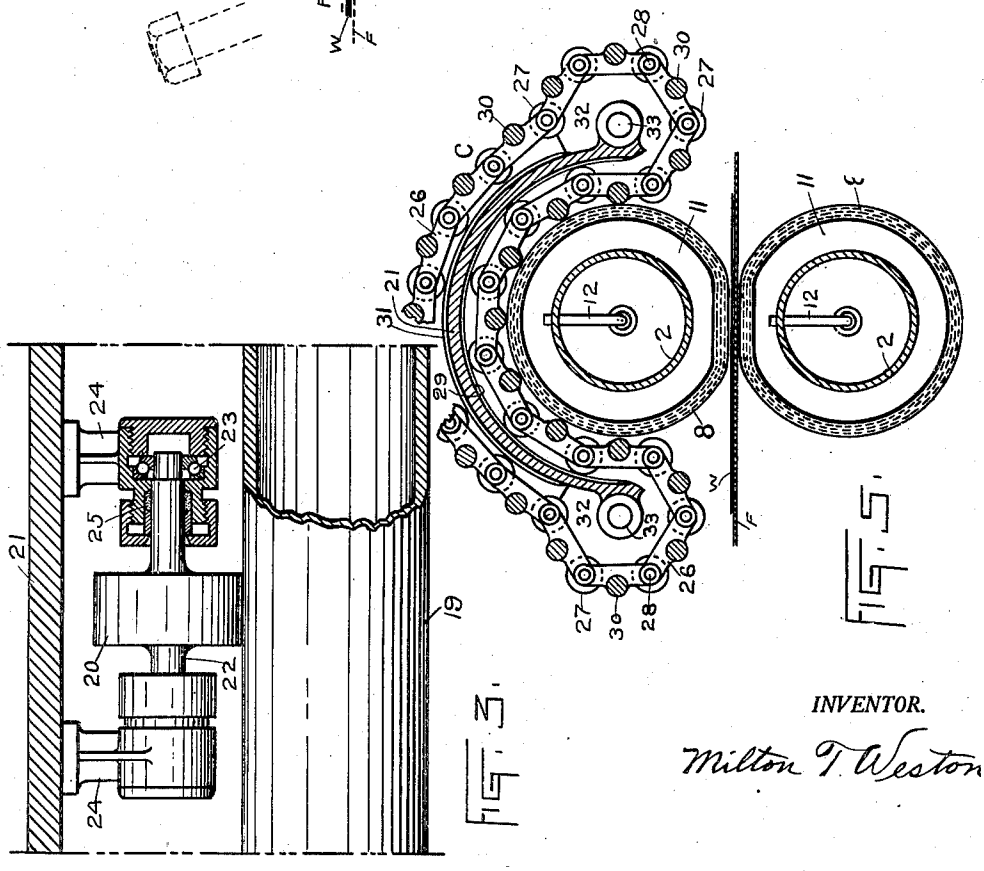


FIG. 5.

FIG. 3.

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Patented Nov. 24, 1925. 1,563,130

UNITED STATES PATENT OFFICE.

MILTON T. WESTON, OF NEW YORK, N. Y.

PNEUMATIC PRESS ROLL FOR PAPER MACHINES.

Application filed August 22, 1924. Serial No. 733,579.

To all whom it may concern:

Be it known that I, MILTON T. WESTON, a citizen of the United States, and resident of 223 Riverside Drive, in the county of New York and State of New York, have invented certain new and useful Improvements in Pneumatic Press Rolls for Paper Machines, of which the following is a specification.

My invention relates to improvements in pneumatic press rolls for paper machines and the like and has for its object to provide a simple and reliable device in which the principal advantages over the present machines lie in its ability to exert a much greater pressure per unit of area and also to present a much larger pressure area along the pressure line. Another object is to provide simple means to control the pressure per unit area at will. Other advantages will appear and be pointed out in the following specification and are clearly shown in the accompanying drawings in which similar reference numerals refer to similar parts in all of the views.

Fig. 1 is a vertical longitudinal sectional view of my invention on a line B—B of Fig. 2.

Fig. 2 is a vertical transverse sectional view on a line A—A of Fig. 1.

Fig. 3 is a detail view showing the construction and mounting of one of the anti-friction rollers.

Fig. 4 is vertical end elevation of one set of pneumatic tubular rolls showing the housing or supporting frames and is taken on the line C—C of Fig. 1.

Fig. 5 shows a modification in the means for backing up the pneumatic tubular rolls. The modification is shown in its relation to the upper roll only but is applicable to a bottom roll also.

In carrying out my invention I show a lower side frame 1 which may be made a part of the paper machine or arranged for separate mounting as the application may necessitate. Lower side frame 1 is adapted to revolvably support the shaft 2 which is shown tubular and of relatively large diameter because of the tendency toward wider paper webs. For example, a four-roll news machine will produce a paper web 306″ wide. To span this width will require the relatively large diameter shown and because there is substantially no weight on the shaft— only the torsional strain of driving the roll—it can be made very light.

In Fig. 4 I show an upper side frame 4 which is hinged to the lower side frame 1 at 3 so that it may be turned back as indicated in dotted lines. The tubular shafts 2 may then be readily taken out of their respective side frames by simply removing caps 5. The open side of frames 1 and 3 are held together by the swing bolt 34. It will be noted that the tubular shafts 2 are mounted in their respective side frames so that the distance between their centers is somewhat less than the sum of the radii of the two pneumatic tubular rolls 8 which, obviously, will cause the sides of said pneumatic tubular rolls in contact with each other to be flattened as shown in the several views. The object of this flattened surface and the means for maintaining it along the entire pressure line will be described hereinafter.

In the drawings I show an upper and a lower pneumatic tubular press roll 8 and as they are identical in construction I will describe one roll or tube and similar parts in both will have the same reference numerals. It will also be understood that one of my pneumatic press rolls complete may be used in conjunction with a solid roll of the present type or with the bottom couch roll of the paper machine.

The tubular shafts 2 are positively driven by means of the meshing gears 6 mounted on the outer ends of the said shafts. One of the shafts 2 may be driven in any suitable manner by the gear 7.

The tubular shaft 2 extends through the pneumatic tube 8 which is preferably made up of alternate layers of duck and rubber similar to the construction of a large hose. The pneumatic tube 8 is somewhat larger in diameter than the tubular shaft 2 and has its ends closed to make an air tight joint by means of the collars 9 which may be at-

tached to the shaft 2 in any approved manner as by welding. The ends of the pneumatic tube 8 are shown somewhat reduced in diameter to fit over the collars 9 and to receive rings 10 which firmly clamp the ends of the pneumatic tube 8 to the collars 9, making connections which are air tight and which cause the pneumatic tube to revolve with its tubular shaft 2.

It will be seen that an air chamber 11 is formed between the inner surface of the pneumatic tube 8 and the outer surface of the tubular shaft 2. I introduce compressed air into this chamber 11 through a small pipe 12 which is shown projecting through the wall of the tubular shaft 2 and firmly welded or otherwise secured therein. The other end of the air pipe 12 is curved outward so as to project beyond the end of the tubular shaft 2 on its axial line and terminates in a swivel joint 13 to which the air supply pipe 14 is connected. A valve 15 in air supply pipe 14 controls the amount of air admitted and consequently the air pressure in the pneumatic tube 8. Connected to the swivel joint 13 is a relatively short pipe 16 on which a pressure gauge 17 is mounted. A valve 18 is located in the pipe 16 and when open communicates with the atmosphere. It can therefore be used to reduce the pressure in pneumatic tube 8 when desirable. It will be clear that opening the valve 15 admits compressed air to the chamber 11 which increases the pressure in the pneumatic tube 8 and opening the valve 18 discharges the air from said chamber 11 and reduces the pressure in the pneumatic tube 8. Both valves are closed when the desired pressure registers on the gauge 17.

It is evident that the pneumatic tube 8 will have no axial stiffness to resist pressure applied to one side even when inflated and it its therefore necessary to provide some means of backing up or holding the said pneumatic tube axially straight in order that it will be capable of exerting a uniform pressure along the entire pressure line. The preferred method of accomplishing this is illustrated clearly in Figs. 1 and 2 in which I show a number of metal rolls 19, which may be hollow and of suitable size, extending the full length of the pneumatic tube 8 and held in rolling peripheral contact with same by the anti-friction rollers 20, mounted on a rigid support 21, attached to and carried by the end frames 1 and 4. The anti-friction rollers 20 are shown arranged in circular groups, each group being axially spaced to give the necessary support to the rolls 19 to prevent excessive deflection of same when the pneumatic tubes 8 are properly inflated and in their operating positions as shown in Figs. 1, 2 and 3. It will be noted in this construction that the rolls 19 are in rolling contact with the periphery of the pneumatic tube 8 and revolve about their own axes by frictional contact with the said tube.

The anti-friction rollers 20 are mounted on the rigid support 21 in fixed radial positions with respect to the pneumatic tube 8. The shafts 22 on which the rollers 20 are mounted are carried by roller bearings 23 in brackets 24 attached to the rigid support 21. A stuffing box 25 prevents the entrance of water into the roller bearings 23.

In Fig. 5 I show a modification in the manner of backing up the pneumatic tube 8 which I consider to be the mechanical equivalent of the method just described but which may be more advantageous under certain conditions. In this modification I employ an endless carrier C composed of links 26, with anti-friction rollers 27 mounted at the pivotal joints 28 and adapted to roll on circular tracks 29 on the rigid support 21, as shown in the figure just referred to. The links 26, of the endless carrier C, are arranged for the mounting of a plurality of parallel bars 30 which extend the full length of the pneumatic tube 8 and which are arranged to contact with the periphery of same and thus give it the necessary support to keep it axially straight. The carrier C complete with the anti-friction rollers 27 and the bars 30 are preferably driven by frictional contact with the periphery of the pneumatic tube 8 but may be positively driven if advisable. The anti-friction rollers 27 on that portion of the carrier C in peripheral contact with the pneumatic tube 8 travel on circular track 29 concentric with said pneumatic tube and the rollers on the returning portion of the carriers C travel on the external track 31 on the rigid support 21. The endless carriers C are guided and supported by rollers 32 in bearings 33 on the rigid support 21.

The operation of my invention will be made clearer by comparison with the present type of press rolls which are essentially of two types—those with two hard surface rolls and those with an upper hard surface roll and a lower rubber covered roll. In both types the upper roll is weighted to increase the pressure on the paper web in order to remove as much water as possible. When the hard surface rolls are used it is necessary to "crown" them at the center to compensate for the axial springing of the rolls due to the weights which are applied at the ends. Obviously there is a limit to the weight which may be applied. This must not be sufficient to cause a greater axial flexure than provided for in the crowning otherwise more water will be pressed out of the edges of the paper web than at the center. Furthermore, excessive weighting of the upper roll tends to hold back the paper web at the "nip" which displaces the fibres

and stretches the web thereby greatly injuring the paper structure.

The use of a lower press roll covered with rubber simplifies the problem of crowning somewhat but does not solve the problem of pressure. Increasing the weight on the upper roll merely forces it deeper into the rubber on the lower roll which presents a correspondingly increased area to resist it. The result is that there has been substantially no increase in pressure per unit area. It will be understood that it is the pressure per unit area that determines the relative amount of water removed from the paper web.

The pneumatic tubular rolls in my invention overcome the first mentioned objection to the hard surface rolls at the "nip" by presenting a much more acute angle of entrance between the rolls due to the flattened pressure area along the pressure line. The "nip" is obviously more flexible and yielding and thereby greatly reduces the danger of injury to the paper web at this point.

The relatively large pressure area along the pressure line obtained by the pneumatic tubular rolls in my invention increases, several fold, the time of passage of the paper web between the rolls as compared to the present type of press rolls with only a line of contact between them. This additional time of passage of the paper web W between the large pressure areas in my invention, either with one felt F as in Figs. 1 and 5 or between two felts F as in Figs. 2 and 4, gives a correspondingly greater time for the transfer of water from the paper web to the felts and hence a more effective water removal.

On account of the large pressure area obtained by the use of my pneumatic tubular rolls, the pressure is applied normal to the paper web with equal force over the entire area. Clearly there is no tendency whatever to stretch or displace any of the fibres in the paper web as in a rolling line contact and the result is a much better and stronger paper web. Since the pressure is applied normal to the paper web over a large pressure area, instead of on a very limited rolling area, a considerably greater pressure per unit area can be applied to the said paper web without injury to it which results in a correspondingly greater amount of water being removed from it.

It will be clear that the pressure per unit area is the same over the entire inner wall of the pneumatic tubular roll and is usually expressed in pounds per square inch. This unit pressure may be read on the gauge at any time and can be increased or decreased at will by operating the valves 15 and 18 as previously described.

I believe that my invention is broadly new and I desire to secure by Letters Patent:

1. In a pneumatic press roll for paper machines and the like, a pneumatic tubular roll, a shaft concentric therewith and means for keeping said pneumatic tubular roll in axial alignment.

2. In a pneumatic press roll for paper machines and the like, a pneumatic tubular roll, a shaft concentric therewith and means independent of said shaft for keeping said pneumatic tubular roll in axial alignment.

3. In a pneumatic press roll for a paper machine, a pneumatic tubular roll, a shaft revolvably supporting said pneumatic tubular roll and revolvable means in peripheral contact with said pneumatic tubular roll to prevent axial flexure of same.

4. In a pneumatic press roll for a paper machine, an axially straight pneumatic tube and means substantially opposite to the line of pressure to prevent axial flexure of said pneumatic tube.

5. In a pneumatic press roll for a paper machine, an axially straight pneumatic tube, a supporting shaft concentric therewith, means for regulating the pressure of the air in said pneuamtic tube and means for keeping said pneumatic tube in axial alignment.

6. In a pneumatic press roll for paper machines, pneumatic tube, a supporting shaft concentric therewith, a compressed air chamber formed by the inner wall of said pneumatic tube and said shaft and means independent of said shaft for preserving the axial alignment of said pneumatic tube.

7. In a pneumatic press roll for a paper machine, a pair of axially parallel co-acting pneumatic tubular rolls revolvable about axes which, in their operable positions, are spaced apart less than the sum of the radii of said pneumatic tubular rolls to form a flattened pressure area of contact, axially parallel non-yielding means contacting with the peripheries of said revolvable pneumatic tubular rolls substantially opposite to the area of contact to prevent axial flexure of said revolvable pneumatic tubular rolls when inflated and means for introducing and equalizing the air pressure in the said revolvable pneumatic tubular rolls.

8. In a pneumatic press roll for a paper machine, a rigid frame, anti-friction rollers carried by said frame, a plurality of axially parallel rolls bearing against said anti-friction rollers and a revolvable pneumatic tube nested in said axially parallel rolls.

9. In a pneumatic press roll for a paper machine, the combination with a suitable support, of an axially straight revolvable pneumatic tube, a plurality of axially parallel rolls in peripheral contact with said pneumatic tube and revolvable thereby, a plurality of anti-friction rollers against which said axially parallel rolls bear and rigid supporting means for all of said anti-friction rollers.

10. In a pneumatic press roll for a paper

machine, an axially straight revolvable pneumatic tube adapted to present a flattened pressure area along the pressure line, means for flattening said pneumatic tube along the pressure line, and revolvable means contacting with the periphery of said pneumatic tube to maintain an equal flattened pressure area along the pressure line by preventing axial flexure of the said pneumatic tube.

In testimony whereof I have hereunto signed my name.

MILTON T. WESTON