

Aug. 9, 1955

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2,714,840

CALENDER APPARATUS

Filed May 27, 1954

2 Sheets-Sheet 1

FIG 1

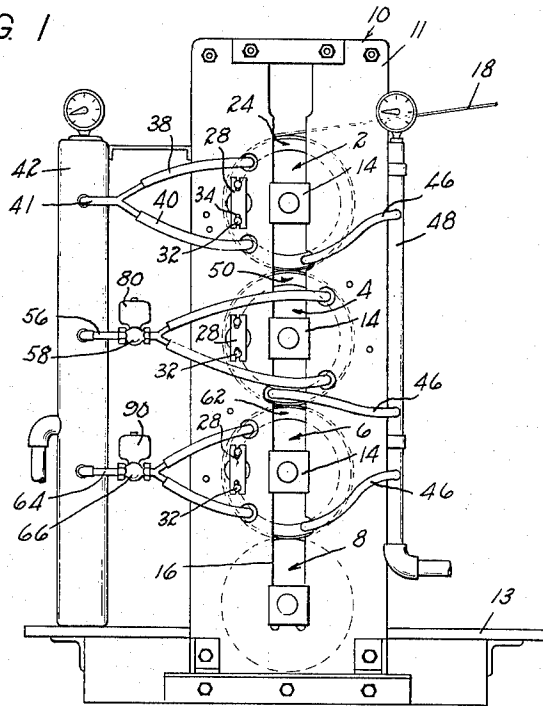


FIG 2

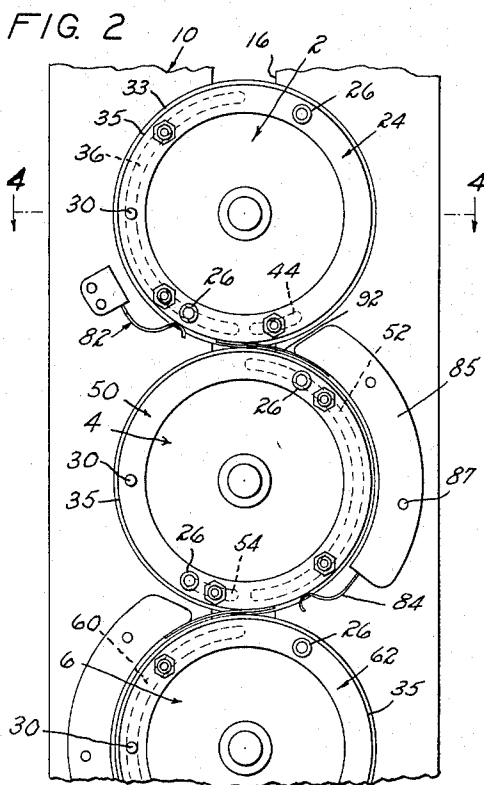
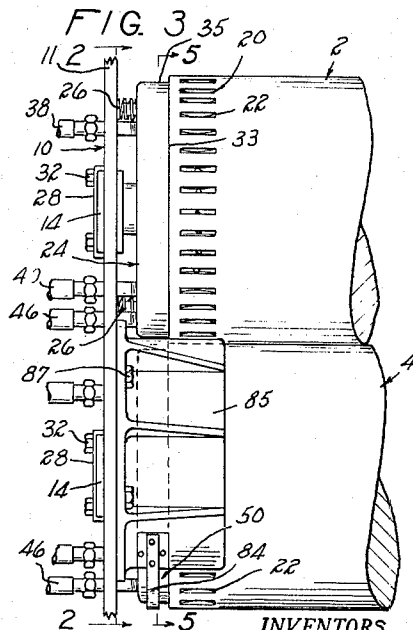


FIG 3



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FIG. 4

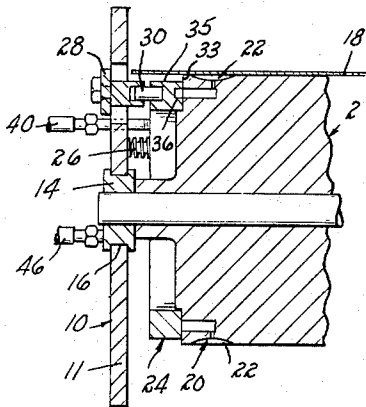


FIG. 5

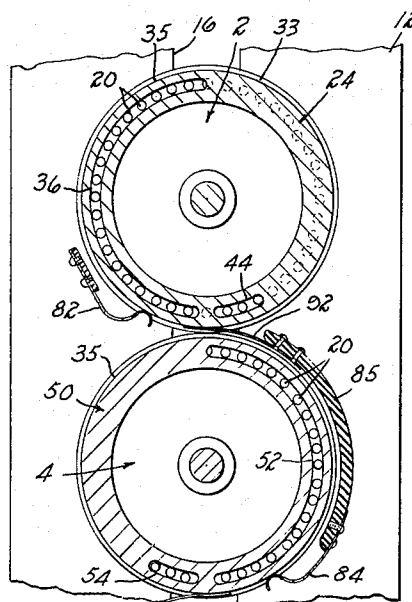
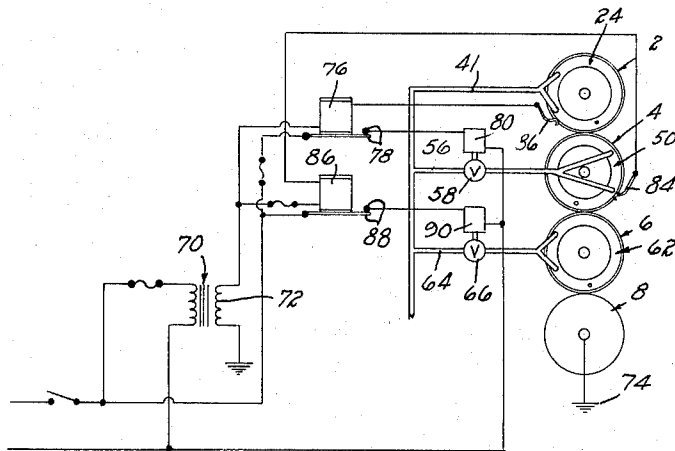


FIG. 6



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CALENDER APPARATUS

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2 Claims. (Cl. 92—73)

This invention relates to apparatus for feeding flexible strip material such as paper through a series of rolls such as the calender rolls of a calendering machine.

Calendering machines are widely used in the paper-making industry and in other fields involving the surface finishing of flexible strip material. Such machines generally consist of a series or stack of heavy smooth-surfaced parallel rolls which rotate in contact with one another at high speed, and through which the paper or other flexible material is fed in a continuous strip. The paper or other material is pressed or squeezed between the rolls and its surface is thereby smoothed and hardened to the desired finish.

One of the principal problems involved in the operation of such machines is that of threading or feeding the leading edge of a strip of material through the rolls at the beginning of a calendering operation, or at times when the strip may tear during a calendering operation. In feeding the strip through the rolls, the leading edge of the strip is first torn on the bias to provide a pointed end. This pointed end is then manually thrust into the nip of the first pair of rolls, while the rolls are rotating. The end of the strip is then grasped as it emerges from the first pair of rolls and thrust into the nip of the second and third rolls, and in this way the strip is fed through all the rolls in the stack. Since the rolls are rotating at high speed when the strip is fed through them, it will be appreciated that the manual feeding operation is an extremely hazardous one because, once the paper is seized in the nip of a pair of rolls, it is drawn into the rolls at high speed and tends to draw the hands of the workman into the rolls also. The accident rate in this operation has heretofore been high, and it is therefore a principal object of the present invention to provide an apparatus for automatically feeding paper or other strip material through rolls such as those in a calendering machine without the necessity of manual assistance of any kind, thereby completely eliminating the hazard heretofore involved in such a feeding operation.

Another object of the invention is to provide means for feeding strip material through calendering rolls or the like at a speed substantially higher than has heretofore been possible when using manual feeding.

Another object is to provide feeding apparatus of the character described, the operation of which is automatically timed and controlled by the strip material itself.

Another object is to provide feeding apparatus of the character described which is simple and rugged in design and may be easily installed at low cost on an existing calendering machine.

Other objects will be in part obvious, and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application of which will be indicated in the appended claims.

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In the drawings:

Figure 1 is an end elevation view of an exemplary stack of calendering rolls provided with a feeding apparatus constructed in accordance with the present invention;

Figure 2 is an enlarged view of the structure shown in Figure 1 taken on the line 2—2 of Figure 3;

Figure 3 is an enlarged view of a portion of the structure shown in Figure 1;

Figure 4 is a sectional view of the structure shown in Figure 2 taken on the line 4—4 thereof;

Figure 5 is a sectional view of the structure shown in Figure 3 taken on the line 5—5 thereof; and

Figure 6 is a schematic diagram of an electrical control circuit for the feeding apparatus.

Referring to the drawings, a preferred embodiment of the present invention is shown as applied to an exemplary stack of calendar rolls. The stack may have any desired number of rolls but is shown by way of example as including four rolls 2, 4, 6, 8. The rolls are mounted in a frame 10 including upright members 11 and 12 supported on a base 13. Rolls 2, 4, 6, 8 are parallel and are journaled at their ends in bearing blocks 14 which are freely vertically slidable in slots 16 in the frame 10 so that the rolls rest on one another. One of the rolls is driven by a motor, not shown, and the remaining rolls are rotated by frictional contact, adjacent rolls being rotated in opposite directions.

In the use of a calendering apparatus of this kind the strip of paper or other flexible material 18 to be calendered is fed across the top and around one side of the uppermost roll into the nip between the uppermost roll and the next roll below. The strip is then threaded S-fashion through the entire stack of rolls and emerges from the bottom of the stack. The rolls are rotated at high speed and are generally of substantial weight, supplying the necessary pressing or squeezing action to the strip material solely by their own weight.

In accordance with the invention, each of the rolls is provided at one end with a series of circumferentially spaced passages 20 each of which, as shown in Figure 4, connects from the end face of the roll to a point on the surface thereof located inside the marginal edge of the strip so as to pass beneath the strip and be covered by it as the roll rotates. At the surface of the roll the mouth of each passage is enlarged to form a longitudinal slot 22. Disposed in wiping contact with the end face of each roll is a stationary member in the form of a ring, as illustrated in Figure 4 by ring 24 associated with roll 2. Each ring is so positioned as to be covered by the edge of the strip material passing around its roll. The ring 24 is biased against the end of roll 2 by compression springs 26 acting between the ring and the frame 10, and is angularly adjustable by means of a clamp 28 connected to the ring by a pin 30 and connected to the frame by bolts 32 engaged in slots 34. Ring 24 is smaller in diameter than roll 2, and thus forms with the roll a shoulder 33 defining an annular notch 35.

In the inner face of ring 24 is an arcuate slot or groove 36 which is disposed so as to register with those passages 20 of roll 2 which are adapted to be covered by the strip of material passing across the roll. The arcuate groove 36 is connected by branch hoses 38, 40 at each end and a main hose 41 to a vacuum supply such as a vacuum manifold 42, which may be maintained in evacuated condition by any desired means such as a vacuum pump (not shown). A partial vacuum is therefore produced in the arcuate groove 36, causing a suction of air at the surface of the roll through the slots 22 of those passages 20 which are in registry with the arcuate groove 36. Groove 36 is substantially semi-circular, so as to register with all the passages 20 on the side of the roll from the

point at which the strip of material arrives at the roll around to the point at which it leaves roll 2 for roll 4. Thus with this arrangement the strip is effectively sucked and held against the roll and is automatically drawn around by the roll and fed into the nip with the next succeeding roll 4.

The stationary ring 24 is further provided with a second arcuate groove 44 disposed so as to register with the passages in roll 2 adjacent the point of departure of the strip from the roll, and on the opposite side of the nip point from the passages in registry with the vacuum groove 36. The arcuate groove 44 is connected by hose 46 to a pressurized air supply, such as a pressure manifold 48, which may be connected to any suitable source of pressurized air such as a compressor (not shown). With this arrangement pressurized air is fed through the arcuate groove 44 and blown out those passages 20 in roll 2 in registry therewith so as to assist in blowing the strip off of roll 2 and onto the second roll 4.

A stationary ring 50 is likewise provided in contact with the end of the second roll 4. Ring 50 is similar in all respects to ring 24 in contact with roll 2, except that its vacuum groove 52 and pressure groove 54 are reversely disposed to coincide with the reversed location of the strip on the second roll 4. The vacuum groove 52 is connected to the vacuum manifold 42 through a hose 56 in which is provided a normally closed electrically controlled valve 58, such as a solenoid-operated valve, the operation of which will be described hereinafter. A third stationary ring 62, similar in all respects to ring 24 and ring 50, is associated with the next succeeding calendar roll 6. Ring 62 likewise has a pressure groove and a vacuum groove 60 connected to vacuum manifold 42 through a hose 64 in which is connected a normally closed electrically controlled valve 66.

In accordance with the invention, the vacuum is supplied to the vacuum groove 52 of the stationary ring for the second roll 4, and to the vacuum groove 60 in ring 62 associated with succeeding roll 6, in a sequential manner, and in response to the arrival of the leading edge of the strip at the roll preceding each. Thus, while the vacuum is continuously supplied to the groove 36 in the stationary ring 24 for roll 2, solenoid valve 58 is maintained in a closed condition until the leading edge of the strip is about to leave roll 2 and pass to the second roll 4, and solenoid valve 66 is maintained closed until the leading edge of the strip is about to leave roll 4 and pass to roll 6, so that no vacuum is applied to rings 50 and 62 initially.

Referring now to Figure 6, there is shown an electrical control circuit for operating the solenoid valves 58, 66 in the aforesaid sequential manner. The control circuit includes a transformer 70, one side of the secondary 72 of which is grounded. The calendar rolls themselves are likewise grounded by a ground connection 74 to complete one side of the electrical circuit. The transformer supplies a relay 76 which maintains a set of contacts 78 open, thus maintaining the solenoid 80 of valve 58 normally deenergized. Valve 58 is a normally closed valve and thus maintains vacuum groove 52 in ring 50 normally disconnected from the vacuum manifold 42. The circuit to the coil of relay 76 is completed through a flexible contact 82 which, as shown in Figure 2, is mounted on the frame 10 and resiliently bears against the first roll 2, through which it is connected to ground. The contact 82 is disposed in the path of the strip of material passing over roll 2, and hence when the leading edge of the strip is carried around the roll toward its nip with the second roll 4, the strip is drawn between the contact 82 and the roll 2 and breaks the electrical connection at this point. This de-energizes the relay 76, permitting contacts 78 to close, which energizes the solenoid of valve 58 and applies the vacuum to the vacuum groove 52 in ring 50 just before the leading

edge of the strip arrives in contact with the second roll 4.

The vacuum is likewise applied to the ring 62 associated with the third roll 6, just before the leading edge of the strip arrives at the third roll, by the engagement of the leading edge of the strip with a contact 84 mounted on the end of an arcuate shoe 85 concentrically spaced from roll 4, and secured thereto by bolts 87. Contact 84 normally resiliently engages roll 4, and is separated from roll 4 by the strip, thus de-energizing a relay 86 similar to relay 76, which closes a set of contacts 88 thereby energizing the solenoid 90 of valve 66 and opening the solenoid valve 66 to connect the vacuum groove 60 of the stationary ring 62 to the vacuum manifold 42.

With this arrangement it may be seen that the vacuum which sucks and holds the leading edge of the strip being fed through the rolls is sequentially applied to each roll in turn just before the arrival at that roll of the leading edge of the strip. Once the strip is threaded around a roll, it covers the passages 20 registrable with the vacuum groove of the ring associated with the roll and thus effectively prevents loss of vacuum through the slots. Thus very little loss of vacuum occurs through the passages 20 covered by the strip, and with the sequential switching arrangement described, the vacuum available at the vacuum manifold 42 is always concentrated at the roll at which the leading edge of the strip is about to arrive. Moreover, since the opening of each solenoid valve in turn is controlled by the advance of the strip material itself, completely automatic timing of the vacuum sequencing at exactly the right moment is assured, even though the strip may be fed through a large number of rolls.

To contribute further to the effectiveness of the feeding apparatus, there is provided at the nip of each pair of rolls a stripper member which assists in guiding the strip material off of one roll and onto the next. The stripper associated with rolls 2 and 4 is best shown in Figures 2 and 5 and includes a reversely curved finger 92 which is supported from one end of the arcuate shoe 85. The stripper 92 extends between the stationary rings 24, 50 associated with the two rolls 2, 4 at their nip point. The end of the stripper secured to the guide shoe 85 is disposed in concentric relation with the stationary ring 50 and is slightly spaced radially outward from the surface of the roll 50. The other end of stripper 92 bears against ring 24, and extends along ring 24 far enough so that it slightly overlaps the adjacent end of the vacuum groove 36 in the ring. The stripper 92 is thinner than the width of the shoulder 33, and hence its end is disposed within annular notch 35, radially inward of the surface of roll 2. In this way the leading edge of the strip passes smoothly over the end of the stripper without interference as it travels around the first roll 2, and the strip is thus effectively peeled off of the first roll 2 and guided onto the second roll by stripper 92. Similar strippers are provided between the second and third rolls and between subsequent pairs of rolls, and the resulting arrangement provides, in cooperation with the action of the sequentially operated vacuum grooves and the pressure grooves, an extremely effective and dependable means for feeding the leading edge of a strip of flexible material through the entire stack of calendar rolls without manual attention of any kind and at high speeds.

In use of the apparatus above described, to feed a strip of paper or the like through the calendar rolls, it is merely necessary to lay the leading edge of the paper on the top of the first calendar roll 2. Thereupon the suction passages 20 of the first roll 2, in registry with vacuum groove 36 in ring 24, grasp and hold the leading edge of the paper and carry it around into the nip with the second roll 4. The resultant breaking of the electrical circuit at contact 82 opens solenoid valve 58 and applies

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the vacuum to the second roll 4, the strip itself meanwhile covering the vacuum connected passages 20 of the first roll to prevent excessive loss of vacuum therethrough. In this manner the strip is carried by the second roll 4 to the third roll 6, and in like manner through the entire stack of calender rolls. The grip of the rolls thus afforded on the paper or other flexible strip material is very strong and enables material of considerable thickness and stiffness to be threaded through the rolls in a reliable and foolproof manner. Manual feeding of the strip material through the nips of the rolls is thus entirely avoided and the hazard heretofore present in this operation is therefore completely eliminated.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrated and not in a limiting sense.

It is also to be understood that the language in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

We claim:

1. In a calender apparatus having a series of continuously rotating calender rolls, means for automatically feeding a flexible strip through the successive nips of the series comprising a series of circumferentially spaced passages in each roll and leading from the surface of the roll to one end thereof, a stationary cylindrical member concentrically mounted at one end of each roll in wiping contact therewith and having an arcuate groove with which the outlet ends of said passages are adapted to register upon rotation of the roll, said stationary member being of smaller diameter than said roll and defining therewith an annular notch about said stationary member, a reversely curved sheet metal stripper member having one end extending along said annular notch beneath the surface of the adjacent roll in angularly overlapping relation with said arcuate groove and having its other end extending concentrically around the stationary member of the next succeeding roll outwardly spaced from the surface of said next succeeding roll, a connection

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between each of said arcuate grooves and a vacuum supply, an electrically controlled valve in each of said connections except the one to the first stationary member, and electrical contacts associated with each roll and with the valve in the vacuum connection to the next succeeding roll, said contacts being engageable by a strip fed through said rolls to operate said valves in sequence.

2. In a calender apparatus having a series of calender rolls, means for feeding a strip of flexible material through said calender rolls comprising a series of circumferentially spaced passages in each roll leading from the surface of the roll to one end thereof, a stationary ring contacting the end of each roll, said stationary ring being of smaller diameter than said roll to define therewith an annular notch about said stationary ring, a supporting shoe on the discharge side of the nip of each pair of cooperating calender rolls, a reversely curved sheet metal stripping finger carried by said shoe extending between the rings contacting each pair of cooperative rolls, said stripping finger having a lower portion concentrically spaced from the ring engaging the lower roll of the pair outwardly of the surface of said lower roll and having an upper portion extending along the notch of the ring engaging the upper roll of the pair inwardly of the surface of said upper roll, an arcuate first slot in each ring registrable with the passages of the roll adapted to be covered by material fed through the rolls, a connection between each of said first slots and a vacuum supply, an electrically controlled valve in each of said connections except the one to said first stationary ring, electrical contacts associated with each roll and with the valve in the vacuum connection to the next succeeding roll, said contacts being engageable by leading edge of a strip fed through said rolls to operate said valves in sequence, an arcuate second slot in said ring registrable with the remaining passages of said roll adjacent its point of tangency with the next succeeding roll, and means for connecting said second slot to a pressure supply.

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