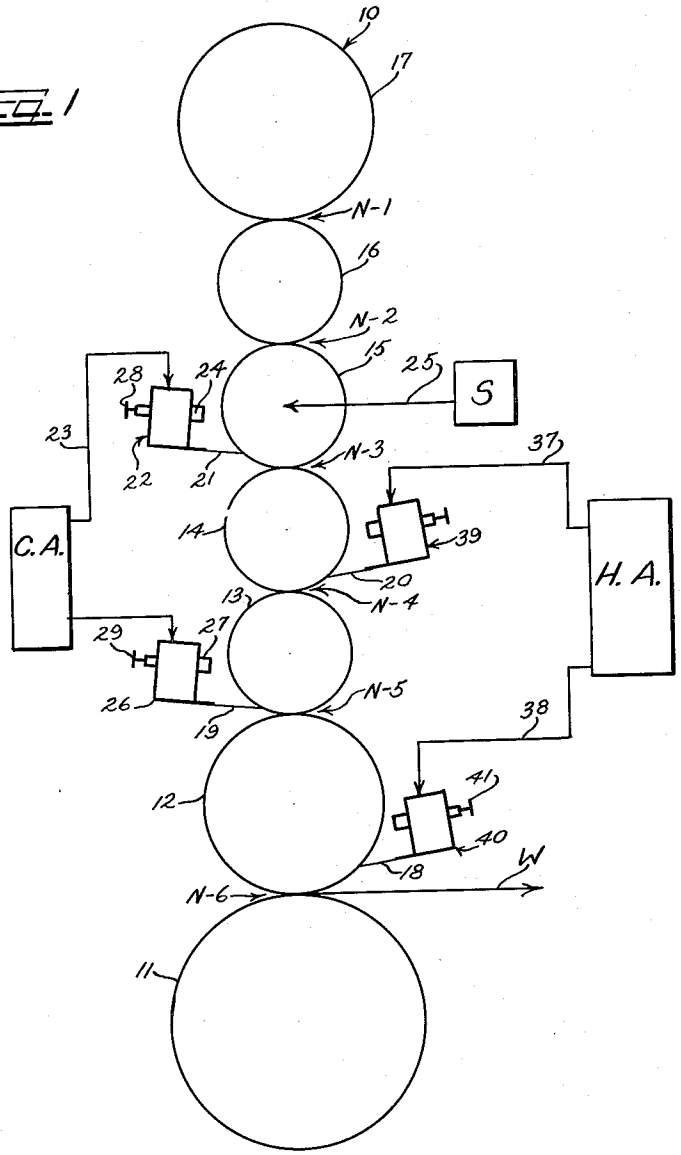
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CALENDER AIR DOCTOR

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FIG. 1




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Fig. 2

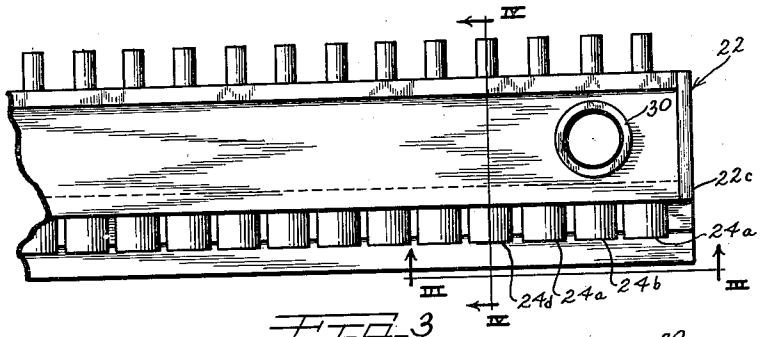



Fig. 3

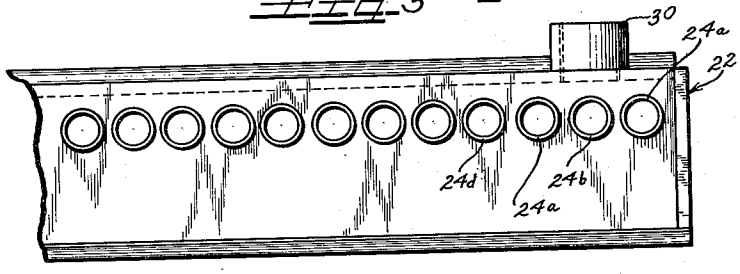
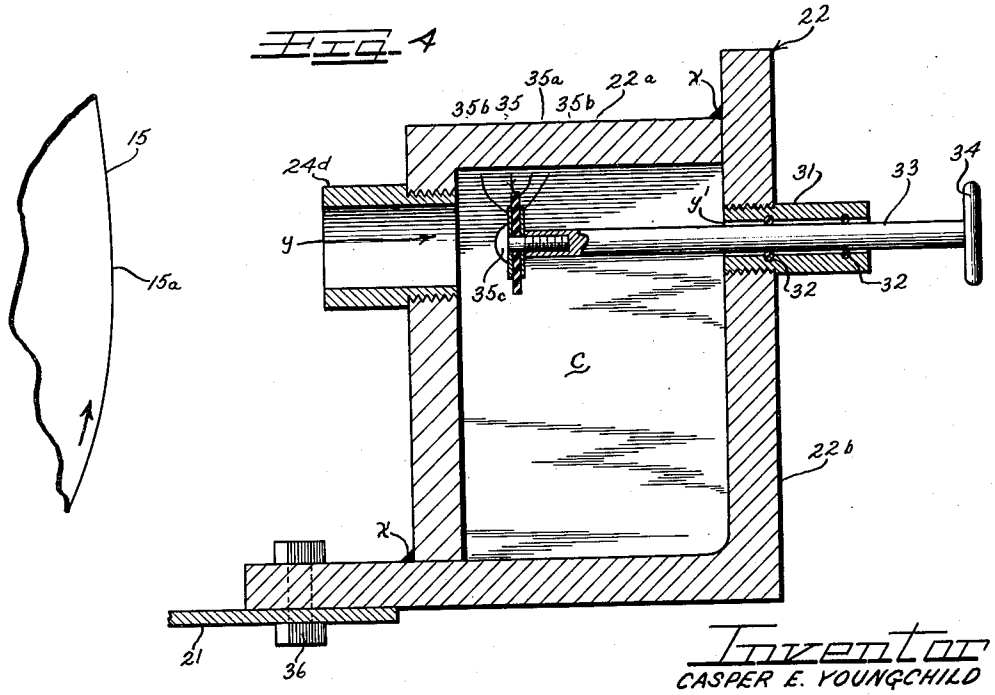



Fig. 4




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2,993,432

# CALENDER AIR DOCTOR

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2 Claims. (Cl. 100—93)

This invention relates to the portion of a paper machine or paper converting machine known as the calender or calender stack, and more particularly, to an improved nip pressure control in calenders.

Although the instant invention may have utility in other fields including the pressing, smoothing, ironing or the like treatment of a strip of flexible material, a particularly preferred use is in the paper machine or paper converting machine calender. The operation of such calenders is well known and understood in the art. The purpose of the calender is to compact the paper to some extent and to give it a fine smooth finish. This effect is obtained on both sides of the paper by the use of friction and pressure. The calender stack comprises a plurality of upright or vertically aligned calender rolls. One or more of such rolls is driven and the drive arrangement is such that there is a certain amount of slip between the rolls at each of the nips defined thereby so that a substantial amount of friction acts on the paper as it passes through each of the calender nips. A controlled amount of pressure is also applied.

It is conventional practice in the operation of a calender to raise the temperature of a particular local circumference of a calender roll in order to increase the calender loading or pressure at that point. The rise in temperature creates an increase in the diameter of the roll at that point and, therefore, a much higher loading on the paper web passing through the nip at that particular point. Friction blocks have been used for this purpose occasionally, but such blocks tend to disintegrate and pass parts through the nips in the calender.

Some calender stacks are provided with rolls which are bored for the introduction of steam. The entire roll is heated in this way and cooling air may be blown on the roll locally in order to reduce the diameter at a particular spot. Any of the aforementioned temperature control devices are employed to compensate for inequalities or streaks which show up on the reel as hard ridges in the winding roll.

The instant invention is based upon a novel solution to the problem here involved. The instant invention resides in the use of a hollow doctor "back" or beam which carries the doctor blade. This hollow beam is equipped to serve as an air manifold. It is equipped with a plurality of spaced air or gas outlets extending the full length of the roll adjacent the doctor blade. Hot or cold air is connected to the manifold and a plurality of valve means mounted in association with each of the spaced gas outlets controls the amount of gas or air flowing through an individual outlet and thus the amount of heating or cooling effect applied to the calender roll. The operator may easily observe the windup roll and notice any inequalities which may appear. Compensation is easily and effectively made for such inequalities by mere adjustment of the valve means mounted in the manifold so as to obtain a desired heating or cooling effect in a particular localized area of the calender roll. For example, if a hard ridge starts to appear on the windup roll at a given location, then the operator adjusts the valves in the manifold along the portion of the calender nip aligned with this imperfection, so as to heat up a portion of a calender roll in this area, thereby to increase the nip pressure.

The doctor is, of course, mounted in close running relation to a calender roll at the off-running side of the calender nip; and this keeps the calender roll perfectly



clean at this region of the off-running side of the nip. The longitudinally spaced gas outlets in the manifold mounting the doctor blade are aimed at the calender roll along a line at the off-running side of the doctor blade, whereat uniform cleanness of the calender roll surface is obtained for best control in the heating or cooling of the calender roll by the application of the gas or air.

It is therefore an important object of the instant invention to provide an improved calender, and more particularly, an improved calender wherein improved means are provided for controlling the loading along the full length of calender nips therein.

Another object of the instant invention is to provide an improved calender comprising a calender roll, a doctor mounted in close running relation to said roll, means mounting said doctor and providing spaced gas outlets extending the length of said doctor aimed at said roll for effecting localized temperature control along the length of the roll, and gas flow control means for each of said outlets.

Other and further objects, features and advantages of the present invention will become apparent to those skilled in the art from the following detailed disclosure thereof and the drawings attached hereto.

On the drawings:

FIGURE 1 is essentially a diagrammatic view showing a calender stack embodying the instant invention in elevation;

FIGURE 2 is a fragmentary top plan view taken substantially along the line II—II of FIGURE 1 showing the doctor back;

FIGURE 3 is an elevational view of the doctor back of FIGURE 2 taken substantially along the line III—III; and

FIGURE 4 is a cross-sectional view of the doctor back of FIGURE 2 taken substantially along the line IV—IV, with the valve means shown in detail (the valve means having been omitted from FIGURES 2 and 3 for purposes of simplification).

As shown on the drawings:

As shown in FIGURE 1, a calender stack indicated generally by the reference numeral **10** comprises a bottom roll **11** and a plurality of superimposed calender rolls **12** through **17** defining a plurality of superimposed nips N–1 through N–6. The web W passes over the top roll **17** through the first nip N–1 around the second roll **16** through the second nip N–2, etc., until the web finally passes through the bottom nip N–6 and out to the windup (not shown).

As indicated in FIGURE 1, the rolls **12**, **13**, **14** and **15** are each furnished with a doctor **18**, **19**, **20** and **21**, respectively, which is mounted in close running relation to the particular roll with which it is associated. As will be noted, the doctor **21** is associated with the roll **15** and it is mounted in close running relation thereto at the off-running side of the nip N–3. The doctor **21** is mounted on a doctor back, indicated generally at **22**. Although the details of the doctor back **22** will be discussed in connection with FIGURES 2 through 4, it will be noted that the doctor back **22** is a hollow beam that is connected through a line **23** to a source of gas, in this case cold air CA. The cold air passes from the source CA through the line **23** and into the hollow doctor back **22**. From there it is forced through outlets **24** against the surface of the roll **15** at the off-running side of the doctor **21**. Optionally, the interior of the roll **15** may be heated, for example, by steam through a line **25** from a source S. In this way the chilling effect of the cold air CA coming through selected outlets or nozzles **24** is very pronounced on the roll **15** and there is a substantial temperature differential between the heated portions of the roll **15** and the chilled or cooled portions exposed directly to a blast of cold air through a nozzle **24**. Actually, the chilling ef-

fect of cold air alone (without the use of steam in the interior of the roll **15**) will also produce a desirable temperature control effect. This is shown in connection with the doctor back **26** which mounts the doctor **19** in association with the roll **13**. Cold air flowing through nozzles or outlets **27** in the doctor back **26** will result in the desired local temperature control in the roll **13** so as to obtain localized control of the diameter of the roll **13**.

If it is desired to eliminate a localized "high spot" or portion of excessive thickness in the web W, the cold air coming from the nozzle **24** is reduced by valve means **28** at the particular area of this "high spot" and the temperature of the peripheral portion of the roll **15** in this region increases. This results in an increase in the diameter of the roll **15** at this region and much greater loading at the nips N–2 or N–3 or both. Additional increase in the loading of the web at the nips N–4 or N–5 or both may also be obtained by reducing the cold air flow through selected outlets **27** (using selected valve means **29**).

Referring now to FIGURES 2, 3 and 4, it will be seen that the doctor back **22** of FIGURES 2 and 3 is provided with a top inlet **30** (which is connected to the cold air inlet line **23**) and the doctor back **22** is provided with a plurality of air outlets **24***a*, **24***b*, **24***c*, **24***d*, etc. These outlets **24***a*, **24***b*, etc. are spaced longitudinally of the roll **15** so that each may serve a longitudinally spaced peripheral portion of the surface. A reduction of the cold air flow at the outlet **24***a* while the cold air flow is maintained at the outlet **24***b* results in a slight increase in the diameter of the roll just opposite the outlet **24***a*, so that greater loading at the press nip is obtained in this region.

FIGURE 4 shows the details of the valve means employed in control of a specific gas outlet, in this case the outlet **24***d*. As will be seen from FIGURE 4, the doctor back **22** has a generally rectangular cross-section formed by welding to angle irons **22***a* and **22***b* together at welds *x* (which are airtight welds). An end piece such as the end piece **22***c* of FIGURE 2 is, of course, provided at opposite ends of the doctor back **22** to provide a closed hollow chamber C. Incoming gas or air is fed into the chamber C through the inlet **30** described in connection with FIGURES 2 and 3. Each outlet **24** is defined by a short section of pipe **24***d* which threadedly engages the doctor back at a suitable aperture *y* in one side of the angle iron **22***a*. Opposite the individual aperture *y* there is a smaller aperture *y'* which mounts a threaded tube **31**. The threaded tube **31** carries spaced O-rings **32**, **32** which function to mount a valve shaft **33** and seal the same to prevent loss of air under pressure through the tube **31**. The valve shaft has a manually graspable handle **34** outside the doctor back **22** for effecting limited axial movement of the shaft **33**. The inner extremity of the shaft **33** carries a valve closing element **35** is the form of an oversize rubber washer **35***a* clamped between the two brass washers **35***b*, **35***b* by a screw **35***c* threadedly engaging the end of the shaft **33**.

The doctor blade **21** (shown only fragmentarily) is secured to the doctor back **22** by suitable nut and bolt assemblies **36** as indicated. The gas passes through the opening *y* and the pipe section **24***d* against the roll **15** (shown only fragmentarily) along a portion **15***a* at the off-running side of the nip N–3 and at the off-running side of the doctor **21**. The amount of air passing through each individual opening *y* is controlled by axial movement of the valve shaft **33**.

It will also be appreciated that hot air can be employed instead of the cold air previously described in connection with the instant device. For example, as shown in FIGURE 1, a source of hot air HA may be provided and lines **37** and **38**, respectively, feed the hot air to the backs **39** and **40** which mount the doctor blades **20** and **18**. The structure of the doctor backs **39** and **40** is the same as that shown in connection with FIGURES 2 through 4 and the only difference in function is that hot air rather than cold air is employed. In such circumstances, additional loading at a region in the press nip is accomplished by opening the valve means **41**, for example, in the doctor back **40** to permit greater heating of the desired portion of the roll **12**.

It will be understood that modifications and variations may be effected without departing from the spirit and scope of the novel concepts of the present invention.

I claim as my invention:

1. In a calender, which comprises a plurality of superimposed rolls defining a plurality of nips, a doctor mounted in close running relation to each of said rolls at the off-running side of the nip and extending along the length of the roll, a hollow doctor beam mounting each of said doctors, said doctor beam being provided with at least one air inlet and a plurality of air outlets spaced therealong and directing a plurality of air streams at the roll at the off-running side of the doctor and the off-running side of the nip for effecting localized temperature control along the length of the roll, and valve means controlling each of the air outlets, the improvement in said valve means comprising a horizontally slidable shaft member mounted by the doctor beam, an air stream-directing pipe member in each outlet generally transverse to the roll opposite thereto, and an outlet closing member at one end of the shaft movable toward and away from each outlet to control the amount of air released from said doctor beam and through each outlet pipe toward the roll.

2. A calender, which comprises a plurality of superimposed rolls defining a plurality of nips, a doctor mounted in close running relation to each of said rolls at the off-running side of the nip and extending along the length of the roll, a hollow doctor beam mounting each of said doctors, said doctor beam being provided with at least one air inlet and a plurality of air outlets spaced therealong and directing a plurality of air streams at the roll at the off-running side of the doctor and the off-running side of the nip for effecting localized temperature control along the length of the roll, and valve means controlling each of the air outlets, the improvement in said valve means comprising an air stream directing pipe member in each outlet generally transverse to the roll opposite thereto, directing air to a selected roll area at the region of contact with the doctor, the pipe member being aligned generally parallel with the doctor blade, a movable shaft member, and an outlet closing member mounted on the shaft member and movable toward and away from closed position in the outlet to control the amount of air released from said doctor beam and through each outlet pipe member toward the roll.

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