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Winterburn et al.

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[54] **ROLL DOCTOR APPARATUS**

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[73] Assignee: **Joseph Winterburn Limited,** Lancaster, England

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[52] **U.S. Cl.** **15/256.51,** 34/120, 100/174

[51] **Int. Cl.** **D21g 3/02,** D21g 3/04

[58] **Field of Search** 15/256.51; 100/174; 118/126, 261, 256; 34/110–121

[56] **References Cited**

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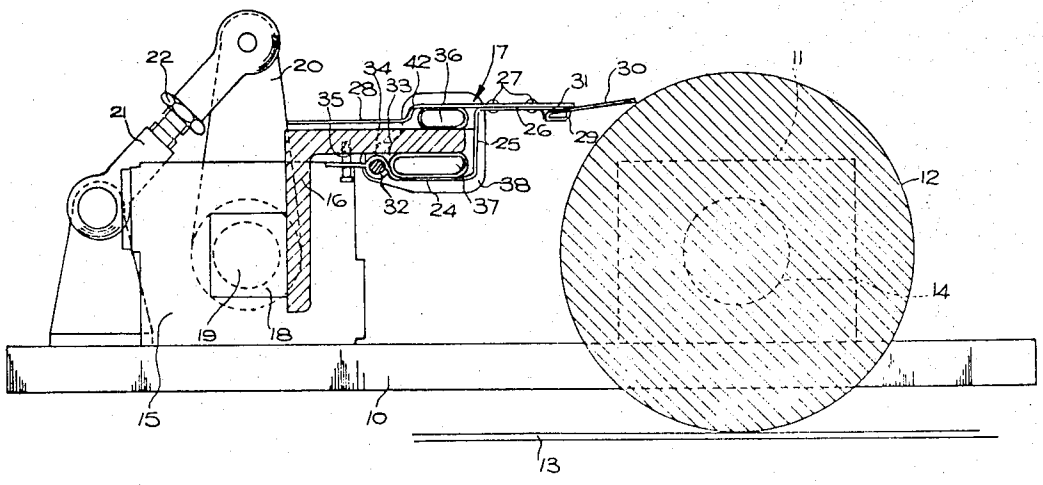
Primary Examiner—Leon G. Machlin

Attorney—Owen, Wickerhsam & Erickson

[57] **ABSTRACT**

Apparatus for doctoring a roll for example in a paper-making machine comprising a doctor blade support of channel form in a number of side-by-side sections for example of sheet metal, the support being pivotally mounted on a carrier projecting into the channel, and two inflatable tubes interposed between the carrier and the support for pivoting the support to cause the doctor blade to engage with or disengage from the roll. The walls of the channel are substantially continuous and cover completely the tubes and the external surfaces of the channel are provided by smooth, plane and/or curved surfaces which are devoid of ribs.

4 Claims, 3 Drawing Figures



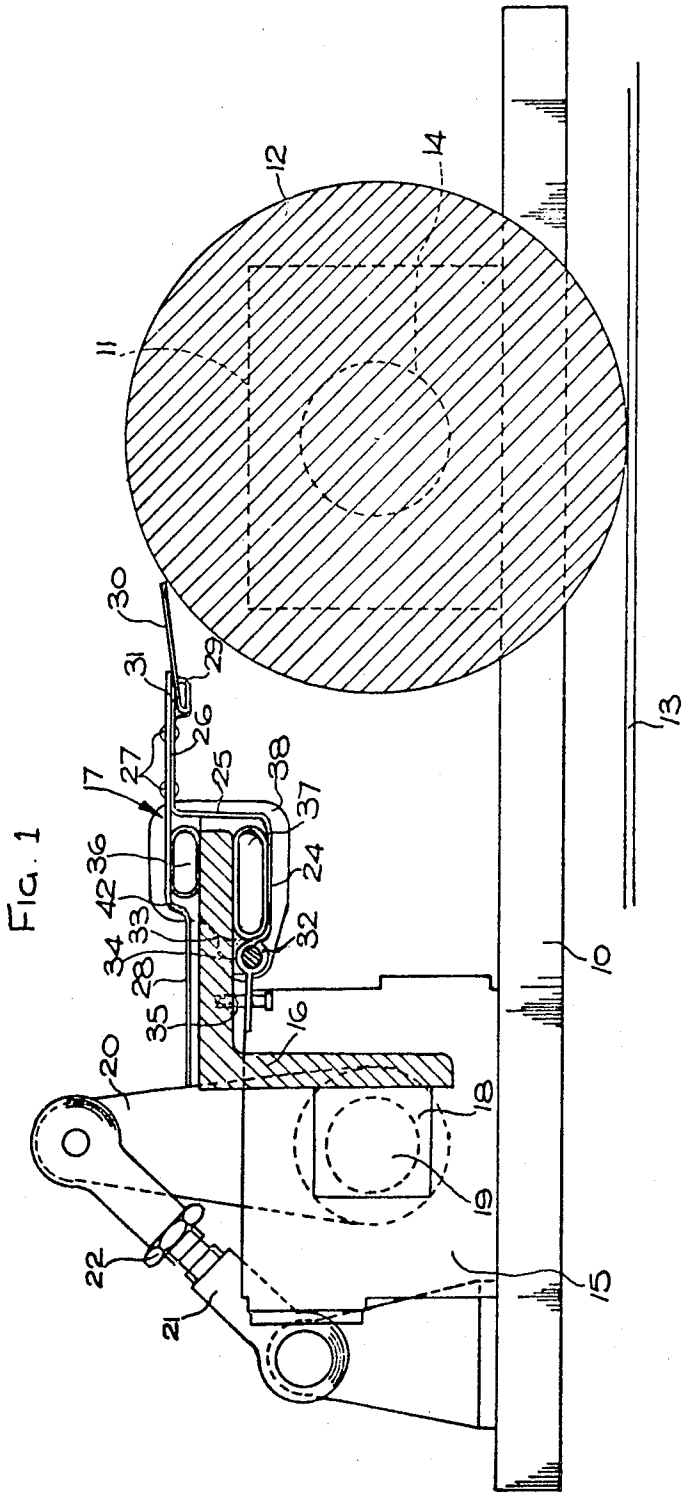

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FIG. 1

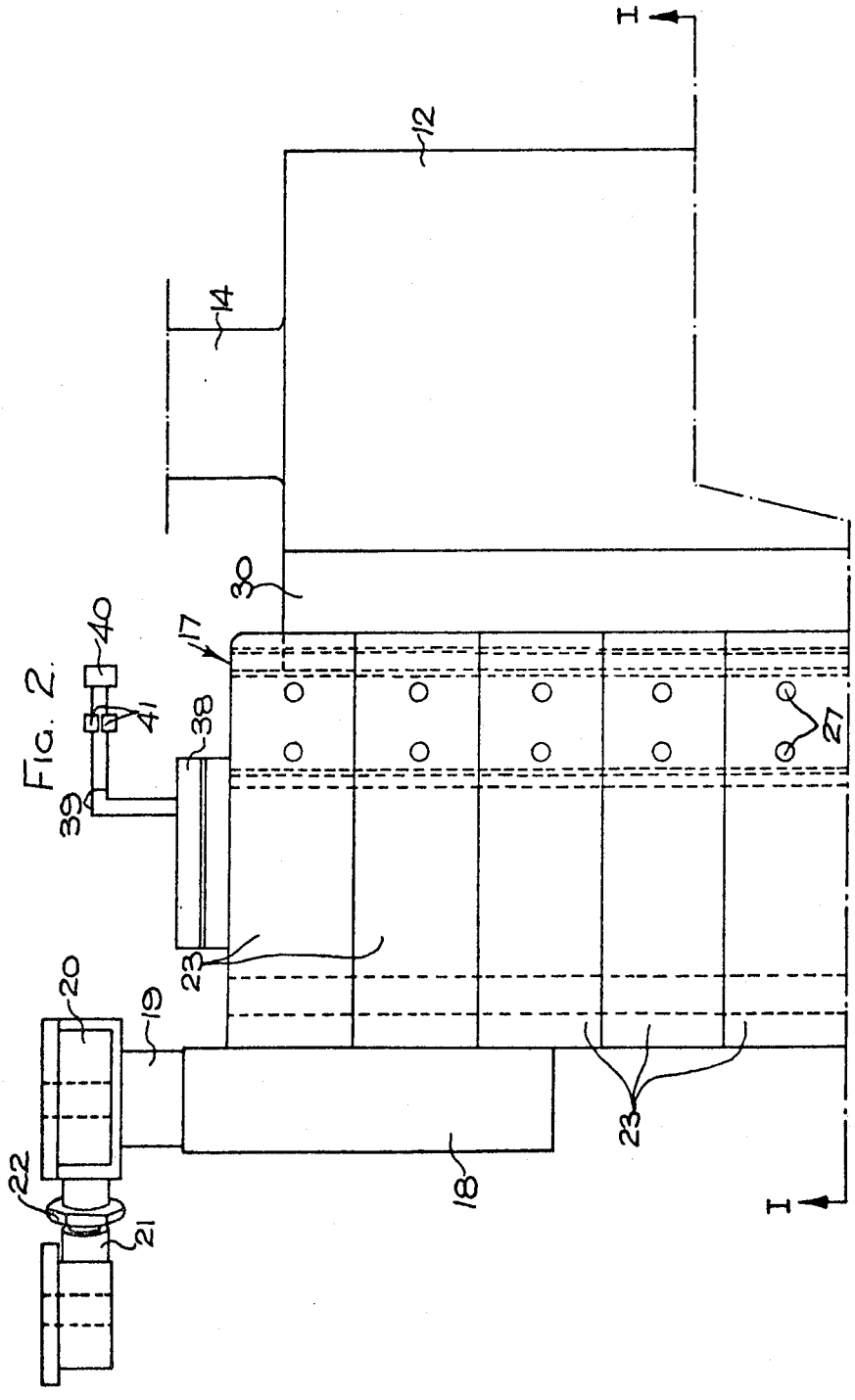

Fig. 2.

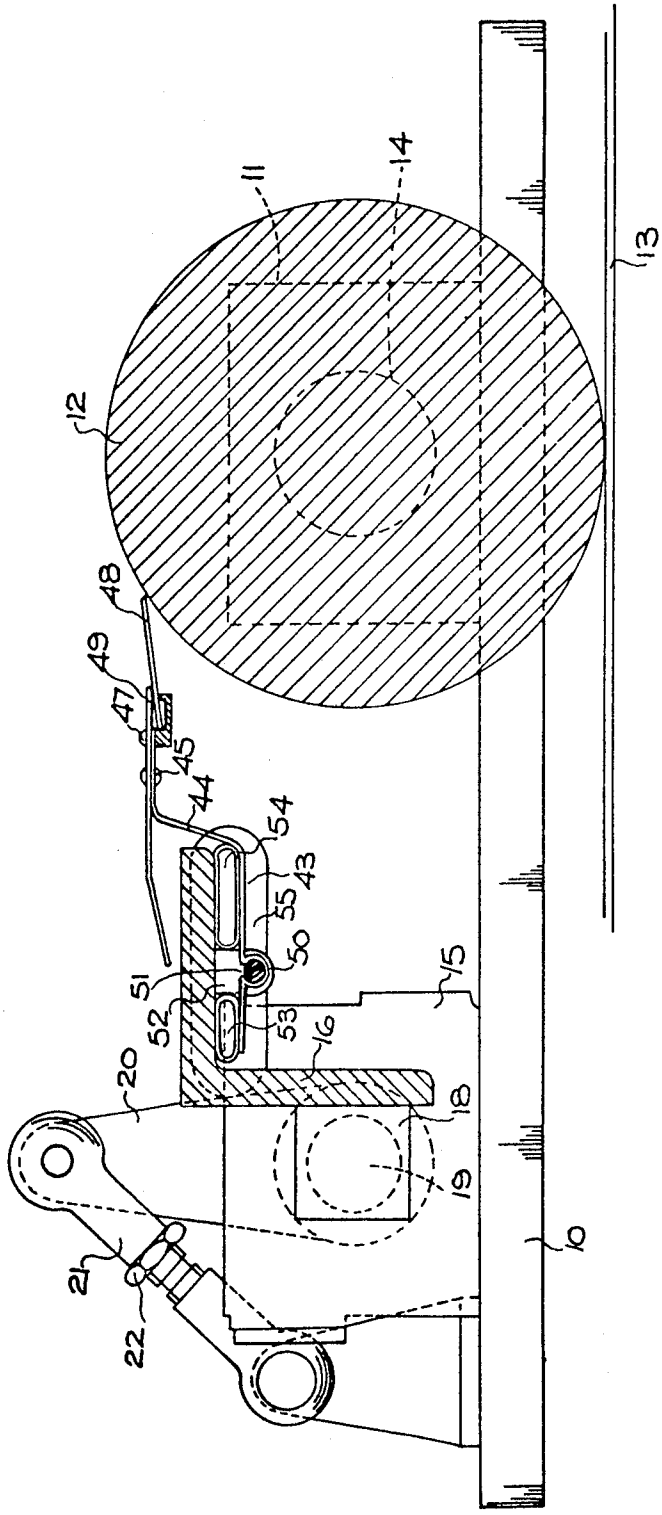

FIG. 3

ROLL DOCTOR APPARATUS

This invention relates to roll doctor apparatus for use with a roll in, for example, a paper-making, bleaching, dyeing or printing machine.

The invention is particularly applicable to the drying rolls of paper-making machines and will be described in relation thereto, but it is to be understood that there is no limitation in this regard.

Two important requirements should be satisfied by roll doctor apparatus and these are as follows:

1. The apparatus should be capable of allowing for the chamber of a long roll while providing substantially uniform pressure on the roll by the doctor blade along the length of the roll.
2. If material passes the doctor blade it must be prevented from impairing the proper operation of the doctor blade and/or accumulating in such a position that it will ultimately drop off on to the web being acted upon by the roll.

The first one of these requirements has been successfully met by the roll doctor apparatus described in the complete specification of British Patent No. 948.679 of D.S.T. Pattern and Engineering Co. Limited. In this apparatus the doctor blade is held by a number of ribbed, cranked levers pivotally mounted in side-by-side relationship on a carrier and these levers are biased by an inflatable tube to urge the doctor blade against the roll.

However, with regard to the second requirement it has been found in practice with the apparatus described in said specification that there is a tendency for paper pulp which has passed the doctor blade to accumulate in the cavities between the ribbed, cranked levers holding the blade. This is because as the pulp passes the doctor blade it loses its velocity and breaks up and thus has a tendency to enter any available cavity such as the space between the ribs on two adjacent blade-holding levers. The pulp which accumulates in the cavities ultimately falls off and may break the web which is being treated. Also, the cranked levers have been arranged at a wider spacing than that shown in the complete specification referred to above since it was found for structural reasons that it was not necessary to place the levers so close together. The pulp tends to get between the levers and the inflatable tube and there is also the danger that, when the operator clears the machine and uses a spiked rod or stick for this purpose, he might puncture the tube.

A third important requirement of roll doctor apparatus is that it should be possible to lift the blade off the roll when the machine is idle or for maintenance and replacement purposes.

It is an object of the present invention to provide a roll doctor apparatus which fulfils not only the first but also the second requirement mentioned above.

An aim of a preferred embodiment of the invention is to provide a roll doctor apparatus which also fulfils the third requirement mentioned above.

According to the invention there is provided a roll doctor apparatus comprising a carrier; a flexible support (as hereinafter defined) of generally channel section mounted on the carrier for pivoting about an axis parallel to the length of the channel, an edge portion of the carrier being received within the channel; a flexible doctor blade (as hereinafter defined) mounted on the support to project externally of the channel and away from the carrier; and a tube which is interposed between the said edge portion of the carrier and a wall of the channel and is expansible by the introduction of fluid into it so as to pivot the support relatively to the carrier and cause the doctor blade to engage the roll, characterised in that the walls of the channel are substantially continuous and overlie completely said tube and the external surfaces of the channel are provided by smooth surfaces which are devoid of ribs.

By this arrangement, any pulp or other material which passes the doctor blade is not encouraged to hang on to the external surfaces of the channel because of their shape and because of the absence of ribs which project from the external surfaces of the channel and which have substantial longitudinal extents in directions perpendicular to the pivot axis of the support, such as are provided on the cranked levers in the apparatus described in the aforementioned complete specification.

With regard to the third requirement, that it should be possible to lift the blade off the roll when the machine is idle or for maintenance and replacement purposes, it may in some cases be possible to arrange the apparatus that the blade will move under gravity out of contact with the roll surface when there is no fluid pressure in the tube. Preferably, however, means are provided for positively lifting the doctor blade off the roll and such means comprises a second expansible tube which is interposed between the edge portion of the carrier and a wall of the channel and is expansible by the introduction of fluid into it so as to pivot the support relatively to the carrier and cause the doctor blade to lift from the roll. If such a tube is provided then it is substantially covered by the wall of the channel which it engages so as to prevent it being punctured during clearing of the machine by a spiked rod or stick as described above.

If two expansible tubes are provided then they may be arranged in one of two manners. The tubes may be on the same side face of the carrier and on opposite sides of the pivot axis of the doctor blade support so that both tubes engage the same side wall of the channel of the support. Alternatively, the tubes may be mounted on opposite side faces of the carrier so that one tube engages one side wall of the channel of the support and the other tube engages the other side wall of the channel.

When we say that the support and the blade are "flexible" we mean that they are arranged so that the blade can engage the roll throughout the whole length thereof when the blade is urged into engagement with the roll by the expansible tube or the relevant one of the expansible tubes. The blade itself will normally be in one piece except when it is used with a very long roll, in which case it may be in a number of sections, and will be constructed so that it can flex about axes transverse to its length. The support may be continuous along the length of the roll and of sufficient flexibility about axes transverse to its length to enable the blade to engage the roll throughout the length of the latter. Alternatively, the support may be in a number of side-by-side sections pivoted to the carrier. In the latter case the sections will be arranged side-by-side at such spacing as substantially to cover the expansible tube or tubes.

Whether the support is continuous or made in side-by-side sections it may be made from sheet metal or from an extrusion.

The support, or each section thereof, preferably comprises a generally Z-shaped member of sheet metal having first and second approximately parallel flanges separated by a web integral therewith and a third flange of sheet metal secured to the second flange and forming, with the first flange, the side walls of the channel or parts thereof, the base of the channel or a part thereof being formed by the web. In such a construction it is obviously necessary to fasten the second and third flanges together and this may be effected by welding or other techniques or it may be necessary to rivet together the two flanges. In this case the rivet heads would form small projections from the otherwise smooth external surfaces of the channel but there would still be no ribs having substantial longitudinal extents perpendicular to the pivot axis to provide cavities in which could accumulate material from the roll being doctored.

Alternatively, the support or the sections thereof could be formed of an extruded section of similar shape to that obtained by securing together a Z-shaped member and said third flange as described above.

Conveniently the first or third flange of the support or each support section is formed with a transverse groove of curved cross section which embraces a pivot shaft mounted on the carrier. This arrangement provides a simple pivotal mounting for the support.

Preferably the first flange or/and the third flange of the support or each support section are shaped so that the end thereof remote from the doctor blade is disposed nearer to the carrier than the remainder of the flange. Thus, the mouth of the channel is narrower than the channel itself so as to provide further protection for the tube or tubes against damage.

The carrier may have means arranged to cooperate with the support to limit the pivotal movement of the support towards the roll.

The support will be provided with means for mounting the doctor blade and such means may be a slot opening towards the roll to receive the blade, the slot having a base which forms an abutment for the edge of the blade remote from the roll and the blade carrying a number of springs which are engaged in the slot to hold the blade in position.

Two embodiments of the invention will now be described in detail by way of example with reference to the accompanying diagrammatic drawings, in which:

FIG. 1 is a part sectional view of roll doctor apparatus constituting a first embodiment of the invention taken on the line I—I of FIG. 2;

FIG. 2 is a plan view of part of the apparatus shown in FIG. 1; and

FIG. 3 is a view similar to FIG. 1 of roll doctor apparatus constituting a second embodiment of the invention.

The two embodiments of the invention illustrated in the drawings are similar in that they each comprise a base **10** carrying two spaced bearing housings, of which one is shown at **11**, supporting between them a roll **12**, (for example a drying roll in a paper-making machine) for acting upon a web **13** (of paper) the ends of the roll being formed with trunnions **14** which are received in the bearings. The web **13** is shown travelling in a horizontal path although its path could be disposed at an inclination to the horizontal. Moreover, a further roll could be disposed beneath the roll **12** so that the web passes through the nip between them.

The base **10** also carries two spaced bearing housings, of which one is shown at **15**, supporting between them a carrier **16** for a doctor blade support generally designated **17**. The carrier is of angle form and has welded to the outer face of its vertical limb two aligned square section bars, one of which is shown at **18**, whose projecting ends are formed to provide trunnions **19** received in the bearings of the housings **15**. One of the trunnions **19** namely the one seen in the drawings, has keyed to it a radially extending arm **20** which is pivotally connected at its outer end to one end of a torque link **21**, the other end of this link being pivotal on a fixed part of the base **10**. The torque link arrangement prevents pivoting of the carrier **16** about the common axis of the trunnions **19**. The torque link **21** incorporates adjusting means **22** whereby the disposition of the carrier **16** can be varied as required.

A further torque link arrangement may be provided at the opposite side of the machine depending on the width of the latter.

Referring now to FIGS. **1** and **2** of the drawings the doctor blade support **17** is generally of channel shape and the horizontal limb of the carrier **16** is received in the channel. The support comprises a number of sections **23**, as shown in FIG. **2**, arranged closely side by side on the carrier. In an alternative arrangement (not shown) the support may be continuous along the whole length of the roll **12**. Each section **23** comprises a Z-section member of sheet metal having a first flange **24**, a web **25**, and a second flange **26**, the flanges **24** and **26** being generally parallel to one another with the web **25** extending at right angles thereto and forming the base of the channel. Secured to the second flange **26** by rivets **27** is a third flange **28** of sheet metal, the two flanges **24** and **28** forming the side walls of the channel. The flange **26** is formed with a U-shaped portion **29** which provides, with the opposed portion of the flange **28**, a slot which receives a doctor blade **30**, the base of the slot providing an abutment for the edge of the doctor blade **30** remote from that part which engages the roll **12**, and the blade being provided along its said edge with a series of spring clips **31** holding the blade in position in the slot.

The support **17** is mounted on the carrier **16** for pivoting about a pivot shaft **32** mounted between brackets **33** depending from the carrier and in the embodiment shown the flange **24** is provided with a transverse portion **34** of curved cross section which embraces the shaft **32**. Screwed into apertures in the carrier **16** are a number of bins **35** which engage in slots in the free edge portion of the flange **24** to prevent the support moving horizontally towards the roll **12** and to limit the pivotal movement thereof. The arrangement may be modified by forming the free edge portion of the flange **24** so that it hooks around the shaft **32** thus dispensing with the pins **35**.

Mounted on opposite side faces of the horizontal limb of the carrier **16** are two inflatable tubes **36** and **37**, one tube engaging one side wall of the channel of the support **17** and the other tube engaging the other side wall. The ends of the tubes are closed by two elements of which one is shown at **38**, and this element has two air lines **39** (shown diagrammatically in FIG. **2**) connected to it and communicating with the respective tubes. The two air lines are connected to a common source of compressed air **40**, and each line incorpo-

rates a valve **41** for controlling the air pressure in the associated tube.

The walls of the channel of the support **17** provided by the flanges **24** and **28** substantially completely cover the inflatable tubes **36** and **37** so as to protect them from being damaged during clearing of the machine by means of a spiked rod or stick and to prevent material from the roll **12** getting between the carrier **16** and the said flanges. It will be noted that the flanges **24** and **28** are so shaped that their free edge portions remote from the roll **12** are disposed nearer to the carrier than their portions adjacent the base of the channel, the flange **28** being provided with a cranked portion **42** for this purpose.

Furthermore, it will be seen that the external surfaces of the channel shaped support **17** formed by the flanges **24** and **28** and the web **25** are smooth and either plane or curved and do not have any ribs on them which have substantial longitudinal extents perpendicular to the shaft **32.** It follows that the cavities in which material can accumulate on the support are limited and there is little danger that material will accumulate on the support and drop on to the web **13** being acted upon by the roll **12.**

The doctor blade **30** is urged into engagement with the surface of the roll **12** by introducing compressed air into the tubes **36** and **37** with a greater pressure in the tube **37** than in the tube **36** so that the tube **37** expands to a greater extent. The tube **36** merely acts as a steady when the blade is being forced into engagement with the roll **12.** The support **17** must be sufficiently flexible for the blade to be able to be engaged with the roll over the whole length of the roll and this is effected either by making the support in a number of sections as illustrated or by making the support continuous but of sufficient flexibility about axes perpendicular to the shaft **32** to enable the blade to engage the roll throughout the length thereof.

It will be appreciated that in operation, material from the roll being doctored passes over the smooth upper surface of the flange **28** and only any material passing the doctor blade can engage the external surfaces of the web **25** and the flange **24** and due to the shape of these surfaces there will be no tendency for the material to build up into an accumulation on the surfaces and then drop on to the web **13** with a danger of breaking it.

By introducing a greater air pressure into the tube **36** than into the tube **37** the support **17** can be pivoted to lift the doctor blade **30** from the roll.

Referring now to FIG. **3,** the support **17** in this embodiment is similar in construction to the support of the embodiment shown in FIGS. **1** and **2.** Thus, the support is in a number of sections each comprising a generally Z-shaped sheet metal member having a first flange **43,** a web **44** and a second flange **45,** the web being disposed at an inclination to the parallel flanges. A third flange **46** of sheet metal is riveted to the flange **45.** Riveted to the flanges **45** and **46** is a U-shaped blade support **47** which provides a slot to receive a doctor blade **48,** the base of the slot forming an abutment for the edge of the blade remote from the roll **12** and the blade being provided with spring clips **49** to hold it in the slot.

The flange **43** is provided with a transverse arcuate portion **50** which embraces a shaft **57** supported by brackets **52** on the carrier **16.** The arcuate portion **50** extends round more than 180° so that it is prevented from becoming disengaged from the shaft **51.**

Arranged on opposite sides of the shaft **51** are two inflatable tubes **53** and **54** which are interposed between one side face of the horizontal limb of the carrier **16** and one side wall of the channel of the support **17.**

The tubes **53** and **54** are closed by end elements **55** and are connected to a pneumatic circuit similar to that shown in FIG. **2.**

Engagement of the doctor blade **48** with the roll **12** is effected by introducing a greater air pressure into the tube **54** than into the tube **53,** and lifting of the blade from the roll is performed by introducing a greater air pressure into the tube **53** than into the tube **54.**

It will be seen that the channel shaped support **17** whose walls are provided by the flanges **43** and **46** and the web **44** has smooth, plane or curved external surfaces which prevent the build up of material thereon and also that the flange **43** substantially covers both of the tubes **53** and **54.** The flange **46** is shaped so that its free end portion is inclined towards the carrier. The tubes are thus protected from accidental damage.

As with the embodiment of FIGS. **1** and **2,** the support **17** may be formed as one continuous member instead of being in a number of side by side sections. In either case it will be sufficiently flexible to allow the doctor blade to engage the roll throughout the whole length of the latter.

In both of the embodiments described, the parts of the support are made from sheet metal and are riveted together. However it is also within the scope of the invention to make the parts in one piece as an extrusion or to fix them together by some other means.

It will be seen that the invention provides an improved roll doctor apparatus in which the expansible tubes are protected and in which the external surfaces of the blade support discourage the build up of material thereon.

In some cases, the tube serving to lift the doctor blade from the roll can be dispensed with if the apparatus is mounted in such a position that the blade will become disengaged from the roll by gravity.

We claim:

1. In combination with a roll, a roll doctor apparatus comprising

a. a carrier;

b. a flexible support of generally channel section mounted on the carrier for pivoting relative to the latter about an axis parallel to the length of the channel, the carrier having an edge portion which is received within the channel and the support comprising a generally Z-shaped member of sheet metal which has first and second approximately parallel flanges separated by a web integral therewith, and a member of sheet metal secured to the second flange and providing a third flange which forms, with the first flange, the side walls of the channel, the base of the channel being formed by the web;

c. a flexible doctor blade mounted on the support to project externally of the channel and away from the carrier;

d. a tube which is interposed between the said edge portion of the carrier and a side wall of the channel, the walls of the channel being substantially continuous and covering completely the said tube

and the external surfaces of the channel being provided by smooth unribbed surfaces; and

e. means for introducing fluid into the tube to expand it so as to pivot the support relative to the carrier and cause the doctor blade to engage the roll.

2. An apparatus as claimed in claim **1** wherein a pivot shaft is mounted on the carrier and the first flange of the generally Z-shaped member of the support is formed with a transverse groove of curved cross section which embraces said shaft.

3. An apparatus as claimed in claim **1** wherein at least one of the flanges defining the side walls of the channel is shaped so that the end thereof remote from the doctor blade is disposed nearer to the carrier than the remainder of the flange.

4. In combination with a roll, a roll doctor apparatus comprising

a. a carrier;

b. a mounting for the carrier;

c. a flexible support having two spaced approximately parallel flanges joined by a web which extends approximately at right angles to said flanges and, with the latter, forms a channel, and a further flange which projects from the web in a direction away from the channel, the carrier having an edge portion which extends away from the mounting and is received within the channel;

d. pivot means between said edge portion of the carrier and said support whereby the latter is mounted on the carrier for pivoting relative thereto about an axis parallel to the length of the channel;

e. a flexible doctor blade mounted on said further flange of the support and extending in a direction away from the channel;

f. a tube which is interposed between the said edge portion of the carrier and a wall of the channel, the walls of the channel being substantially continuous and overlying completely the said tube and the external surfaces of the channel being provided by smooth unribbed surfaces; and

g. means for introducing fluid into the tube to expand it so as to pivot the support relatively to the carrier and cause the doctor blade to engage the roll.

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