DOCTOR ASSEMBLY AND FRONT REMOVABLE BLADE AND HOLDER THEREFOR WITH CAPACITY FOR OSCILLATION


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16 Claims. (Cl. 15—256.5)

This invention relates generally to paper and other sheet material manufacturing and processing wherein matter may accumulate on drums and rolls. More particularly, the invention concerns doctors or scrapers for clearing and cleaning the surfaces of calender, dryer, and the like rolls and cylinders comprised in the apparatus used in such manufacture and processing, especially including paper and the like machinery.

This application is a continuation-in-part of my co-pending doctor application Serial No. 205,704, filed January 12, 1951, and issued January 31, 1956, as United States Letters Patent No. 2,732,773.

Early doctors had blades fastened directly upon a carriage mounted rigidly in the machine frame. Certain more recent constructions have introduced a blade removable endwise of the support means, as from a longitudinal slot or groove therein. But removal of the blade as for inspection, repair, or replacement has generally been obstructed by jamming or plugging of the support by the fibrous and other waste material carried from the roll. Also heretofore desired vibration or oscillation of the blade has required that an entire relatively heavy carrier means be reciprocated.

By the present invention there is provided a doctor assembly which permits front or transverse as well as lengthwise removal of the doctor blade from the blade carrier, and by which the blade may be oscillated independently of the support means. My invention further provides a doctor mechanism which is simple in design and of light weight but rugged construction, and adapted firmly to support the blade over the full length of the roll, while preserving such flexibility as may be desired for the same. Additionally the doctor blade of the invention is characterized by a freedom from the mentioned jamming or plugging and is speedily and safely demountable without stopping the machine, thus decreasing costly down time and the quantity of defective paper caused by the changing of blades.

In the improved embodiments herein concerned my novel doctor assembly provides more particularly a unique extruded blade holder of universal design and economical construction, and combining also desired weight, strength, and flexibility.

These and other objects of the invention will more fully appear from the following description taken in conjunction with the accompanying drawings, in which like numbers refer to like parts throughout the several views, and wherein:

Fig. 1 is a perspective of one form of the doctor assembly, shown in operative position, with the blade applied to a roll;

Fig. 2 is a front view of the doctor assembly, shown with the blade and holder shifted preparatory to front removal;

Fig. 3 is a vertical section of the doctor assembly, shown with the blade and holder lowered as in front removal;

Fig. 4 is a vertical section of another form of the doctor assembly, shown in the operating position;

Fig. 5 is a vertical section of the doctor of Fig. 4, shown with the holder shifted and rotated to an intermediate demounting position;

Fig. 6 is a section on the line 6—6 of Fig. 4;

Fig. 7 is a vertical section of a further alternative form of the doctor assembly;

Fig. 8 shows one form of the blade retaining means; and

Figs. 9 and 10 illustrate an alternative form of the blade retaining means.

Referring now more particularly to Fig. 1 a representative roll or cylinder of a paper making or the like machine is there indicated in fragmentary outline at R, and a roll cleaning and cleaning doctor blade is shown at 10 in operative engagement therewith. The doctor means or assembly of the invention is seen generally to comprise, in combination with said blade 10, an elongate tubular holder 20 engaging and supporting the blade at the back or rear margin thereof and a housing or carrier 30 supporting the said blade and holder. In accordance with the invention, blade, holder, and carrier 10, 20, 30 are together operatively supported in roll-facing position by a doctor back or support S, which latter may be of any usual or preferred structure and supported for bodily movement toward and from the roll, to present or to throw off the doctor. The doctor support S will be understood generally to be rockable on a through-going or other shaft means (not shown) journaled on the machine side frames or other supporting structure.

My novel doctor will be understood to be adapted to blades 10 of metal, fibre, or plastic composition, as required or preferred for various applications. The roll-engaging blade 10 may be described generally as a thin sheet member uniformly dimensioned and of adequate strength and rigidity for supporting thrust stresses in its own plane, yet having the inherent flexibility both lengthwise and radially of the roll as renders itself-aligning with the doctor surface under operating pressures. My improved doctor is intended further for use with blades of varying thickness, as hereinafter mentioned.

Referring still to the doctor of Fig. 1 the blade holder 20 therein comprises more particularly an elongated, flexible, light weight, tubular member of generally annular cylindrical exterior shape and cross section. In accordance with the invention, the holder 20 has a longitudinal frontial segment shaved off, as at the flatted face 21 and to defined a reduced radius (diameter) through the normally horizontal axis thereof. The holder 20 is interiorly formed with a recess 22 and defines therein a generally parallel entrant portion on lip 23 opening through said front face 21 and of a width reduced from that of the blade with which the holder 20 is intended for use. Said recess 22 is seen further as inwardly enlarged equally above and below said horizontal axis and as affording the holder desired weight, balance, and flexibility. The holder further defines at said recess 22 a rearward merging of generally rounded upper and lower enlarged portions into a central, vertical, straight back portion, Fig. 1.

Those skilled in the art will appreciate that in the form just described the holder 20 of the invention is adapted for manufacture by the extrusion process, and so lends itself to economical uniform construction.

From the foregoing it will be apparent also that suitable deterrent means are provided my novel doctor whereby the blade 10 is retained against forward or lateral removal from the holder 20, comprising in the Figs. 1—3 form engagement of the lug or lip 23 defined by and between the holder face 21 and recess 22 in a longitudinal recess 11 formed in and at the upper or lower face of
the blade 10. This holder lip 23 interfitting blade recess 11 is seen further as spaced from the rear edge of the blade and so as to order the engagement of said rear blade edge with the aforementioned vertical strakes with portion defined at the rear of the holder recess 22 and whereby the holder 20 receives the blade back and affords the desired radial thrust receiving bearing support for the blade 10.

My novel doctor may comprise further cotter pin or the like detent means 12, Fig. 1, through the blade 10 and overlapping the ends of the holder 20 and whereby the blade is normally held against side or longitudinal displacement or removal from said holder 20.

It will be understood that without departing from the invention, the holder 20 may be adapted to receive and support blades of varying construction and thickness. Thus, whether the blade 10 be a steel member of say .030 in. in thickness or a fibre element of say .125 in. the indicated interfitting with the holder of Fig. 1 is readily afforded provided only that the similar thickness is left between groove 11 and the opposite blade face. With this Fig. 1 holder, then, my novel doctor is seen to afford the blade 10 the desired bearing support against radial thrust, while permitting freedom of pivotal or vertical movement such as desired for flexibility of the blade and also adaptability to varying conditions longitudinally of the roll. And the promoting of this desired flexibility and adaptability or flexibility has been indicated as flowing in part from the relatively light weight, tubular holder design earlier described.

Further in accordance with the invention, my improved doctor provides for the plug-in or free mounting and the quick and easy removal of the blade 10, as for replacement or repair, both frontally and transversely of the doctor. Those skilled in the art will readily appreciate that the lateral or frontal entry and removal eliminates the modifying of the machine side frames or equivalent supporting apparatus as hereinafter required in connection with doctors capable only of longitudinal or sidewise blade entry and removal. More particularly, the blade 10 and holder 20 are securely held in the carrier 30 when in the operative position of Fig. 1, but are freed for lateral or sidewise removal therefrom when swung or rotated away from the roll, or downwardly to the position indicated in Fig. 3.

The carrier 30 by which the blade and holder are operatively supported for this front as well as side removal comprises generally an elongated plate member of steel, aluminum or the like material, combining strength, weight, and elasticity as affords it the desired firm support across the roll and whereby it in turn impacts to the blade and said roll the desired uniform pressing action over the full roll width and without sagging, twisting, and the like. The carrier member 30 is defined further and rearwardly by a longitudinal mounting flange or the like means 31 whereby it may be rigidly secured to the back bar or equivalent support means S, and forwardly by the inclined bearing arm 32 which is seen to terminate in a point 33 arranged for biasing engagement against blade 10 preferably along a mid portion thereof. In cooperation with the novel blade-holder design already described, this bearing arm 32 additionally affords the doctor and more particularly the blade and holder bearings desired shielding from the fibre and other waste removed from the roll R, which waste would otherwise serve to jam or plug the doctor.

The blade-supporting carrier 30 comprises further the integrally dependent forwardly hooked rib 34 extending similarly as the flange 31 and arm 32 over the full carrier length and defining a bearing housing or recess 35 open both at the front and at the sides, as for the mentioned frontwise or sidewise entry and removal of the blade and holder, and having the indicated generally rounded contour as supports the cylindrical holder 20 for pivoting or rotation in such front entry and removal.

In accordance with the invention, the bearing recess 35 is herein defined by the radially infacing longitudinal projections or ridges 36, Fig. 1, spaced about and as at the top, bottom, and side wall of the holder recess 22 and whereby the holder 20 is understood to afford the carrier 30 the desired snugly interfitting operative relation with the holder 20 and without requiring the costly closing to close tolerances of the entire recess 35.

Importantly also, there is defined at the bearing recess 35 a longitudinally disposed portion of a width between the upper and lower ridges 36, 36, predeterminedly intermediate the aforementioned vertical and horizontal or major and minor diameters of the holder 20.

Referring now more particularly to Fig. 2 the blade and holder 10, 20 are seen as pivoted in the operative position, there shown in dotted line, and more particularly against the aforementioned downward swinging by detent or the like means 21a projecting at the holder front face 21 and so as to overlie the lower ridge 36 of the carrier housing or recess 35. The blade and holder may be retained also against sidewise, generally from the operative position, Fig. 1, as by cotter pin or the like detent means 37, shown as inserted at the left and removed at the right, Fig. 2, and which means may be received through the carrier 30 and outwardly of and so as to overlie the ends of the holder 20.

For in accordance with the invention of the blade 10 and holder 20, the doctor as a whole is moved out of roll-engaging position by lifting or retraction of the supporting back S, as permitted by the usual pivotal mounting of the latter. Referring now to Fig. 2, the blade 10 and holder 20 are then simply pushed or pulled from the dotted to the solid line position and more particularly to bring the detents 21a into the indicated vertical alignment with the carrier rib recesses 38 which are seen, Figs. 1 and 2, to extend through or remove the lower bearing ridge 36. The blade and holder 10, 20 are then free to pivot or rotate by gravity or otherwise downwardly from the Fig. 1 through the Fig. 2 and to the Fig. 3 position, and more particularly to bring the aforementioned minor holder diameter within the roll-facing entrant opening of the bearing recess 35. It will be readily apparent that the blade and holder may then be withdrawn forwardly therefrom.

If desired, the separation of blade and holder may additionally be effected, as merely by requiring the removal of the detents 12, Fig. 2, and the relative longitudinal sliding of the parts to clear the doctor from the blade recess 11.

In Figs. 4-6 I show another and commercially preferred form of my novel doctor, comprising a blade 40 supported at its rear margin in and by a holder 50. The blade 40 is seen to be retained against front or lateral removal from the holder 50 by the detents 41, Fig. 4. It is aptly aperted also, and similarly as with the Figs. 1-3 form, to receive the cotter pins 42 overlapping endwise, and thus preventing side or longitudinal removal from, the said holder 50.

In the Figs. 4-6 the holder 50 is seen as an elongated flexible light weight tubular member having the generally cylindrical bearing surface 51 and the longitudinal frontal flatted face 52, all similarly as with the holder of Figs. 1-3.

In accordance with the invention, the holder 50 is fashioned as a hollow extrusion, and initially the longitudinal bore or recess 53 is seen as a substantially generally elliptical form, and to afford the holder the desired weight, balance, and flexibility. The holder 50 is defined further and ultimately by the horizontal lengthwise cut 54 made at the flatted face 52, through the recess 53, and into the holder rear wall, as shown. Thus the holder provides a firm seating for the rear longitudinal blade margin, and also embraces the blade generally and provides bearing support of the same forwardly of its said back edge. It will be readily appreciated that the blade back
receiving and seating cut 54 may be of varying width, and to accommodate the particular thickness desired for, and closeness of fit desired about, the blade 40.

Further to the foregoing, the 54 form the carrier 60 comprises generally the similarly elongate plate member as described in connection with Figs. 1–3, and providing a rearward mounting flange 61, a forward blade biasing arm 62, and the integrally dependent rib 63. The rib 63 is seen also as interiorly formed with the cylindrical bearing recess 64 and defines thereat the longitudinal infacing bearing projections or ridges 65. In accordance with the invention, the carrier 60 defines at recess 64, as between said ridges 65, a longitudinal front opening of a width intermediate the vertical and horizontal diameters of the holder 50, and so that without more the same is capable, in the normal operating position, of sliding and also rotation in, but not front removal from, the carrier 60.

Normally, however, the sidewise sliding of the holder 50 in the carrier is prevented, as by the cotter pins 67. Fig. 6, received through the carrier rib 63 and the downward rotation of the holder is prevented by rivets or the like dent means 66 supported through the carrier arm 62 and so as to overlie the holder's flat faced 52.

The holder 50 of Figs. 4–6 seen further to be provided with longitudinal arcuate recesses 55 cut into its superior facing surface 51 and flat faced 52, which recesses 55 are proportioned to clear the carrier mounted locking pins 66.

From the foregoing it will be apparent that the downward of the holder 50 of Figs. 4–6, as for repeat or replacement of the blade 40, is carried out in the similar manner as described for the doctor of Figs. 1–3. More particularly, the carrier 60 is withdrawn from the roll, and the holder 50 shifted from the normal operative or Figs. 4 and 6 positions to that indicated in Fig. 5, or so as to bring the above-mentioned holder recesses into vertical alignment with the carrier mounted locking pins 66.

By the described lateral sliding of the holder 50, then, requiring only the removal of one of the other of the holder retaining pins 67, the said holder 50 is seen to be freed for gravity induced downward rotation and then the front removal.

In the Figs. 4–6 form just described, and also in the other embodiments herein concerned, my novel doctor will be understood to be adapted to applications requiring exceptional flexibility in the doctor blade, and where-in the said blade may be supported, such as by spring or similar means, and as conventional, by separate spring metal or the like plates or fingers engaging its back edge and supported in turn by the holder herein. It will be appreciated that with the doctor of my invention the individual blade supporting fingers may be individually removed and replaced, and without requiring the demounting of the carrier.

From the foregoing it will be appreciated also that the doctor of my invention lends itself to the use of various forms of blade retaining or detent means, and such as requiring minimum modification of the blade structure. Considering now more particularly Fig. 8, wherein I show a relatively thick fibre, plastic, or composition blade 100, the detent means may comprise the rivets 101 received through and alternately projecting at one and the other side of the said blade 100. Variously, where a relatively thin metal blade is preferred, such as indicated at 110, Figs. 9 and 10, the blade retaining detent means may comprise the integral lugs or fins 111 which are seen simply to be struck up from the blade proper. As heretofore noted also, my improved doctor is not required to be specially fitted to a particular detent size or form. And in the preferred form of Figs. 4–6 designing the doctor 40 as a particular desired fit with a blade of a given thickness merely requires that the holder cut 54 be made of appropriate, complementary width.

In Fig. 7 I show yet another embodiment of my novel doctor, wherein the doctor blade 70 is seen to be of uniform dimension and intersected only by the indicated locking pin apertures, this promoting maximum strength and minimum manufacturing cost for the same. Receiving and supporting the blade 70 is a spring metal holder 80 of an open resilient character and generally cylindrical or rounded cross section. It is distinguished curved rearwardly connecting upper and lower wings 81 integrally supported at the front edge of a central blade seating slot or channel 82, which is sized and arranged for sliding reception with blades of different thickness. The blade holder also has a lesser or reduced portion defined by the flattened face 83 and affording it, similarly as with the embodiments heretofore described, a normally horizontal roll-facing minor diameter.

Further, the blade 70 and holder 80 are similarly held against rotation and front removal by the locking pins 71 passed through aligned apertures in the lower wing and channel portions 81, 82 and held in place as by cotter pins.

In the Fig. 7 embodiment my novel doctor comprises further a carrier 90 comprising a rearward mounting flange 91, a forward blade biasing arm 92, and the dependent rib 94 having a generally cylindrical holder receiving recess 95 and presenting a plurality of longitudinally extending ridges or swardly received, the carrier defining at said bearing ridges 96 for firm support of the holder 80. If desired a bearing sleeve 97 may be sprung into place between the ridges 96 and to define therewith a substantially continuous bearing surface for the modified, open, light weight, resilient spring holder 80, here concerned.

It will be readily appreciated that the doctor of Fig. 7 imparts to the blade 70 exceptional adaptability to radial and also longitudinal thrusting or flexing and that upon removal merely of the pins 71 the blade 70 and holder 80 may be withdrawn both frontally and sidewise of the carrier 90, as for replacement or repair, and in the similar fashion as described for the embodiment of Figs. 4 and 5.

From the foregoing description it will be understood that in the improved embodiments herein disclosed my invention provides an improved doctor of simple design and sturdy construction, and wherein the blade and blade holder may be inserted and removed both frontally and laterally of the holder or support. My novel doctor has been disclosed also as providing a holder adapted to blades of varying thickness, and securely and also reassemblably retaining the same with minimum blade fixation. The doctor of the invention is characterized further as advantageously combining desired weight, strength, and flexibility. It is seen still further to be one which protects the blade against accumulation of size, fibres, or the like foreign matter such as otherwise tending to freeze it to the holder. Finally, and in the present embodiment, it is recognized as specially fitted for applications requiring high flexure of the doctor blade, and in which space limitations make blade changing difficult and wherein greater ease and convenience of blade changing is desired.

It will be understood that my invention is not limited to the particular embodiments thereof illustrated and described herein, and I set forth its scope in my following claims:

I claim:

1. In a doctor of the type described, in combination, an elongated blade, an elongated light weight flexible generally cylindrical holder having a flatted front face and a longitudinal recess in said holder face receiving the blade back, detent means carried by said blade and recessed means on said holder and interfering to prevent frontwise removal of the blade from the holder and an elongated carrier, having a cylindrical portion bearing recess in which said holder is rotatably and slidably received, the carrier defining at said bearing recess a front opening proportioned to retain the holder in
operative position and to permit its front removal there-through when rotated to present thereat said flattened face.

2. In a doctor of the type described, in combination, an elongated blade, an elongated light weight flexible generally cylindrical holder having a flattened front face and a longitudinal recess in said holder face receiving the blade back, detent means carried by said holder and recessed means on said blade and interfitting to prevent frontwise removal of the blade from the holder and an elongated carrier having a cylindrical open ended bearing recess in which said holder is rotatably and slidably received, the carrier defining at said bearing recess a front opening retaining the holder in operative position and permitting its front removal there-through when rotated to present thereat said flattened face, and a longitudinally forwardly projecting bearing arm disposed to engage and bias said blade and to seal off said holder in said operative position.

3. In a doctor of the type described, in combination, an elongated blade, an elongated light weight flexible generally cylindrical holder having a flattened front face and a longitudinal recess in said holder face receiving the blade back, and an elongated carrier having a cylindrical open ended bearing recess slidably receiving said holder, the carrier defining at said bearing recess a longitudinal front opening through which said holder is front removable when rotated to present thereat said flattened face, and means associated with said blade back and interfitting with said holder recess whereby the blade is retained against removal frontwise from said holder.

4. The apparatus of claim 2, and detents supported on said blade and engaging said holder and retaining the blade against removal endwise of said holder.

5. In a doctor of the type described, in combination, an elongated blade, an elongated light weight flexible generally cylindrical holder having a flattened front face and a longitudinal recess in said holder face receiving the blade back, detent means carried by said holder and recessed means on said blade and interfitting to prevent frontwise removal of the blade from the holder and an elongated carrier having a cylindrical open ended bearing recess in which said holder is slidably received, the carrier defining at said bearing recess a longitudinal front opening through which said holder is front removable when rotated to present thereat said flattened face, and detent means supported on said carrier and engaging said holder and retaining the holder against removal lengthwise of said carrier.

6. In a roll doctor, an elongated blade having at one end a longitudinal recess; said elongated cylindrical tubular holder having a flattened face and therapeut a longitudinal recess, the holder walls including said recess defining an entrant portion interfitting said blade recess, an inwardly enlarged portion defining the holder weight, balance and flexibility and a vertical straight back portion supportingly engaging the back; an elongate carrier having a cylindrical open end at its front and ends and rotatably and slidably receiving said holder, the carrier recess front opening proportioned to pass said holder only when rotated to bring therewithin said flattened face and longitudinally forwardly projecting bearing arm disposed to engage and bias said blade and to seal off said holder in operative position, and detent means on said holder and engaging said carrier for preventing rotation of the holder from said operative position.

7. A roll doctor according to claim 6 wherein said detent means comprise projections on said flattened blade segment, and detent receiving formations recessed in said carrier and longitudinally displaced from the normal position of said holder projections, whereby said holder may be rotated only when shifted to align said projections and recesses.

8. A roll doctor according to claim 7 and detent means removably supported on said blade and engaging said holder to retain the blade the shifting of said holder.

9. A roll doctor according to claim 3, and longitudinal bearing ridges spaced around said cylindrical holder and having bearing engagement with said holder.

10. A doctor according to claim 9, and longitudinal bearing ridges spaced around said holder and longitudinally displaced from the normal position of said holder projections and whereby said holder may be rotated only when shifted to align said projections and recesses.

11. A doctor according to claim 10 and detent projections on said carrier and normally overlying said flattened face, and detent receiving formations recessed in said holder and longitudinally displaced from the normal position of said holder projections and whereby said holder may be rotated only when shifted to align said projections and recesses.

12. A doctor according to claim 11 and detent means removably supported on said carrier and engaging said holder to prevent the lengthwise shifting of said holder.

13. A doctor according to claim 6, and longitudinal infacing ridges spaced around said carrier recess and having bearing engagement with said holder.

14. In a doctor of the type described, in combination, an elongated blade, an elongated light weight flexible generally cylindrical holder having therethrough a longitudinal bore interfitting said detent means and a flattened face having a parallel lengthwise cut embracing said blade, the holder walls defining said cut recessing also the rear wall of said bore and there seating snugly the blade back; and an elongated carrier having a longitudinal cylindrical end and front opening bearing recess slidably and rotatably receiving said holder, the recess front opening proportioned for front removal of the holder only when said holder is rotated to bring said flattened face within said recess.

15. In a doctor of the type described, in combination, an elongated blade, an elongated light weight flexible generally cylindrical holder having a flattened front face and a longitudinal recess in said holder face receiving the blade back, an elongated cylindrical holder having therethrough a longitudinal bore interfitting said detent means and a flattened face having a parallel lengthwise cut embracing said blade, the holder walls defining said cut and recessing the rear wall of said bore and there seating snugly the blade back; and an elongated carrier having a longitudinal cylindrical end and front opening bearing recess slidably and rotatably receiving said holder, the recess front opening proportioned for front removal of the holder only when said holder is rotated to bring said flattened face within said recess.

16. In a roll doctor according to claim 13, and detent means removably on said carrier and engaging said holder to prevent said holder shifting the holder.

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CERTIFICATE OF CORRECTION

Patent No. 2,972,767

Richmond W. Smith

February 28, 1961

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 8, line 58, after "removably" insert -- supported --.

Signed and sealed this 12th day of September 1961.

(SEAL) Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents
USCOMM-DC