Feb. 28, 1961 R. W. SMITH 2,972,767

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

Filed Jan. 27, 1956 2 Sheets-Sheet 1

Fig. 1.

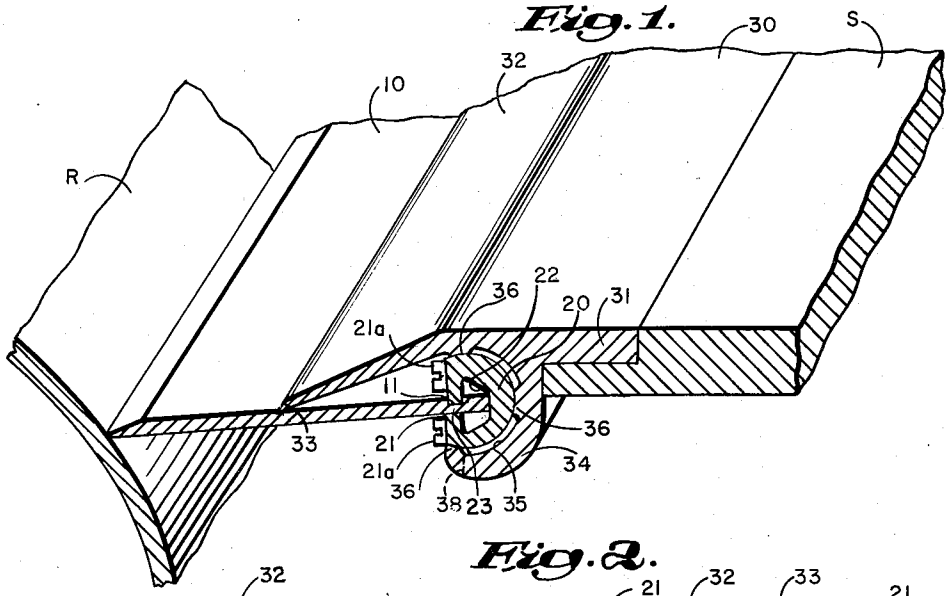


Fig. 2.

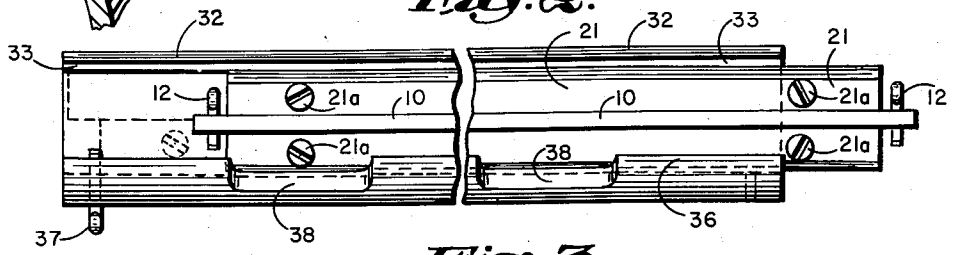
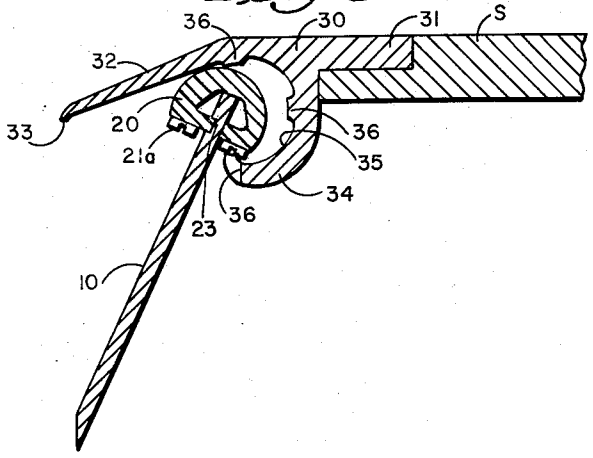


Fig. 3.



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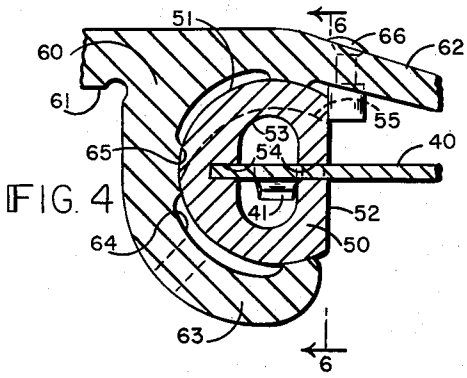


FIG. 4

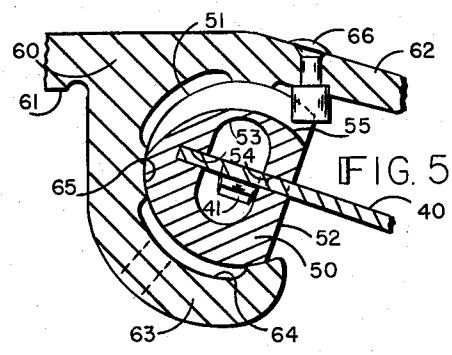


FIG. 5

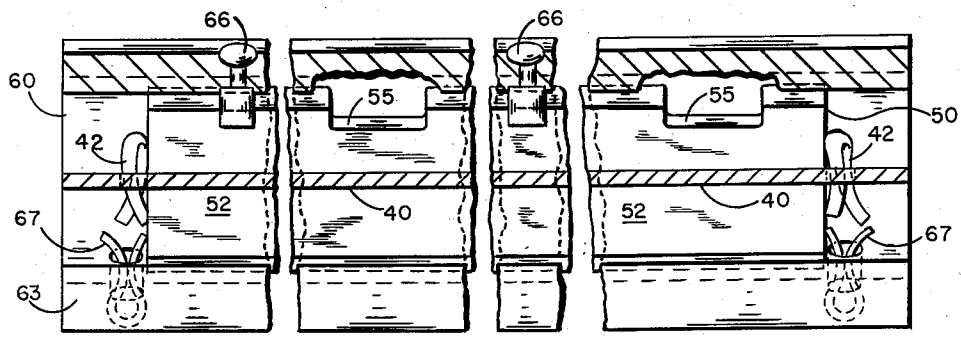


FIG. 6

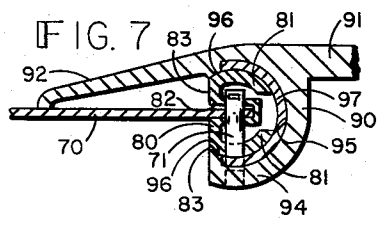


FIG. 7

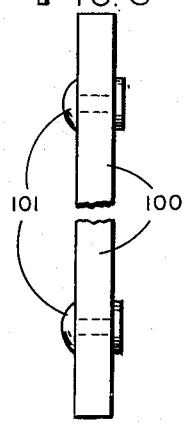


FIG. 8

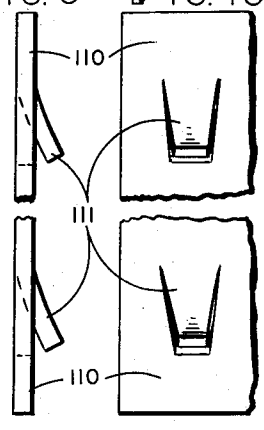


FIG. 9 FIG. 10

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2,972,767

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

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Filed Jan. 27, 1956, Ser. No. 561,845

16 Claims. (Cl. 15—256.5)

This invention relates generally to paper and other sheet material manufacture 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 copending 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 drawing, 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 clearing 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 inventoin, 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 throughgoing or other shaft means (not shown) journalled 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 it self-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 frontal 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 thereat 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 detent 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 straight wall 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. 2, received 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 surface. And the promoting of this desired blade adaptability and 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 plugging-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 heretofore 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 frontwise 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 and 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 margin or lip **33** arranged for biasing engagement against blade **10** preferably along a mid portion thereof. In co-operation 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 and 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 rear wall of the same. The ridges **36** will be understood to afford the carrier **30** the desired snugly interfitting operative relation with the holder **20** and without requiring the costly finishing to close tolerances of the entire recess **35**.

Importantly also, there is defined at the bearing recess **35** a longitudinal frontal opening of a width, as 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 retained in the operative position, there shown in dotted line, and more particularly against the aforementioned downward swinging by detent or the like means **21***a* 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 shifting laterally 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 inspection, repair, or replacement 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 **21***a* 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 from said carrier recess **35**. 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 holder 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 apertured 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 form 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 with the longitudinal bore or recess **53**, which is seen to be of a 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 **40** for desired 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 Figs. 4–6 doctor form, the carrier **60** comprises generally the similarly elongated 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 detent means **66** supported through the carrier arm **62** and so as to overlie the holder's flatted face **52**.

The holder **50** of Figs. 4–6 is seen further to be provided with longitudinal arcuate recesses **55** cut into its upper bearing surface **51** and rearwardly from its front flatted face **52**, which recesses **55** are proportioned to clear the carrier mounted locking pins **66**.

From the foregoing it will be apparent that the demounting of the holder **50** of Figs. 4–6, as for repair 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 wherein the said blade may be supported, for the desired greater flexure, 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 holder **50** for 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 interrupted 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 by curved rearwardly projecting 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 flatted 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 thereat the longitudinal 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 construtcion, 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 releasably retaining the same with minimum blade modification. 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 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 proportioned to retain the holder in

operative position and to permit its front removal therethrough when rotated to present thereat said flatted face.

2. 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 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 therethrough when rotated to present thereat said flatted face, and a longitudinal 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 flatted 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 flatted 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 flatted 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 flatted 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 face a longitudinal recess; a generally cylindrical tubular holder having a flatted face and thereat 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 supportively engaging the blade back; an elongate carrier having a cylindrical recess open 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 flatted holder face, a longitudinal 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 flatted holder 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 carrier recess and having bearing engagement with said holder.

10. A doctor according to claim 3 and detents supported on one and engaging the other of said blade and holder to retain the blade against removal sidewise of said holder.

11. A doctor according to claim 3 and detent projections on said carrier and normally overlying said flatted 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 having detent means projecting at one longitudinal face, an elongated light weight flexible generally cylindrical holder having therethrough a longitudinal bore interfitting said detent means and a flatted 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 flatted 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 flatted front face and a longitudinal recess in said holder face receiving the blade back, 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 formed with a front opening proportioned to retain the holder in the normal roll-contacting position and to permit its front removal therethrough when rotated to present thereat said flatted face, detent projections on said carrier and engaging said holder to prevent downward rotation of the holder, and detent receiving formations recessed in said holder, said formations longitudinally displaced from the normal position of said projections, whereby said holder may be so rotated only when shifted to align said projections and recesses.

16. A roll doctor according to claim 15, and detent means removably on said carrier and engaging said holder to prevent said shifting of the holder.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,972,767 February 28, 1961

Richmond W. Smith

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