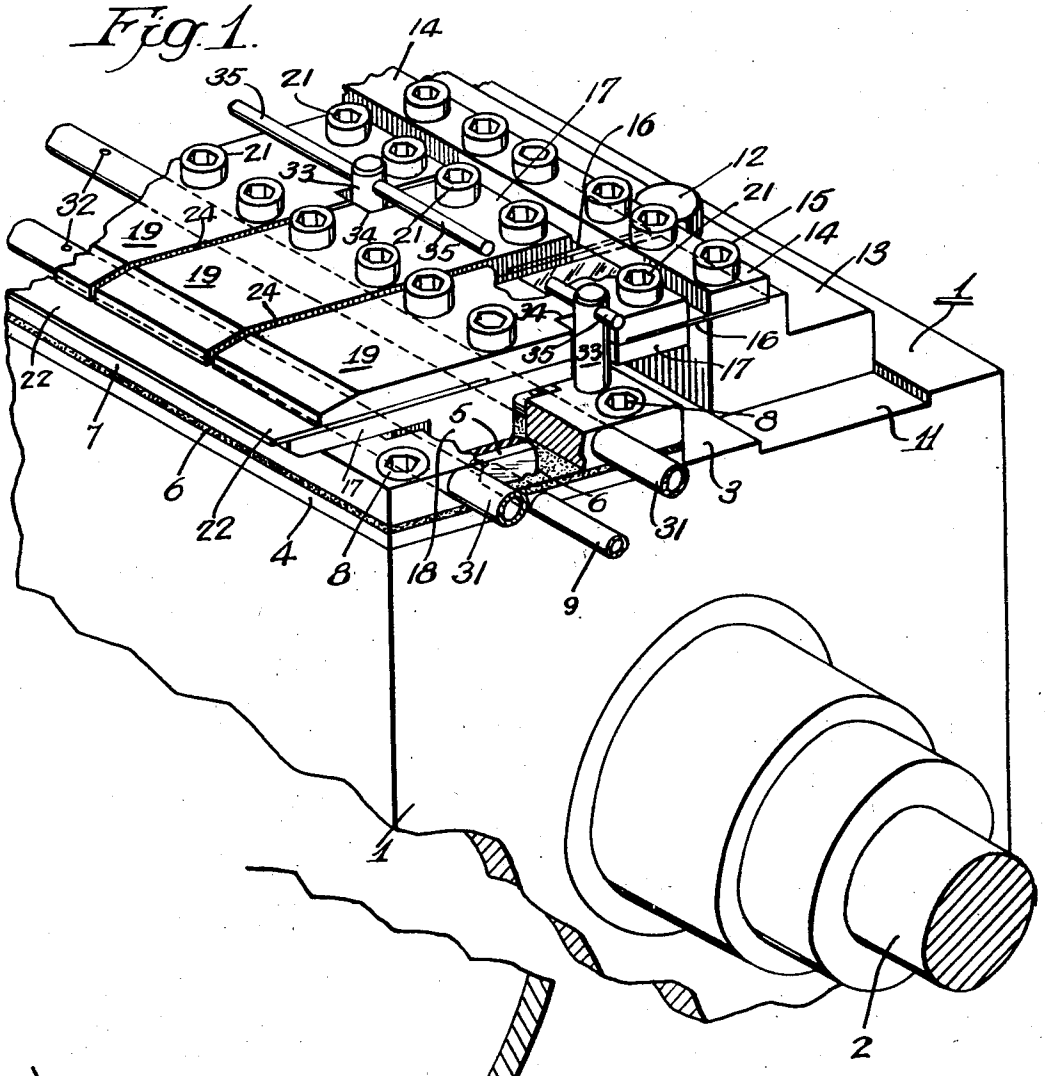
July 13, 1948. J. R. CURTIS, JR 2,445,135

DOCTOR HOLDER

Filed Dec. 18, 1944

3 Sheets-Sheet 1

Fig. 1.



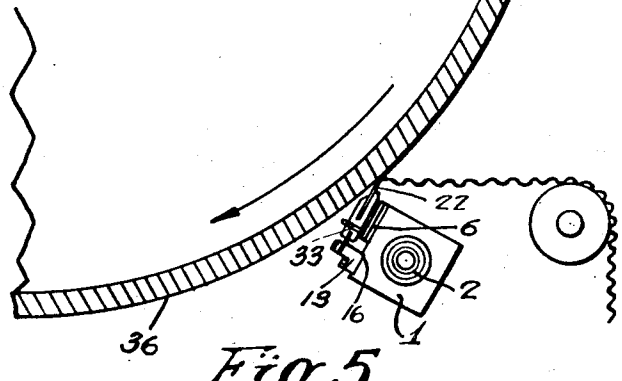


Fig. 5.

Inventor:—
John R. Curtis Jr.
by his Attorneys
Howson & Howson

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Filed Dec. 18, 1944 3 Sheets-Sheet 2

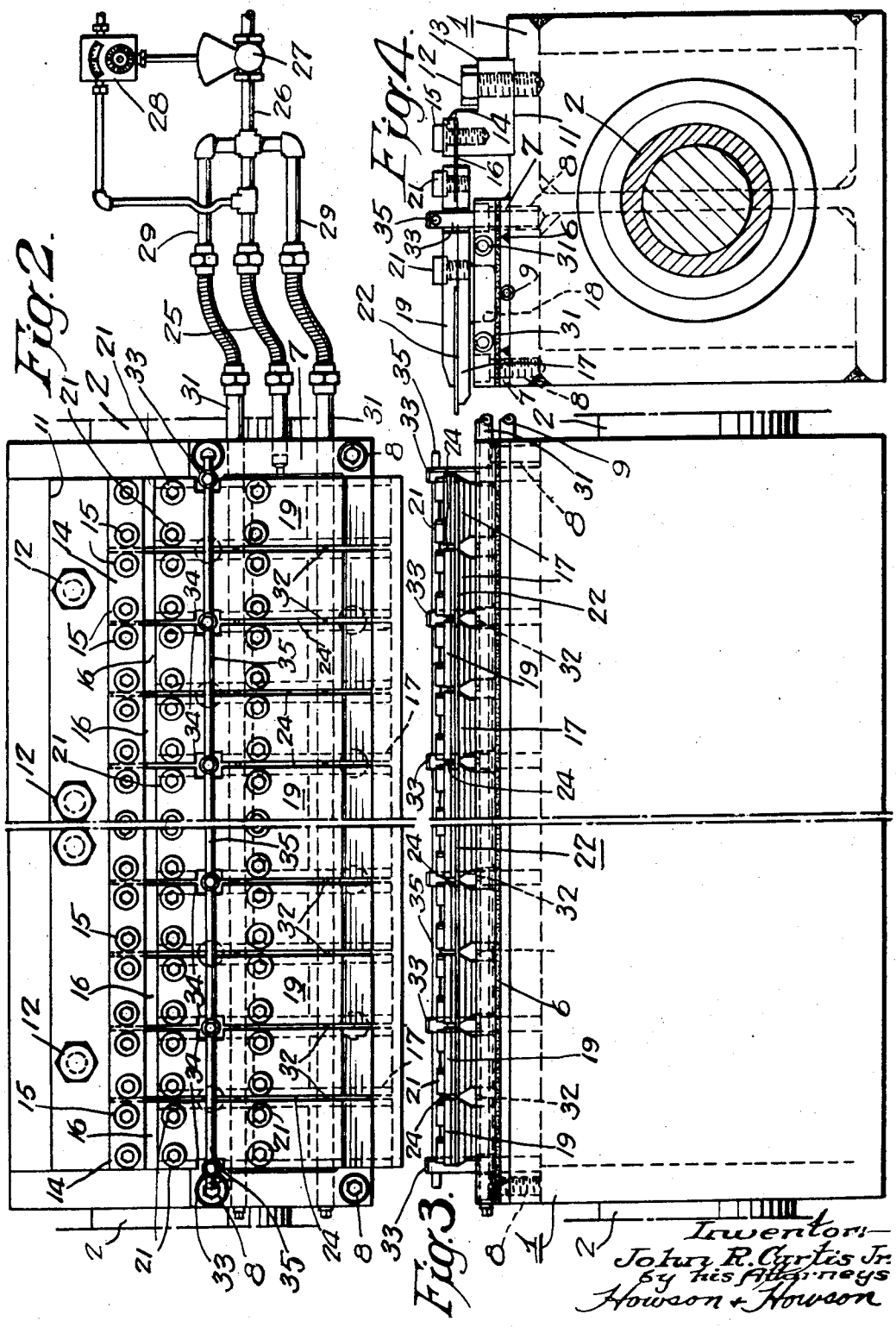


Fig. 2.

Fig. 4.

Fig. 3.

Inventor—
John R. Curtis Jr.
by his Attorneys
Howson & Howson

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Filed Dec. 18, 1944 3 Sheets-Sheet 3

Fig. 6.

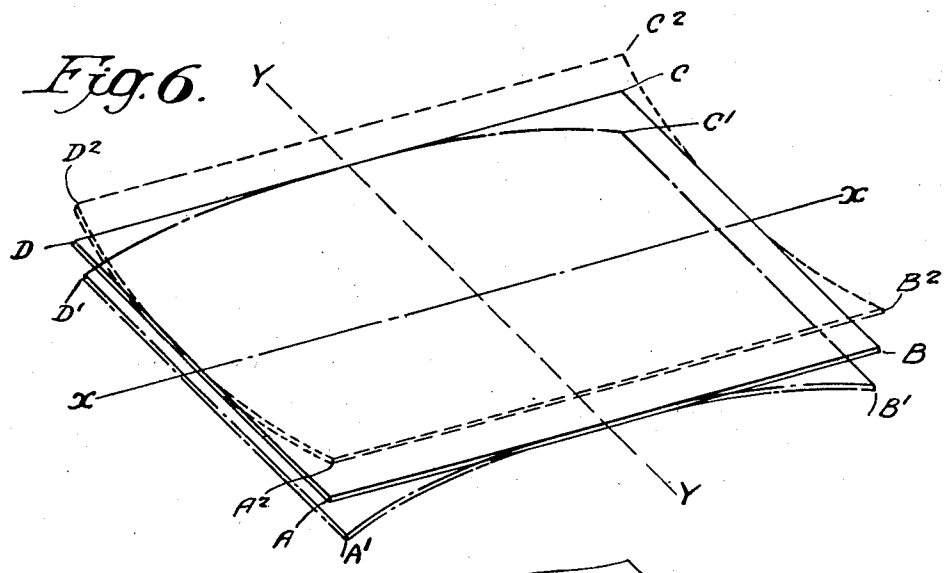
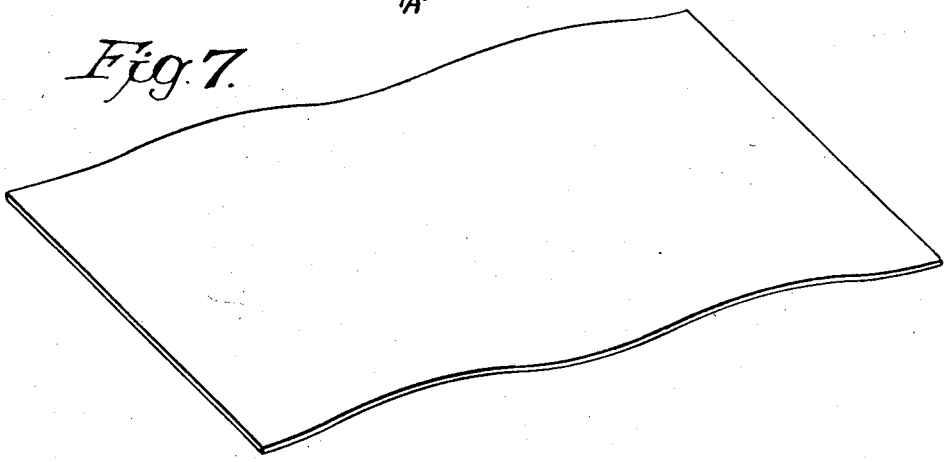


Fig. 7.



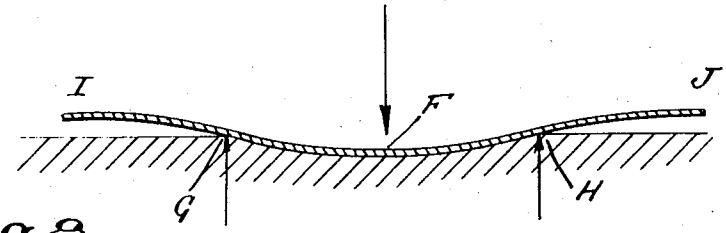


Fig. 8.

Inventor:—
John R. Curtis Jr.
by his Attorneys
Howson & Howson

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2,445,135

UNITED STATES PATENT OFFICE

2,445,135

DOCTOR HOLDER

John R. Curtis, Jr., Norwood, Pa., assignor to Scott Paper Company, Chester, Pa., a corporation of Pennsylvania

Application December 18, 1944, Serial No. 568,769

4 Claims. (Cl. 92—74)

1

This invention relates to improvements in doctor assemblies, and more particularly in the construction and mode of operation of the holder for the doctor blade.

A principal object of the invention is to provide a holder which will afford substantial uniformity of pressure between the edge of the blade and the surface with which the blade coacts, said uniformity being maintained irrespective of minor irregularities in said surface and abnormalities of contour.

Another object of the invention is to provide a holder having the characteristics of structural simplicity; absence of wearing parts and close fits; flexibility; accurate control of the pressure of the blade against the coacting surface; and maintenance of a most favorable angle between the blade and said surface.

The conventional method of creping paper of the type, for example, used for towels and toilet tissues, is to scrape the web from the surface of a revolving drum by means of a doctor blade. This blade takes the form of a thin resilient strip, one edge of which is held in angular contact with the said surface so as to remove the sheet material adhering to the latter. In the use of a doctor in this manner for the creping of papers, several factors of operation assume importance.

Papers of the class mentioned above are usually manufactured on a "Yankee" machine at relatively high speeds, and the creping process is carried out on the "Yankee" drier, a highly polished drum some 10 ft. to 12 ft. in diameter. Up to the present time it has not been practicable due to manufacturing limitations, to provide a drier of this class which will maintain an absolutely uniform creping surface. Generally, the surface develops a number of high and low spots, radial eccentricities and circumferential grooves which, although slight, may have an appreciable adverse effect on the creping process, on the rate of deterioration, and on the durability of the surface finish. To obtain a high quality crepe it is necessary that the doctor be held in uniform intimate contact throughout its length with the drier surface and it must, therefore, be capable of flexing to conform to the aforesaid irregularities of surface and contour. If this contact is not provided, not only is the uniformity of crepe adversely affected, but accumulation of corrosion products on the low spots of the drier surface will impair the surface polish and accelerate wear.

The contact pressure of the blade should be kept to a minimum and should be distributed as uniformly as possible over the entire length of the blade. This is important both to reduce wear and to insure that such wear as occurs will be uniformly distributed over the drier surface and along the blade.

2

It has been found also that the creping process is affected to some degree by the angle at which the blade contacts the drier surface, this angle being measured between the plane of the blade at the contact edge and a plane tangent to the drier surface at the line of contact. It is desirable, therefore, to hold and support the blade in a manner which will maintain the proper angle under all operating conditions.

The invention will be more readily understood by reference to the attached drawings wherein:

Figure 1 is a fragmentary view in perspective of a doctor holder made in accordance with my invention;

Figures 2, 3, and 4 respectively are top plan, front elevational, and side elevational views of the holder;

Figure 5 is a fragmentary view illustrating the normal relation of the holder and doctor to the surface of the associated drum from which the paper web is removed in the creping operation, and

Figures 6, 7, and 8 are diagrammatic perspective and sectional views illustrating the mode of operation of a doctor made in accordance with the invention.

With reference to the drawings, the doctor holder forming the subject of the invention may comprise a substantially rectangular frame or body member 1 having trunnions 2—2 at the opposite ends thereof through the medium of which the holder may be mounted for pivotal adjustment about a longitudinal axis and in a manner providing for reciprocation of the holder parallel to said axis. The body member 1 has at the top a flat surface 3 and to this surface are attached elements which form a rectangular enclosure 4, said enclosure extending the entire length of the frame and defining the sides of a pressure chamber 5, the upper wall of which is formed by a flexible diaphragm 6. The edges of this diaphragm are clamped solidly against the upper surface of the enclosure 4 through the medium of a superimposed rectangular clamping frame 7 which is detachably secured in place by means of screws 8. Fluid pressure may be applied to the chamber 5 through a duct 9 which extends through one wall of the chamber.

Secured within a longitudinal recess 11 in the upper surface of the body member 1, by means of screws 12, is a bar 13, said bar extending the

full length of the body member and having at the top thereof a clamping plate 14 which functions through the medium of screws 15 to clamp to the bar 13 the rear ends of a series of flexible elements 16. These elements 16, which extend in closely arranged series over the entire length of the bar 13, are clamped at their opposite ends and respectively to the rear ends of a plurality of fingers 17 which extend forwardly over the top of the pressure chamber 5, and which have each a depending portion 18 seated upon the diaphragm 6. Each of the fingers 17 has a superimposed clamping plate 19, which is secured to the associated finger by screws 21 so as to clamp the forward end of the associated element 16 previously described, and which serves also as a retainer for the doctor blade 22. As illustrated the forward end of the plate 19 is recessed so as to form a slot between the plate and the finger for reception of the said blade, and the slot is dimensioned so as to provide a close but free fit for the blade permitting longitudinal expansion of the blade and facilitating insertion and removal of the blade in the holder.

In the aforedescribed construction, it is to be noted that each of the fingers 17 with its clamping plate 19 is attached by means of a separate flexible element 16 to the bar 13, and that while the fingers are thus independently flexibly supported in the holder, they constitute together a common support for the resilient doctor blade 22. As illustrated, there is a narrow clearance between the sides of the adjoining fingers as indicated at 24, and these clearances are sufficient to slight relative angular movements of the fingers about longitudinal axes thereof, said movements being permitted by the flexible elements 16.

In practice, compressed air or other fluid pressure is applied to the chamber 5 through the duct 9, which duct may be connected by way of a flexible tube 25 and a pipe system 26 to a suitable source of said pressure. This system may be supplied with a control valve 27 including a gage and pressure regulator 28 to maintain a selected pressure within the chamber 5. Such instruments are well known and readily available commercial articles and require no detailed description herein. When air is used as the fluid medium the system may further comprise branch ducts 29 which are connected to conduits 31—31, said conduits extending longitudinally of the holder in the space immediately above the diaphragm 6, and being provided with nozzle perforations 32 through which pressure air is directed into the spaces between the fingers 17 both forwardly and rearwardly of the pads 18. It is the function of this air to cool the assembly and keep it clear of dirt and dust accumulations which might interfere with free movement of the fingers.

It will be apparent that pressure in the chamber 5 in excess of atmospheric will tend to expand the diaphragm and to elevate the fingers 17, such movement of the fingers being afforded by the flexible connectors 16 at the rear ends of the fingers. In order to limit this movement of the fingers 17 under expansion of the diaphragm 6, the enclosure 7 is provided at the top with a plurality of posts 33 which extend upwardly through complementary recesses 34 in the adjoining sides of the finger elements 17 and which support a rod 35 which overlies the fingers and limits their upward movement under the action of the expanding diaphragm. This rod serves also to line up the series of fingers to facilitate insertion of a new blade.

In association with a drum or drier, the holder is mounted as illustrated in Figure 5, a fragmentary portion of the outer cylindrical shell of the drum or drier being indicated by the reference numeral 36. With the chamber 5 under pressure as described above and the fingers 17 extended to the limit established by the rod 35, the body member 1 is turned on its trunnions to bring the projecting forward edge of the blade 22 into pressure contact with the surface of the drum at an angle to said surface calculated to afford the most efficient results and is held in this position by jack or torsional loading means well known in the art. The contact pressure between the blade and the drum surface is sufficient to force the fingers 17 away from and clear of the rod 35. The blade 22 is then held against the surface of the drum under a pressure corresponding to the fluid pressure within the chamber 5 as indicated on the gauge 28. Since the fingers 17 are separately and resiliently mounted in the holder, they are susceptible to independent self adjustment under the influence of flexure in the blade 22 so that the blade is free to accommodate itself to the aforedescribed irregularities of surface and contour. Such flexure of the blade will however, entail no modification of the pressure exerted by the blade upon the drum surface which pressure will remain theoretically uniform throughout the length of the blade.

This function of the device to maintain uniform pressure can be better understood by reference to Figures 6, 7, and 8 of the drawings. To permit the blade to conform to irregularities in the drum surface, it is necessary that the blade have resilience both along the length of the blade and radially from the drum surface. In Figure 6 a longitudinal section of a doctor blade is indicated by the letters A, B, C, and D, the longitudinal axis of the blade being indicated by X—X and the transverse axis by Y—Y. Assuming that the blade is flexed in the longitudinal direction along the Y—Y axis into the form represented by A', B', C', and D', the blade is stiffened against flexure on longitudinal lines paralleling the X—X axis; and conversely if the blade is flexed in the transverse direction on the X—X axis to the form represented by A^2, B^2, C^2, and D^2, it will be stiffened against flexure on transverse lines paralleling the Y—Y axis. It will be apparent that although resilient, the blade cannot be flexed freely along both axes simultaneously, as would be necessary in order to provide the required resilience in two directions by action solely of the blade.

The conventional doctor mountings flex the blade against the drum in the manner illustrated by A^2, B^2, C^2, and D^2, in order to attain the required resilient pressure contact. The contact edge AB, thereby stiffened against flexure along lines parallel to the Y—Y axis, will not readily follow surface irregularities, but will tend instead to bridge across the depressions and subject the elevations to excessive contact pressure. If this stiffening effect is to be avoided, the blade must not be flexed on a longitudinal axis, that is to say in the transverse direction, and some external means must be provided for attaining resilient pressure contact. Attempts have been made to utilize forms of springs and hydraulic or pneumatic means to supply the required loading but while the prior devices may provide an external source of pressure, they do not insure

that the longitudinal flexing, that is flexure on a line paralleling the Y—Y axis shall be uniform across the entire width of the blade. In a majority of cases, the rear edge of the blade is held straight and the loading force is applied on a line or over a limited area near the working edge. Thus, while the contacting or working edge AB attempts to follow irregularities in the drum surface, the edge CD will remain straight. The blade is, therefore, not flexed freely and the resulting stiffening is reflected in uneven pressure contact.

The present invention, by providing a series of support elements which closely support the blade across substantially its entire width, parallel, that is, to the Y—Y axis, precludes flexure of the blade on the X—X axis. The pressure applying means, in flexing the blade to follow irregularities, applies its force through these elements evenly across the blade and produces a uniform longitudinal wave as illustrated in Figure 7. Since the blade offers the least resistance to flexing when bending is limited to one axis, the bridging effect and consequent excessive pressure on high spots is minimized.

Another effect of flexing the blade into hollows in the surface is illustrated diagrammatically in Figure 8. When a force is applied at F to bend the blade into a hollow between high spots G and H, the inherent stiffness of the blade tends to relieve the pressure at I and J. Since this effect is a factor of the stiffness of the blade and since the present invention contemplates flexure of the blade in the manner of least resistance, this effect is also minimized.

A further advantage of the blade holding means of this invention arises from the fact that the blade is supported almost entirely across its width so that the transverse elements of the blade remain straight irrespective of pressure. It is apparent that if the blade is flexed transversely as in the conventional holder, the creping angle will vary as the blade is subjected to more or less pressure in loading or in following the irregular contour of the drier. With a holder made in accordance with the present invention, even though the blade is flexed longitudinally, the creping angle remains constant.

In the aforedescribed assembly, it will be apparent that the function of the radial movements of the blade required for conforming to the roll or other surface is divorced from the blade itself and is imposed upon the flexible elements 16, which preferably are composed of spring steel or other resilient material. Another function of the elements 16 is to provide for the torsional movements of the fingers 17, that is to say, movements of these fingers about their own longitudinal axes, which are required when the blade is flexed longitudinally. Such torsional movements are permitted by the clearances 24 between the fingers, it being understood that irregularities of surface such as herein referred to are extremely shallow and extend over areas embracing several of the fingers.

The invention provides a doctor assembly of high efficiency and which by reason of the functional characteristics recited above largely avoids undesirable localized frictional wear upon the associated creping surface. The assembly is well adapted to afford accurate conformation of the blade to circumferential grooves in a creping roll surface during longitudinal reciprocational movements of the blade.

I claim:

1. In a doctor assembly, an adjustable body structure, a flexible blade, a plurality of rigid blade-carrying elements arranged in series longitudinally of said structure, said elements backing the blade on both faces to an extent precluding any material flexure of the blade in the transverse direction and being spaced apart to afford freedom for limited relative angular movements and thereby provide for flexure of the blade in the longitudinal direction, means in said structure for exerting uniform pressure on said elements tending to displace the elements simultaneously and in a common direction as a unit, said pressure means forming a flexible seat for the elements in the body structure, and flexible means for anchoring said elements to the body structure.

2. In a doctor assembly, an adjustable body structure, a flexible blade, a plurality of rigid blade-carrying elements arranged in series longitudinally of said structure, said elements backing the blade on both faces to an extent precluding any material flexure of the blade in the transverse direction and being spaced apart to afford freedom for limited relative angular movements and thereby provide for flexure of the blade in the longitudinal direction, a flexible diaphragm forming a common seat for said elements in the structure, means for applying fluid pressure to said diaphragm thereby to exert a uniform pressure to the said elements tending to displace the entire series simultaneously as a unit, and flexible means for anchoring said elements to the body structure.

3. A doctor assembly according to claim 1 wherein the blade is seated in aligned slots in the several carrying elements and is left free in said slots for longitudinal expansion and contraction.

4. A doctor assembly according to claim 2 wherein the said anchoring means takes the form of a plurality of leaf springs individually connecting the elements to the structure.

JOHN R. CURTIS, JR.

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