

Nov. 14, 1933.

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1,935,164

CALENDER DOCTOR ASSEMBLY

Filed Jan. 9, 1931

3 Sheets-Sheet 1

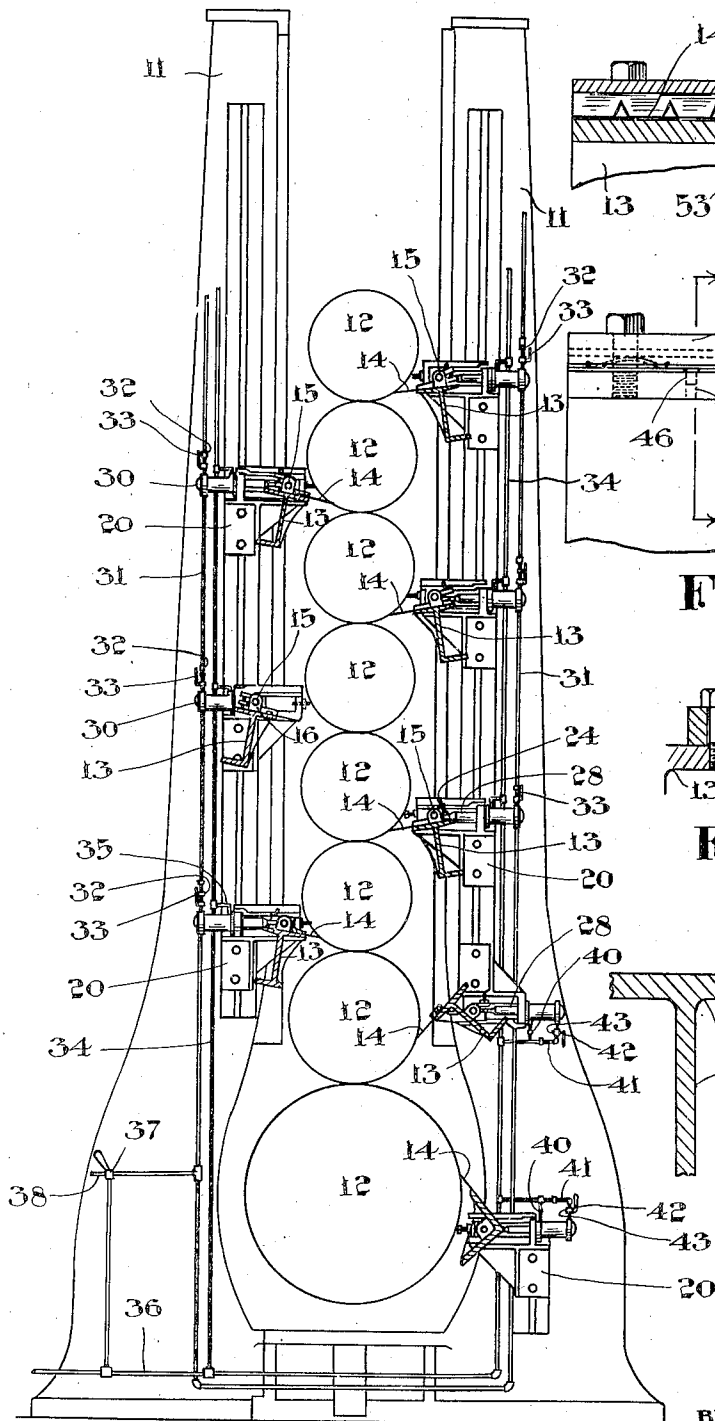


FIG. 1

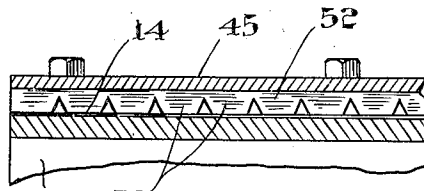


FIG. 9

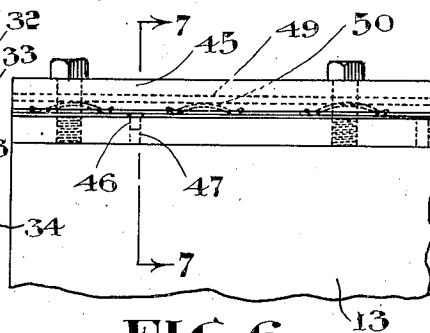


FIG. 6

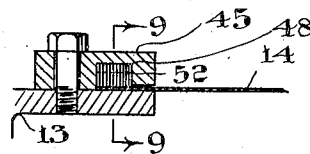


FIG. 8

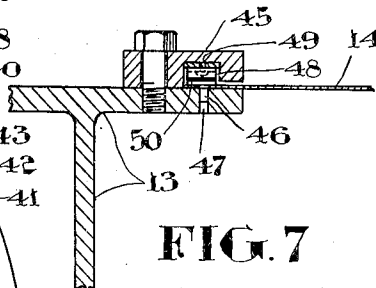


FIG. 7

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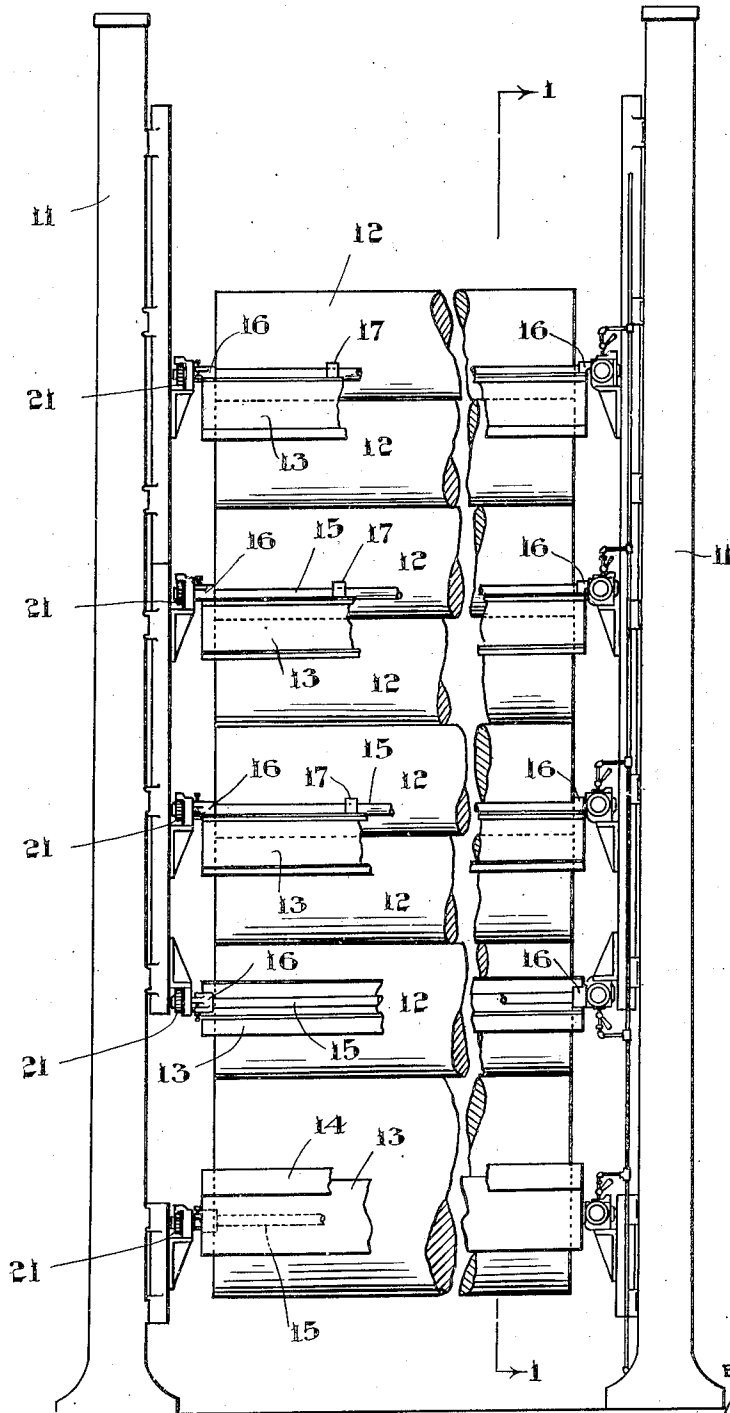
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3 Sheets-Sheet 2



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CALENDER DOCTOR ASSEMBLY

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3 Sheets-Sheet 3

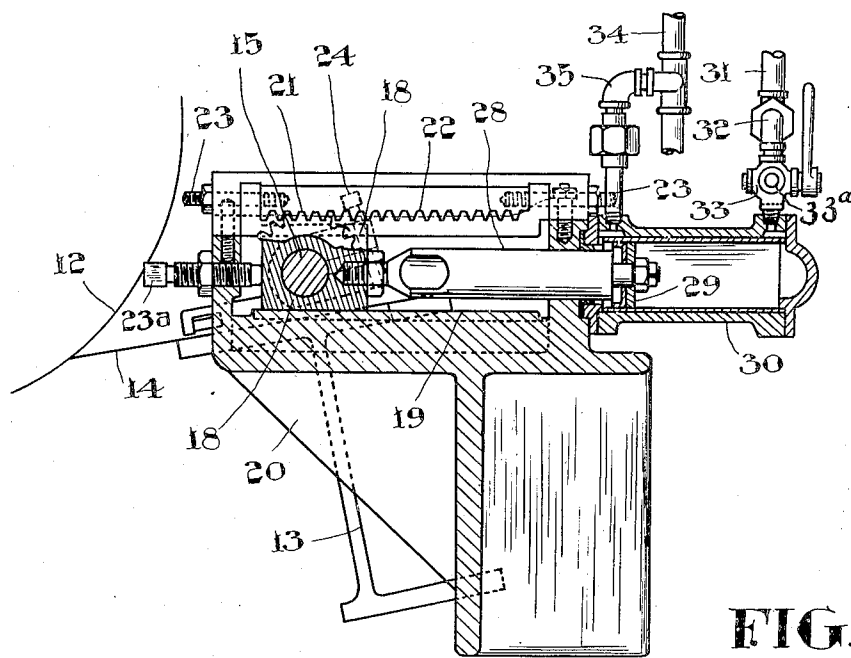


FIG. 3

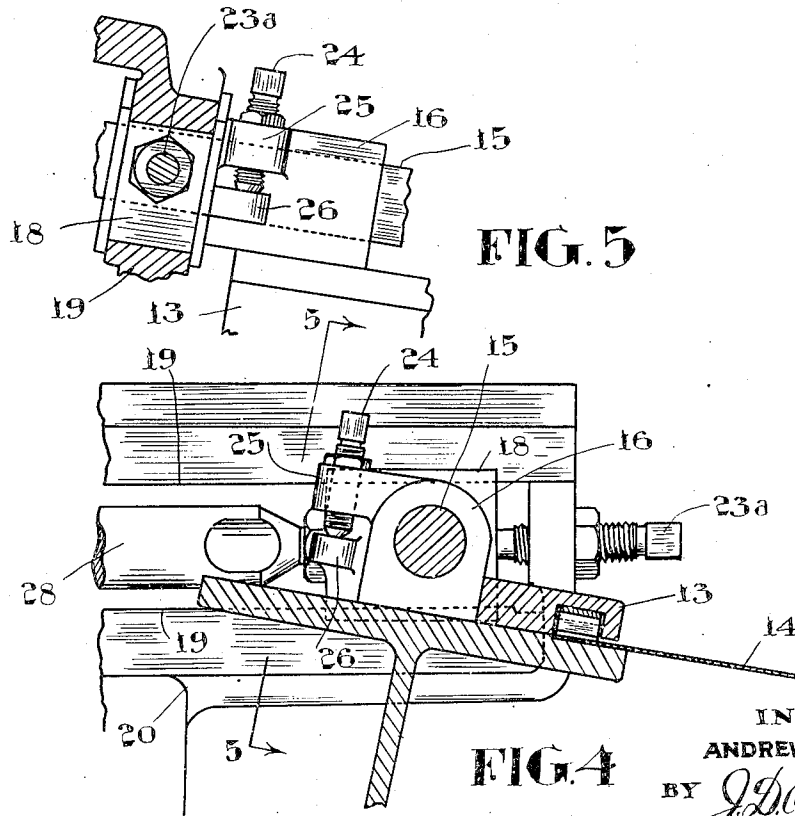


FIG. 5

FIG. 4

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CALENDER DOCTOR ASSEMBLY

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21 Claims. (Cl. 92—74)

This invention relates to a doctor assembly for general use in connection with rolls or cylinders over which a web of paper or other material is passed during manufacture or treatment thereof. More specifically the invention aims to provide a doctor assembly particularly adapted for use on paper calender machines of the stack roll type.

One of the principal objects is to provide for withdrawal of the doctors to a retracted position sufficiently remote from the rolls to eliminate the difficulties usually caused by wads of paper or other accumulations on the roll surfaces coming in contact with the doctor blades. To this end the doctors are withdrawn from contact with the rolls a distance sufficient to leave a clearance of about 4" between the roll surfaces and the operative edges of the doctor blades.

Another very important object is to provide a thin flexible doctor blade mounted to have a high co-efficient of local flexure so that the edge of the blade in contact with the surface to be doctored is remarkably free to adjust itself to irregularities occurring on said surface.

A further and more specific object is to provide novel doctor mounting and controlling means whereby rectilinear movement, preferably in a horizontal plane, is imparted to the doctors during positioning thereof with reference to the roll surface, suitable provision being made to maintain the doctors at all times parallel with the roll surface and the extent to which the operative edges of the doctor blades are withdrawn from contact with the rolls by the controlling means being predetermined to leave a degree of clearance impossible to obtain by normal operation of any of the doctor controlling mechanisms now in use.

A still further object is to provide for individual or group operation of the doctors through the agency of a differential pressure device associated with each doctor, the group operation of the doctors being controlled by a single main valve common to a plurality of the pressure devices and the individual operation of the doctors being controlled by a further valve associated with each individual pressure device.

Figure 1 is a transverse sectional view of a calender equipped with my improved doctor assembly, this view being taken substantially along the line 1—1 of Figure 2.

Figure 2 is a side view, with a part broken away, of the assembly appearing in Figure 1.

Figure 3 is an enlarged detail sectional view showing the manner of mounting certain of the

doctors and the fluid operated pistons assembled therewith.

Figure 4 is a view of the opposite side of certain of the elements appearing in Figure 3.

Figure 5 is a fragmentary detailed sectional view taken along the line 5—5 of Figure 4.

Figure 6 is a fragmentary front edge view of the doctor proper showing one method of mounting the doctor blade on the doctor body.

Figure 7 is a transverse sectional view taken substantially along the line 7—7 of Figure 6.

Figure 8 is a view similar to Figure 7 but showing a slight modification.

Figure 9 is a longitudinal sectional end view taken along the line 9—9 of Figure 8.

Referring more particularly to the drawings, 11 designates the frame of a conventional calender equipped with the usual arrangement of calender rolls 12. The present invention, as applied to this type of calender, contemplates no radical changes in the general arrangement of the doctors with respect to the calender rolls but is chiefly concerned with certain improvements in the construction and operation of the doctors.

According to this invention, each doctor includes a body 13 equipped with a flexible doctor blade 14 attached to said body in a particular manner hereinafter described. When the doctors are in their operative positions, the blades 14 are arranged to engage the roll surfaces to be doctored as shown to advantage in Figure 1.

All of the doctors are mounted for sliding movement to and from the roll surfaces to be doctored and are also capable of vertical swinging movement as hereinafter described. Each doctor body is swingably connected to a shaft 15 by means of suitable end and intermediate shaft receiving bearings appearing at 16 and 17, the shaft being rotatable in these bearings. The end portions of the shaft are rotatably carried in a pair of slide bearings 18 arranged to slide in slotted guides 19 forming part of the brackets 20 attached to the sides of the calender frame. The extreme ends of the shaft 15 project beyond the slide bearings 19 and are equipped with pinions 21 meshing with short racks 22 slidably associated with the guides 19. The racks are adjustable through the medium of the screws 23 and co-operate with the pinions 21 to position the opposite ends of the shaft 15 when aligning the doctor with reference to the roll surface to be doctored. Adjustable stop screws 23a are carried by the inner ends of the guides 19 for engagement with the slide bearings 19 to limit

and adjust the forward operating position of the doctor. A further adjusting screw 24 is threaded through a lug 25 on each of the end bearings 16 and bears against a lug 26 on the adjacent slide bearing 18. When the doctor blade 14 is withdrawn from engagement with the calender roll these screws 24 serve to limit gravity tilting of the doctor about the axis afforded by the shaft 15, as hereinafter referred to.

One slide bearing 18 of each doctor, is attached to the inner end of a piston rod 28 of relatively large diameter. A piston 29 fixed to the outer end of the piston rod is arranged to operate in a cylinder 30 attached to the guide 19. The outer end of each cylinder 30 (with the exception of the cylinders controlling the doctors associated with the two lowermost rolls of the calender) is connected to a header 31 by means of a branch pipe 32 equipped with a valve 33. The inner end of each of said cylinders is also connected to a header 34 by a valveless branch pipe 35. All of the headers 31 and 34 are supplied with compressed air or other fluid under pressure from a common supply pipe 36. The headers 34 are in continuous communication with the supply pipe 36, but the flow of fluid from the supply pipe to the headers 31 is controlled by a single three-way valve appearing at 37.

Due to the large diameter of the piston rod 28, it will be evident that each cylinder and piston is adapted to function as a differential pressure device since fluid supplied to the outer end of the cylinder from the header 31 is effective to move the piston 29 towards the inner end of the cylinder against the resistance of the fluid which is continuously supplied to the last mentioned end of the cylinder from the header 34. Assuming that the outer ends of all of the cylinders referred to are in open communication with the header 31, it will be evident that the position of the doctors controlled by the pistons operating in these cylinders is dependent upon the position of the main control valve 37. If this valve is operated to place the headers 31 in communication with the supply pipe 36, all of the doctors mentioned will be simultaneously moved in the direction of the calender roll to engage the doctor blades with the roll surfaces to be doctored. If the valve 37 is subsequently turned to place the headers 31 in communication with the exhaust connection appearing at 38, all of the doctors will be simultaneously withdrawn from engagement with the rolls by the pressure of the fluid continuously supplied to the inner end of the cylinders from the headers 34.

Individual or selective group operation of the doctors is also made possible by the provision of the valves 33 controlling communication between the outer ends of the cylinders 30 and the headers 31. These valves are operable to place the outer ends of the respective cylinders in communication with the headers 31 or in communication with the atmosphere through the exhaust connections appearing at 38a. Hence by proper manipulation of these valves any selected doctor or any selected group of doctors may be moved to or maintained in an operative or an inoperative position, irrespective of the status of the remaining doctors.

With reference to the cylinders controlling the doctors associated with the two lowermost rolls of the calender, it will be noted that the opposite ends of each cylinder are connected to one of the headers 34 by the branches appearing at 40 and 41. Fluid is continuously supplied to the

inner end of these cylinders through the branch 40, but the flow of fluid to the outer ends of the cylinders is controlled by the valve 42 corresponding to the valves 33 previously described. When the valves 42 are positioned to permit the flow of fluid from the headers 34 to the outer ends of the cylinders here referred to, the doctors controlled by the pistons operating in said cylinders are shifted to their operative positions. When the valves 42 are positioned to place the outer ends of said cylinders in communication with the atmosphere through the exhaust connections 43, the fluid pressure supplied to the inner ends of the cylinders through the branch connections 40 becomes effective to withdraw the doctors from engagement with the roll surfaces.

With this explanation, it will be understood that the positioning of the doctors associated with the two lowermost calender rolls is manually controllable by the valves 42 irrespective of the operation of the main control valve 37 previously referred to.

As previously pointed out only one slide bearing 18 of each doctor is connected to the operating piston of the associated pressure device and, hence, it is desirable that some means be provided for causing the ends of the doctor to move in unison so as to maintain the doctor at all times parallel with the roll surface to be doctored. This is accomplished in the present instance by the pinions 21 on the shaft 15 co-operating with the racks 22 in the following manner. Movement of the piston operated slide bearing 18 in its guide 19 causes the adjacent pinion 21 to be rotated as it is moved relative to the co-operating rack 22. The rotation thus imparted to the shaft 15 causes pinion 21 at the opposite end of the shaft to travel over the rack 22 so that the shaft and the doctor associated therewith is at all times parallel to the roll surface to be doctored. During movement of the doctor to its operative position the doctor blade 14 is brought into engagement with the roll surface before the movement of the slide bearings 18 is arrested by engagement with the stop screws 23a. Hence, as the slide bearings 18 continue their forward movement into engagement with the screws 23a, the doctors are caused to swing upwardly about the shaft 15 so that, in its final operative position, each doctor is held to the roll surface solely by its own weight. When the blade 14 is withdrawn from engagement with the roll the doctor then swings about the shaft 15 in the opposite direction until further swinging movement in this direction is arrested by engagement of the lugs 25 and 26. The permissible travel of the slide bearings 18 in the guides 19 is such that, in the retracted position of the doctors, a clearance of approximately 4 inches is left between the roll surfaces and the operative edges of the doctor blades 14. This clearance is considerably in excess of that provided by any doctor mechanism now in use and eliminates all danger of wads of paper or other accumulations on the roll surface fouling the doctor blades when the doctors are in retracted position.

In addition to the control mechanism described in the foregoing, an important feature of the invention resides in the particular mounting of the doctor blades 14. The preferred mounting is shown in Figures 6 and 7, wherein it will be noted that the heel portion of the doctor blade is confined between the doctor body 13 and a cover plate 45 and is provided with positioning pins 46 entering suitable sockets 47 provided in the doctor

body. The cover plate is provided with a groove 48 in which is arranged a metal strip 49 carrying a plurality of relatively spaced bowed springs 50. The arrangement is such that the ends of each spring bear resiliently upon the heel portion of the doctor blade immediately in line with the positioning pins 46. The advantage of this arrangement is that it permits the free edge of the doctor blade to accommodate itself to any accumulations or irregularities occurring on the roll surface with which the plate is engaged.

In Figures 8 and 9 I have shown a modified form of blade mounting in which the strip 49 and springs 50 are replaced by a strip 52 composed of soft rubber or similar material. The lower face of the strip 52 is notched to provide a series of partially separated portions 53 which bear resiliently on the heel portion of the doctor blade and serve the purpose of the bowed springs 50 previously described.

Having thus described my invention, what I claim is:—

1. A doctor mounted to slide into and out of engagement with the surface to be doctored, a doctor positioning mechanism connected to one end of the doctor, and means for causing both ends of the doctor to move in unison to maintain the doctor at all times parallel with the doctored surface.

2. A doctor equipped with a shaft rotatably connected therewith, slide bearings rotatably carrying said shaft, pinions fixed to the ends of said shaft, stationary racks meshing with said pinions and means connected to one of said slide bearings to impart sliding movement thereto.

3. A doctor equipped with a shaft rotatably connected thereto, slide bearings rotatably carrying said shaft, brackets supporting said bearing for sliding movement, racks carried by said brackets, and pinions on the shaft meshing with said racks.

4. A doctor equipped with a shaft rotatably connected thereto, slide bearings rotatably mounting said shaft, guides supporting said slide bearings, racks adjustably carried by said guides, pinions on said shaft meshing with said racks and means connected to one of said slide bearings to impart sliding movement thereto.

5. The combination with a plurality of doctors of a differential pressure device attached to each doctor to control the positioning of the doctor with respect to the surface to be doctored, and means for controlling the flow of fluid to and from said pressure devices said means including valves operable to effect selective individual or group operation of the doctors.

6. The combination with a plurality of doctors of a differential pressure device, attached to each doctor for controlling the positioning of the doctor with respect to the surface to be doctored, each device including a cylinder and a piston means operating in said cylinder and connected to one of said doctors, a fluid supply pipe header receiving fluid from a supply pipe, branch connections for placing certain of the headers in communication with one end of said cylinders, branch connections for placing the remaining headers in communication with the remaining ends of said cylinders, a single valve controlling the passage of fluid from the supply pipe to the headers connected to one end of said cylinder and additional valves arranged in the branch connections between the cylinders and the last mentioned headers.

7. The combination with a plurality of doctors

of a differential pressure device attached to each doctor for controlling the positioning of the doctor with respect to the surface to be doctored, means for supplying motive fluid to said devices, and means for controlling the supply of motive fluid to effect simultaneous operation of the pressure devices connected to all of said doctors or to operate merely the pressure devices controlling one or more selected doctors without affecting the position of the remaining doctors.

8. The combination with a doctor movable to and from a surface to be doctored of a differential pressure device including a cylinder and piston means operating in said cylinder and connected to one end of the doctor, means for continuously supplying fluid to one end of each cylinder to create a pressure tending to withdraw the doctor from engagement with said surface, and means for supplying fluid to the remaining end of each cylinder to create a pressure sufficient to overcome the first mentioned pressure and to move the doctor into engagement with said surface said last means including manually operable valves for placing the last mentioned ends of the cylinder in communication with the atmosphere or with the source of fluid pressure.

9. The combination of a doctor including a shaft rotatably connected to the doctor body, slide bearings rotatably mounting said shaft, guides slidably supporting said bearings and means for moving the bearings in said guides to shift the doctor towards and away from the surface to be doctored.

10. The combination of a doctor including a shaft, rotatably connected to the doctor body, slide bearings rotatably mounting said shaft guides slidably supporting said bearings, racks carried by said guides, pinions fixed to said shaft and meshing with said racks and doctor positioning means connected to one of the bearings.

11. The combination of a doctor including a body, a shaft rotatably attached to the body and projecting beyond the ends thereof, slide bearings rotatably receiving the ends of said shaft, guides slidably supporting said bearings, co-acting stop members carried by the bearings and the doctor to limit tilting movement of the doctor in one direction, racks carried by said guides, pinions fixed to said shaft and meshing with said racks and means connected to one of said bearings to advance or retard the doctor with reference to the surface to be doctored.

12. A doctor comprising a body, a cover member secured thereto, a doctor blade having a portion thereof interposed between the body and the cover member and provided with positioning pins received in sockets formed in said body and resilient pressure applying means interposed between the blade and the cover member.

13. A doctor assembly including a pair of slide bearings movable to and from the surface to be doctored, a shaft having its ends mounted in said bearings, a doctor pivotally suspended from said shaft and adjustable means for limiting pivotal movement of the doctor in one direction.

14. A doctor assembly including a pair of slide bearings movable to and from the surface to be doctored, a shaft having its ends mounted in said bearings, a doctor pivotally suspended from said shaft and coacting stop members carried by the doctor and one of said bearings for holding the doctor in a definite position and for limiting pivotal movement of the doctor in one direction.

15. A doctor assembly including a pair of slide bearings, guides slidably supporting said bearings,

a shaft rotatably mounted in said bearings, pinions at each end of said shaft, stationary racks meshing with said pinions, a doctor body pivotally suspended from said shaft and a thin flexible doctor blade secured to said body.

16. A doctor assembly including a pair of slide bearings mounted to slide toward and away from the surface to be doctored, a doctor body pivotally carried between said bearings, a cover member secured to said body, a thin flexible doctor blade having its heel portion interposed between the body and the cover member and resilient pressure applying means arranged beneath the cover and bearing on the upper surface of the blade.

17. A doctor comprising a body, a cover member secured to said body, a doctor blade having its heel portion interposed between the body and the cover member so that the body constitutes a fulcrum about which the blade is movable in the manner of an intermediately pivoted lever when the scraping edge of the blade is pressed against the surface to be doctored, the movement of the heel portion of the blade being in the direction of the cover member and the movement of the projecting portion of the blade being in the opposite direction, and resilient pressure applying means interposed between the heel portion of the blade and the opposing surface of the cover member towards which this portion of the blade is movable as aforesaid.

18. A doctor comprising a body, a cover mem-

ber secured to said body, a doctor having its heel portion interposed between the body and the cover member and a plurality of bowed springs interposed between the heel portion of the blade and the cover member and lying at the side of the heel portion opposite that engaged with the body.

19. A doctor comprising a body, a cover member secured thereto, a doctor blade having a portion thereof interposed between the body and the cover member, and a series of bowed springs interposed between the cover member and the blade with the ends of the springs bearing on the blade.

20. A doctor comprising a body, a cover member secured thereto, a doctor blade having a portion thereof interposed between the body and the cover member, a series of bowed springs interposed between the cover member and the blade with the opposite ends of each spring bearing on the blade and a common connecting strip secured to the intermediate portions of said springs.

21. A doctor comprising a body, a cover member secured to said body and having a groove formed in its body opposing surface, a doctor blade having a portion thereof interposed between the body and the cover member and flatly engaging said body, a metal strip arranged in said groove and a plurality of relatively spaced bowed springs carried by said strip with the ends of each spring bearing on the doctor blade.

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