July 3, 1956 A. K. ANANDER 2,753,181

FEED MECHANISM FOR WEB MATERIAL

Filed May 14, 1953

Fig. 1

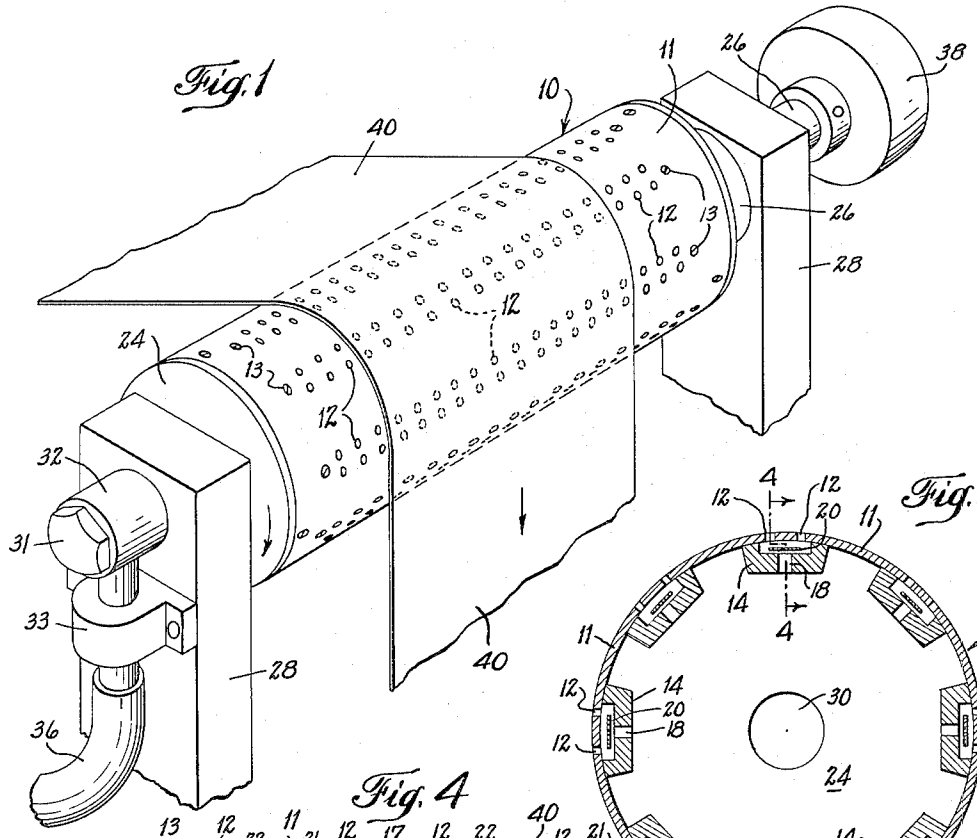
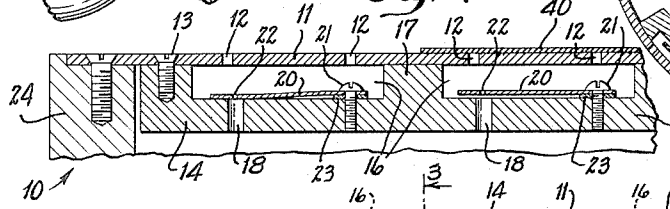


Fig. 3

Fig. 4



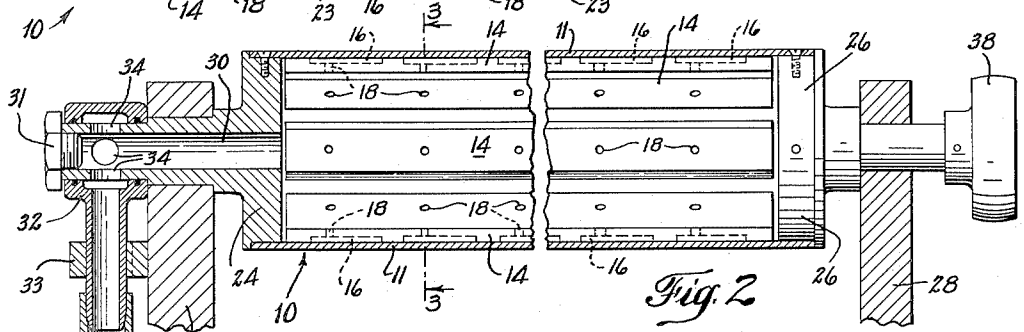
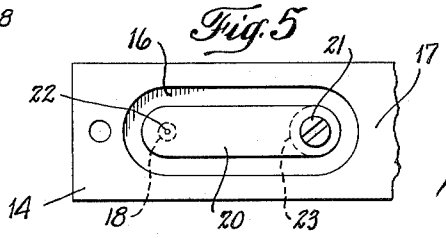


Fig. 2

Fig. 5



INVENTOR.
ANDREW K. ANANDER
BY
Morgan, Finnegan, Durham & Pine
ATTORNEYS.

United States Patent Office

2,753,181

Patented July 3, 1956

2,753,181

FEED MECHANISM FOR WEB MATERIAL

Andrew K. Anander, Glen Cove, N. Y., assignor to Powers Chemco, Inc., Glen Cove, N. Y., a corporation of New York

Application May 14, 1953, Serial No. 355,103

3 Claims. (Cl. 271—2.3)

The present invention relates to a novel and improved web feeding mechanism for feeding web material such as paper to be coated or for feeding photographic film or other web material while coating the same.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

In the drawings:

Figure 1 is a perspective view of a typical and preferred embodiment of the invention as adapted for use in a web feeding mechanism showing web material in place on a feeding roll;

Figure 2 is a longitudinal sectional view of the mechanism shown in Figure 1 with the web material removed;

Figure 3 is a cross section through the feeding roll taken on the line 3—3 of Figure 2;

Figure 4 is an enlarged detail section taken on the line 4—4 of Figure 3; and

Figure 5 is an enlarged fragmentary detail of the leaf spring valve and its holder.

The present invention relates to web feeding mechanism, such as feed rolls over which the web of paper, photographic film or other substantially non-porous material may be forwarded and in which the nature of the material or the operations to be performed thereon require that the material be supported on only one side or where the use of vacuum or suction grippers are required or preferred as in the coating of paper or photographic film.

The present invention has for its object the provision of web feeding mechanism which can be used indiscriminately with webs of various widths or thickness and which will hold the web against the feeding mechanism with the output of a small capacity suction pump. A further object is the provision of a suction operated feed mechanism having a plurality of suction apertures and in which the air flow through any apertures not covered by the web is substantially reduced so as to maintain substantially full suction on the web through other apertures. Still another object is the provision in a feed mechanism, such as a feed roll, having a plurality of suction apertures, only a portion of which are covered by the web at any particular time, of means for reducing the wasted suction at the uncovered apertures. This invention thus provides a feeding mechanism for web material of varying widths in the coating process insuring substantial frictional contact with feed mechanism while avoiding the use of suction pumps of unduly large capacity.

In accordance with the present invention the feed mechanism is provided with a foraminated face to the back of which suction is applied to hold the web firmly against the foraminated face and by the pressure differential create sufficient friction between the web and the face to carry the web along with the feeding mechanism and at the same time hold the web firm and flat against the face of the feeding mechanism to facilitate any coating process. The foraminated face is subdivided into a plurality of sections, each of which may be less than about 5% of the total area of the face and may include several suction apertures, and these several areas are connected to a suction pump through valves resiliently urged to an open position but which are moved to a restrictive position by the effect of air passing therethrough due to the absence of material overlying the section of the face and blocking the apertures. In those sections of the face which are covered by the web being fed so as to block the apertures and prevent the flow of air through the apertures the valves are urged to fully open position so that the full suction is applied to the back of the web, while in those sections which are not completely covered by the web the restrictive valves are moved by the effects of the suction to restrictive position; thereby conserving the capacity of the suction pump and insuring that the full area of the web in contact with the feed mechanism is securely and firmly held against the face of the feed mechanism.

As embodied, each section is provided with a restrictive valve comprising a resiliently opened member provided with means for passing a small amount of air through it and overlying a relatively large aperture in the valve body through which air is removed by the suction pump. The restrictive valve in each section communicates with a plurality of small apertures on the foraminated face of the feed mechanisms and controls and is controlled by the air flowing through the small apertures as it is led to the suction pump through the large aperture underlying the restrictive value.

By the present invention the necessity for any adjustment or manipulation is avoided and no complex devices are required for insuring that suction is limited to the area of the web contact. When a feed roll is utilized and the web is led thereto the apertures of each successive section upon coming in contact with the web will be covered, which will block air flow therethrough and cause the restrictive valve to open and apply the full suction to that section. In leaving the roll, the web, as it is peeled from the roll, will first uncover one of the apertures which will cause the restrictive valve to close and reduce or destroy the suction in all the remaining apertures of that section, thus permitting the web to be readily peeled from the roll and not tend to follow around the roll. As each section is uncovered the restrictive valves act to reduce the duty imposed on the pumps, leaving the system at all times ready to maintain the full suction on the portion of the web in contact with the feed roll.

It will be understood that the foregoing general description and the following detailed description as well are exemplary and explanatory of the invention but are not restrictive thereof.

Referring now in detail to the present preferred and illustrative embodiment of the present invention as shown in the accompanying drawings, there is shown a feed roll suitable for feeding paper to be coated or for feeding photographic film or other web material while coating the same. As embodied, there is provided a hollow, rigid, cylindrical feed roll, indicated generally at **10**, longer than the widest web to be fed and of sufficient thickness to maintain its shape while feeding the web. The shell **11** of the roll **10** is provided with a large number of small apertures **12** which are arranged in small

groups over the usable surface of the roll 10 in any desired manner, to form the suction members by which the web to be fed is firmly gripped and caused to adhere to the surface of the feed roll 10.

As shown the apertures are arranged in a plurality of circumferentially spaced longitudinally extending pairs of rows, and by means to be described are divided into groups of four apertures comprising two adjacent apertures of one of these pairs of rows. Secured in air tight relation to the inner surface of the shell 11 by screws 13 are a plurality of longitudinally extending strips 14 of rigid material, each strip underlying and extending beyond one pair of rows of apertures. Each strip 14 is recessed at intervals throughout its length to form with the shell 11 a plurality of chambers 16, separated by partitions 17, with each chamber underlying and communicating with the four apertures of one group of apertures. A passageway 18 through the strip 14 leads from chamber 16 to the interior of the hollow roll 10, thus connecting each group of apertures 12 with the interior of the hollow roll.

In a manner to be described later, suction is applied to the interior of roll 10 and air is drawn through passageway 18 to evacuate chamber 16 and apply suction to apertures 12 to hold the web being fed firmly against the exterior of roll 10. In order to limit the flow of air drawn through passageway 18 whenever one or more of the apertures 12 communicating with it is not covered by the web being fed and thereby reduce the required capacity of the suction pump and increase the suction which is usefully applied to the group of apertures 12 which are covered by the web, a restrictive valve is provided to restrict the passageway 18. This valve comprises a reed 20 secured by a screw 21 to the side of chamber 16 containing passageway 18. The reed 20 which may be of any suitable resilient material, such as a metallic leaf spring, is spaced from the surface of strip 14 by a washer 23 and is normally biased to non-restricting position so as to be slightly spaced from the strip 14 over the passageway 18. The reed 20 is, however, readily moved to closed or restrictive position over the passageway 18 by an abnormally large flow of air through the passageway 18, such as might be caused by one of the small apertures 12 not being covered by the web being fed. Thus when an abnormally large flow of air through the passageway 18 occurs, the reed 20 is drawn toward the bottom of the recess and into firm contact with the edges of the passageway 18. The reed 20 is provided with a relatively fine aperture or bleed 22 at its free end and positioned to register with the passageway 18 when the reed 20 is drawn into contact with the edges of the passageway. In effect closing of the restrictive valve substitutes the aperture or bleed 22 for the passageway 18 and thus greatly restricts the flow of air.

In Figure 3 the several valves are shown in their normal positions which they occupy when no suction is applied to the interior of the roll 10 or when all of the corresponding apertures 12 in the roll shell are covered by the web being fed. Figure 4, on the other hand, shows only the right hand valve in its normal position and shows the left hand valve in the closed position. The several apertures 12 communicating with the left hand valve are not covered by the web being fed and with suction applied to the interior of the roll 10 the reed 20 has been drawn down onto the bottom of the chamber 16 covering the passageway 18 and closing it except for the fine aperture or bleed 22 registering therewith.

In some cases it may be found that the restrictive aperture 22 is not needed, but more reliable operation of the restrictive valves is assured by the provision of some such means. As the roll rotates and the web being fed leaves the roll, apertures 12 are uncovered and suction inside roll 10 causes air to flow through apertures 12, chambers 16, and passageway 18 in a quantity to close restrictive valve 20 and thus materially reduce the air flow. As long as apertures 12 remain uncovered the differential pressure acting on valve 18 will hold it in closed position. As the apertures 12, controlled by a closed valve, again come under the web being fed, due to the rotation of the roll, the apertures 12 are again closed and the excessive air flow stops. The suction on the interior of roll 10, however, continues to evacuate chamber 16 through the bleed aperture 22 and thus creates a suction in chamber 16, reducing the pressure on the exposed side of reed 20 to such an extent that the resilience in the reed 20, assisted by centrifugal force acting on the reed when and if the roll is rapidly rotating, will overcome any differential pressure tending to hold the valve closed and the valve will open establishing unrestricted communication between the interior of the roll, the chamber 16 and the apertures 12, applying the full suction to the apertures 12 and the web covering them to hold the web firmly against the surface of the roll so as to cause the web to move with the roll.

It will be appreciated that bleed aperture need not be in the reed 20 but may be unobstructed passageways in the member 14 from the interior of the roll 10 into the chamber 16 or they may be grooves cut in the seating surface of the reed 20 either in the reed or in the member 14 so that when the valve is closed the chamber 16 will still be connected by a small passageway with the suction in the interior of roll 10.

The shell 11 of the roll 10 is closed at its ends and supported for rotation. As shown, end closure members 24 and 26 are inserted into the ends of shell 11 and secured therein in airtight relation by screws. Each end closure is provided with a concentric axial extension forming oppositely extending shafts which are journaled in spaced supports 28. Closure member 24 is provided with a concentric passageway 30 extending axially throughout its length and opening at one end into the interior of the roll 10. The opposite end of passageway 30 is plugged in an air tight manner by plug 31. A transfer bearing 32 is rotatably mounted in airtight relation on the outer end of closure member 24 and is held against rotation with closure member 24 and in position thereon between support 28 and plug 31 by clamp 33 secured to support 28. Radial passages 34 in closure member 24 connect the hollow interior of transfer bearing 32 with passage 30. A pipe 36 connects the hollow interior of transfer bearing 32 with a suitable source of suction such as a vacuum pump (not shown). The source of suction is thus connected in airtight relation, through the transfer bearing and passage 30 with the interior of the roll 10, which in turn acts as a manifold connecting all the passageways 18 in the members 14 arranged around the interior of the shell 11 of the roll 10. The roll may be rotated in any desired manner as for example by power supplied to the pulley 38 secured to closure member 26 and driven by a belt (not shown) in a well known manner, and through the transfer bearing 30 suction is continuously applied to the interior of the roll while it is rotating. As described above, the full suction is selectively applied to apertures 12 under the web 40 to clamp the web 40 firmly against the exterior of the roll 10 and feed it long as the roll is rotated.

While the relative sizes of the apertures 12, bleed hole 22 and passageway 18 may be widely varied it is of course desirable to maintain the areas of apertures 12 as small as practicable commensurate with satisfactory operation of the feed roll thereby keeping the suction loss through this aperture at a minimum.

While the reed 20 may vary widely in size and shape, it is preferably made straight and flat and when used in feed rolls about 6" in diameter may be 2½" long and ½" wide and, depending on the material of which it is made, thin enough to be drawn to closed position by

the suction available when spaced in its normal position, about 1/16" from passageway **18** when passageway **18** is a 1/4" hole.

While the number and arrangement of the apertures **12** may vary widely, I have found that with a 6" feed roll 8 groups of apertures around the circumference of the roll is satisfactory while the number lengthwise will depend substantially entirely on the length of the feed roll which will be slightly longer than the widest web to be fed.

Athough the invention has been herein shown and described in connection with a preferred embodiment wherein a hollow chamber or cylinder is employed with the interior of this cylinder forming a common passage which is in communication with the evacuating means, it is to be understood that this is merely illustrative and not restrictive and that other organizations may equally well be employed as for example a multiplicity of channels or pipes may be employed in lieu of this common passage for establishing communication between passage **18** and the evacuating means. In the latter instance individual passages or pipes may be employed for each of the chambers **16** or more than one chamber may be associated with a single passage or pipe.

The invention in its broader aspects is not limited to the specific mechanism shown and described but departures may be made therefrom, within the scope of the accompanying claims, without departing from the principles of the invention and without sacrificing its chief advantages.

What is claimed is:

1. A web feeding roll for gripping a web by suction and moving along with the web, comprising a hollow roll adapted to have a web passed thereover, means for applying suction to the hollow interior of the roll, means dividing the interior surface of the roll into a plurality of chambers, individual passageways connecting the chambers with the interior of the roll, a plurality of apertures connecting each chamber with the exterior of the roll whereby suction may be applied through the passageways, chambers and apertures to the web to hold

it on the exterior of the roll, a valve having a bleed aperture in each passageway spring pressed to open position, and automatically movable to flow restricting position by suction induced airflow to restrict said passageway, said valves being actuated by variation in airflow due to closing and opening of said apertures by the web passing thereover.

2. A web feeding roll as claimed in claim 1 in which the valve comprises a resilient reed mounted in a chamber and normally spaced from but overlying the passageway and movable to cover said passageway and having a bleed aperture through said reed in registering relation to said passageway.

3. A web feeding roll for gripping a web by suction and moving along with the web, comprising a hollow cylindrical roll adapted to have a web passed thereover and having a plurality of apertures therein, a cylindrical plate forming a closure for one end of the roll and removably secured thereto, another cylindrical plate removably secured to the roll forming a closure for the opposite end thereof and provided with means for applying a suction to the interior of the roll, a plurality of rigid strips removably secured to the roll and spaced about the inner periphery thereof, said strips having chambers communicating with the apertures in the roll and passageways communicating the chambers with the interior of the roll, resilient reeds mounted in the chambers normally spaced from but overlying the passageways and movable to cover said passageways, and bleed apertures in the reeds in registering relation to said passageways.

References Cited in the file of this patent

UNITED STATES PATENTS

1,408,688	Broadmeyer	Mar. 7, 1922
1,457,775	Henderson	June 5, 1923
1,580,671	Nichols	Apr. 13, 1926
1,774,315	Broadmeyer	Aug. 26, 1930
2,242,548	Regan et al.	May 20, 1941
2,366,935	Schmid	Jan. 9, 1945