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V. E. HEYWOOD
SUCTION GRIPPING MECHANISM FOR ENVELOPE
MACHINES AND THE LIKE

2,730,360

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2 Sheets-Sheet 1

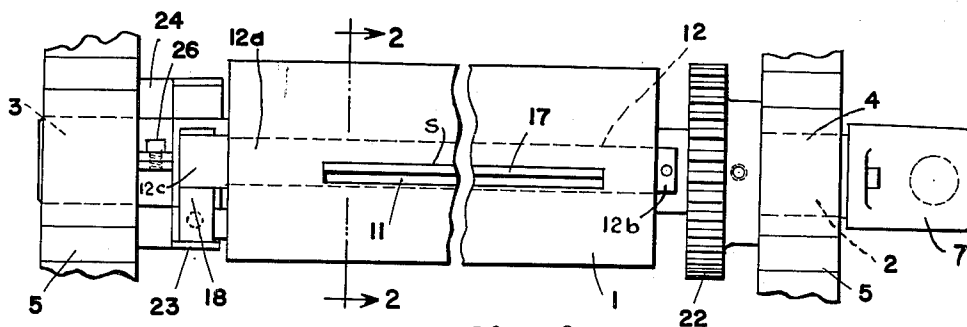


Fig. 1.

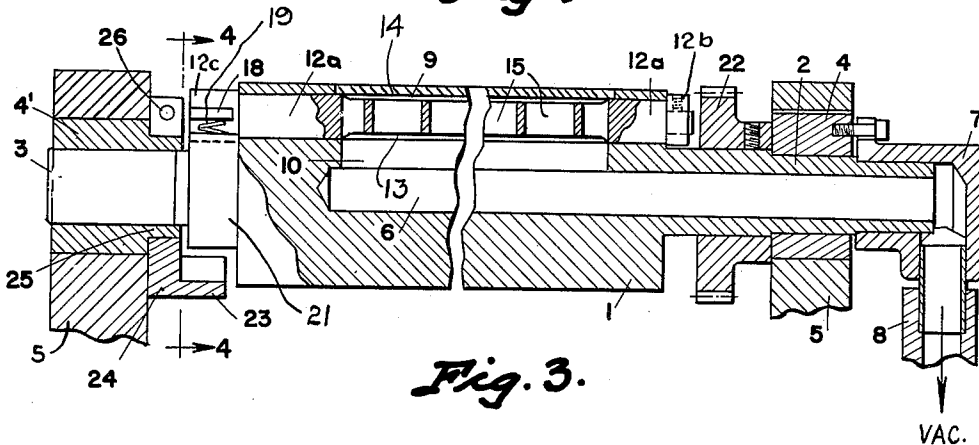


Fig. 3.

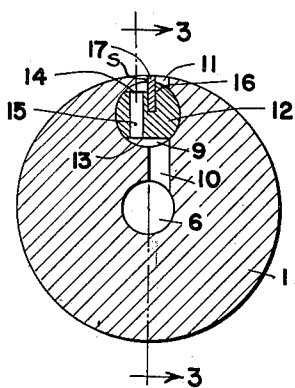


Fig. 2.

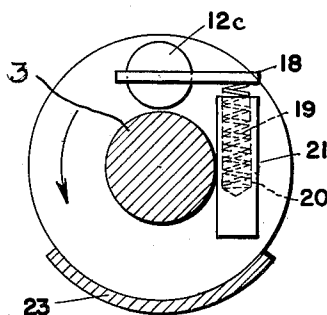


Fig. 4.

INVENTOR
VINCENT E. HEYWOOD

BY
Cornel H. Kennedy Jr.
ATTORNEY

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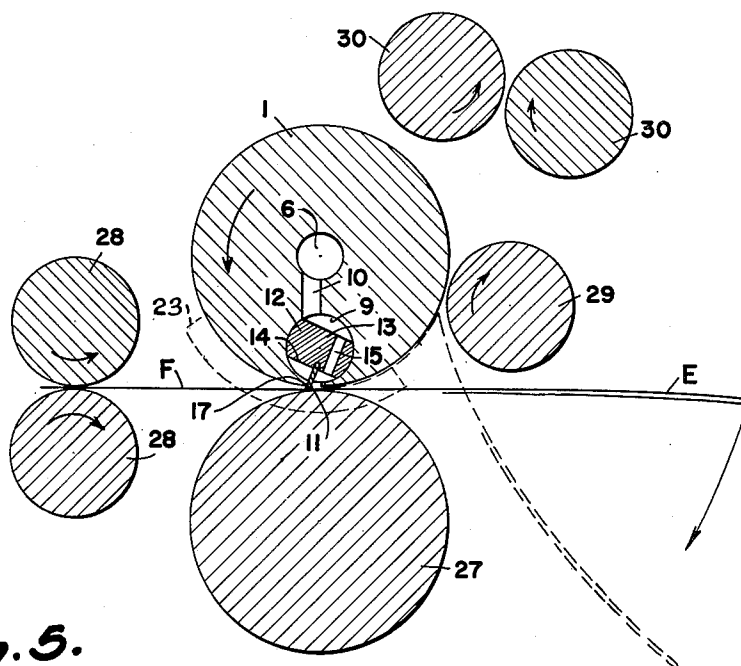


Fig. 5.

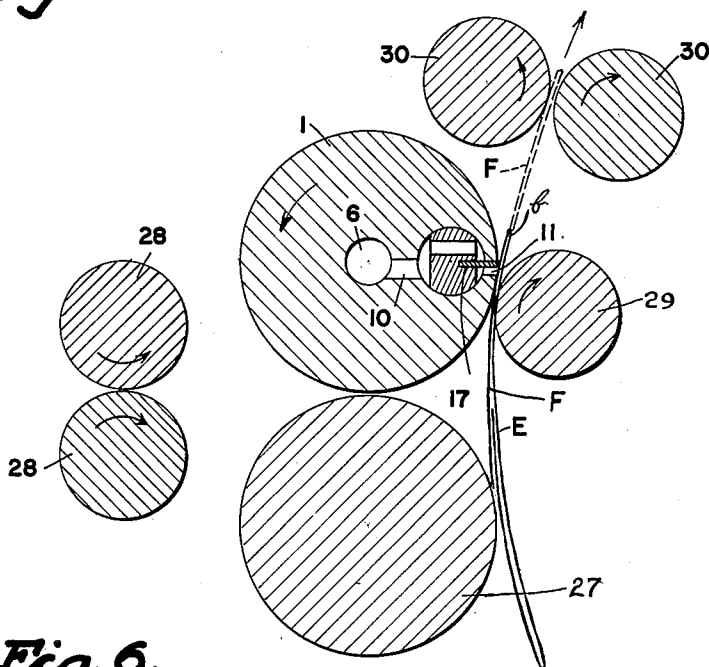


Fig. 6.

INVENTOR
VINCENT E. HEYWOOD

BY
George H. Kennedy
ATTORNEY

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SUCTION GRIPPING MECHANISM FOR ENVELOPE MACHINES AND THE LIKE

Vincent E. Heywood, Worcester, Mass., assignor to United States Envelope Company, Springfield, Mass., a corporation of Maine

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4 Claims. (Cl. 271-27)

The present invention relates to suction gripping devices for use in the handling of flexible material in sheet or web form, as in envelope machines, printing machines and the like. On rotary rolls or cylinders of such machines, it is common practice to provide peripheral openings through which to exert suction for the seizure and movement by such roll of successive blanks or sheets; the latter, after a predetermined movement, are released by said roll through discontinuance of the suction.

In prior suction gripping devices of this type it has been difficult, if not impossible, to achieve close and accurate timing of the sheet's alternate seizure and release, because of appreciable spacing between the cylinder's peripheral opening or openings and the valve or other device which alternately establishes and shuts off the suction supply. Under such conditions upon closure of the valve there is still a tendency for the sheet to be held by the suction opening or openings because of the vacuum being trapped in the space or spaces between such sheet and the valve.

By the same token, the opening of the valve, in prior suction devices of this type, cannot obtain the full suction effect on the sheet material until the air occupying such space or spaces has been evacuated.

These and other difficulties encountered in the operation of conventional suction gripping devices are wholly eliminated and overcome by my invention. The latter, for alternately admitting and shutting off the suction exerted at the cylinder's peripheral opening or openings, provides a valve member substantially flush with the cylinder's periphery, and a seating surface for such valve member which practically coincides with the area or areas of sheet seizure. In consequence of this, on opening of said valve, the maximum suction effect is instantly available for sheet seizure, and on closing of said valve, the suction is pinched off substantially at the seizure zone or area, with no possibility of the sheet's release being delayed by any trapped or residual vacuum.

The above and other advantageous features of the invention will hereinafter more fully appear from the following description, considered in connection with the accompanying drawings, in which:

Fig. 1 is a plan view of a suction gripping device embodying the present invention.

Fig. 2 is a larger scale transverse sectional view of said device, the section being approximately on the line 2-2 of Fig. 1, looking in the direction of the arrows.

Fig. 3 is a longitudinal sectional view, on the same scale as Fig. 1, the section being approximately on the line 3-3 of Fig. 2, looking in the direction of the arrows.

Fig. 4 is an end view, partly in section, on the same scale as Fig. 2, the section being approximately on the line 4-4 of Fig. 3, looking in the direction of the arrows.

Figs. 5 and 6 are transverse sectional views, illustrating, in different positions, my suction gripping device, in working association with other instrumentalities, as applied to the accurate folding of envelope flaps.

Referring first to Figs. 1 and 3, the device of the present invention is shown for purposes of illustration as being incorporated in a cylinder 1 having reduced end portions 2 and 3 that are rotatably supported in suitable bearings 4 and 4' respectively, mounted on spaced frame members 5. The cylinder 1 provides the usual internal vacuum

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chamber, here shown as a central bore 6 which extends through the right-hand end portion 2, but not through the left-hand end portion 3. The end portion 2 is of sufficient length to extend beyond the right-hand bearing 4 and the open end of the bore 6 is connected to a suitable source of vacuum, such as a suction pump, not shown, by a pipe connection 8 to a suitable fitting 7, the latter being attached to said bearing 4 and receiving with a snug running fit, the extended open end portion 2 of roll or cylinder 1. Thus the latter can be rotated, as by a driving gear 22, Fig. 3, secured to its end portion 2, without disturbing the constant maintenance of suction or vacuum in its interior chamber or passage 6.

The roll or cylinder 1 at a short distance inwardly from its periphery is formed with a longitudinal bore 9 which extends for the full length of said cylinder. Said bore 9, except at its opposite end portions, has communication with the evacuated chamber 6 through a substantially radial cylinder passage 10, as shown in Figs. 2 and 3. Said bore 9, except at its opposite end portions, has communication with the atmosphere through a narrow longitudinal cylinder slot 11 which, as best shown in Fig. 2, is of very slight depth, by reason of opening from bore 9 onto that portion of the cylinder's periphery which is closest to the bore 9. This shallow slot 11 constitutes the aperture or opening on the periphery of roll or cylinder 1 through which the suction prevailing in chamber 6 is made effective for the seizure and movement by said cylinder of the sheet or other material. It is particularly to be noted that one side of the shallow slot 11 (the left-hand side as seen in Fig. 2) presents, in intersecting relation to the cylinder's periphery, a narrow flat surface S substantially radial to the axis of bore 9, such surface as hereinafter described being utilized as the seating surface for the valve member by which the suction prevailing in chamber 6 is admitted to and shut off from the shallow cylinder slot 11.

Within the bore 9 is disposed a rockable shaft 12, providing at one end beyond said bore a reduced portion that receives a collar 12b for preventing endwise displacement of said shaft. As best shown in Fig. 3, the opposite end of rock shaft 12 projecting beyond the bore 9, is suitably enlarged, as shown at 12c, so as to prevent said shaft's endwise displacement in the other direction. Inwardly of collar 12b and of enlargement 12c the shaft 12 provides spaced cylindrical bearing portions 12a, 12a, which serve to journal said shaft for the periodic slight rocking movements which it makes, as hereinafter described, within the bore 9. These cylindrical bearing portions 12a, 12a, as shown in Fig. 3, occupy portions of bore 9 that are beyond the ends of the communicating cylinder passage 10 and the communicating cylinder slot 11.

The intermediate portion of shaft 12, between its bearing portions 12a, 12a, is cut away, on opposite sides of its axis, to provide opposite flat faces 13 and 14, which are substantially co-extensive, lengthwise, with the cylinder passage 10 and the cylinder slot 11. The inner and outer bore spaces created by such flat faces 13 and 14 of rock shaft 12 are connected by a plurality of shaft passages 15, 15, disposed in offset relation to the shaft axis. Said inner bore space, in both extreme positions of said shaft's slight rocking movement (Fig. 2 and Fig. 5) is in constant communication with the outer end of cylinder passage 10 that leads from suction chamber 6. Thus, through the passages 15, 15 the outer bore space underlying the aforesaid narrow seating surface S of cylinder slot 11 is also subject to the full suction prevailing in cylinder chamber 6, in both extreme positions of said rock shaft.

The outer flattened rock shaft face 14 is grooved, as shown at 16, to receive a relatively thin blade 17, whose left-hand face, Fig. 2, is substantially radial to the axis of bore 9 and shaft 12. Said blade 17 extends into the slot

11 for the full length thereof, and has its outer edge substantially flush with the surface of cylinder 1. Said blade 17, being of less thickness than the width of slot 11, is moved widthwise of said slot when the shaft 12 is rocked, and thus constitutes a valve member, whose seat is the aforesaid narrow radial surface S provided by one side of said slot.

For periodically rocking the shaft 12, to seat and unseat the valve blade 17, the shaft enlargement 12c carries an arm 18 whose outer end portion (see Fig. 4) receives the thrust of a compression coil spring 19 seated in a socket 20 provided by a member 21 secured to the end surface of the rotary cylinder 1. The force of spring 19 is thus effective to urge the shaft 12 counterclockwise, so as to hold valve blade 17 in firm seating engagement against the seat S. In this closed position (see Figs. 2 and 6) all access of suction to the slot 11 is shut off by the valve 17 and rock shaft 12, but the construction nevertheless is such that the full force of the suction prevailing in cylinder passage 6 is effective right up to the slot surface S against which the valve 17 is seated, so that with the slightest movement of said valve away from said seating surface S, the full force of the suction is instantly available, along the slot's full length, for the accurate and closely-timed seizure of the sheet or other material being handled by the cylinder 1.

This slight opening movement of valve 17 is obtained, periodically in the rotation of cylinder 1, by a slight clockwise rocking of shaft 12, against the force of spring 19, obtained as here shown by a stationary cam surface 23 of appropriate length, which is concentric with the axis of cylinder 1, and is disposed in the path of the extreme outer end of the operating arm 18 projecting from rock shaft 12. As best shown in Figs. 1 and 3, the cam 23 is formed on a holder or clamp 24 in the form of a split ring surrounding an extension 25 of the cylinder's left-hand bearing 4', and equipped with a suitable screw 26, for drawing closely together the ring portions at the split thereof. Thus the cam 23 is angularly adjustable about the axis of cylinder 1, for engagement by the tip of arm 18, to procure the opening of valve 17, at any desired point in the path of travel of the cylinder slot 11, and likewise for the closing of said valve, which occurs when the arm 18, in the cylinder's rotation, moves past and off of said cam. On such closing of valve 17, by the action of spring 19, the suction force effective on the material is pinched off at and within the slot 11 itself, thereby completely releasing the sheet or other material on the cylinder, since the slot is positively cleared of any residual vacuum by movement therein of the valve blade 17.

Figs. 5 and 6 show sectionally the application of my invention to a sheet folding operation requiring utmost accuracy in the suction seizure and release of the material. The latter is a succession of envelopes E advancing flatwise at high speed in spaced relation, and requiring for their completion only the folding over of their trailing seal flaps F. Here the roll 1 equipped with my invention operates in conjunction with a lower roll 27, for the flatwise forwarding of each such envelope E, as advanced by suitable feed rolls 28, 28, until the desired line of transverse fold of its trailing flap F arrives, as shown in Fig. 5, at the point of tangency or bight between the rolls 1 and 27 simultaneously with the arrival there of the slot 11 of roll 1. The latter's cam surface 23 is shown by broken lines in Fig. 5 as angularly adjusted to obtain opening movement of valve blade 17 at this point, as a result of which the junction line of trailing flap F with the envelope body is suction seized and carried upwardly by roll or cylinder 1, between the latter and an adjacent cooperating roll 29, leaving the advanced envelope body portion free to swing downwardly through the broken line position of Fig. 5, for initiating the fold f, shown by full lines in Fig. 6. This figure shows the fold f as having been released from the suction of cylinder 1 by seating of the valve blade 17, when its operating arm 18, not here shown,

moves past and off of the cam 23, thus freeing the so-completed envelope E for movement, flap fold foremost, to and through the subsequent forwarding rolls 30, 30.

In the performance of a flap folding operation such as described above, or any other operation involving the handling of flexible material at high speed, accurate timing is of the utmost importance. It has been found that a suction gripping device embodying the present invention is particularly effective in performing alternate gripping and release operations requiring close timing, due to the fact that the actual control of the suction is obtained substantially on the cylinder's periphery at the zone or area where suction is applied. It will be apparent from a consideration of Fig. 2 that the slightest opening movement of the blade 17 in the slot 11 will immediately apply the full force of the suction to sheet material covering said slit, since there is no need for any air to be evacuated. Furthermore, the closing movement of the blade will clear the slot of any suction, so that the material is released cleanly, without any residual vacuum effect, such as is encountered with existing valve devices that permit the vacuum to be trapped in the cylinder opening between the sheet material and the valve.

I claim:

1. A suction gripping device for flexible sheet material comprising in combination, a rotatable cylinder providing a slot in its peripheral surface, a passage extending through said cylinder for connecting said slot to a source of vacuum, an element movable in said slot widthwise thereof for alternately establishing and shutting off the access of suction to said slot from said vacuum-connected passage, means for maintaining said element seated against an edge of said slot at said cylinder's periphery to close off communication between said slot and said evacuated passage and means for moving said element away from said edge to establish communication between said slot and said passage.

2. A suction gripping device for flexible sheet material comprising in combination, a rotatable cylinder having a slot extending along the surface thereof, a chamber within said cylinder connected to a source of vacuum, a rockable member extending lengthwise of said cylinder and providing a passage between said evacuated chamber and said slot, and a blade extending from said member into said slot, and movable widthwise thereof by said member, to control the connection of said slot to said chamber through the passage in said member.

3. A suction gripping device for flexible sheet material comprising in combination, a rotatable cylinder having a slot extending along the surface thereof, a chamber within said cylinder connected to a source of vacuum, a rockable member extending lengthwise of said cylinder and providing a passage between said evacuated chamber and said slot, a blade extending from said rockable member into said slot for widthwise movement thereof by said member, to control the connection of said slot to said chamber through the passage in said member, and means for imparting rocking movement to said member simultaneously with the rotation of said cylinder.

4. A suction gripping device for flexible sheet material comprising in combination, a rotatable cylinder having a slot extending along the surface thereof, a chamber within said cylinder connected to a source of vacuum, a rockable member extending lengthwise of said cylinder and providing a passage between said evacuated chamber and said slot, a blade extending from said member into said slot, and movable therein, to control the connection of said slot to said chamber through the passage in said member, an arm on said member projecting beyond said cylinder and a stationary cam for engaging said arm as said cylinder rotates to cause rocking movement of said blade within said slot.

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