June 10, 1969 G. A. GIBSON 3,448,978

PAPER-FEEDING METHOD AND MACHINE

Filed March 13, 1967 Sheet 1 of 5

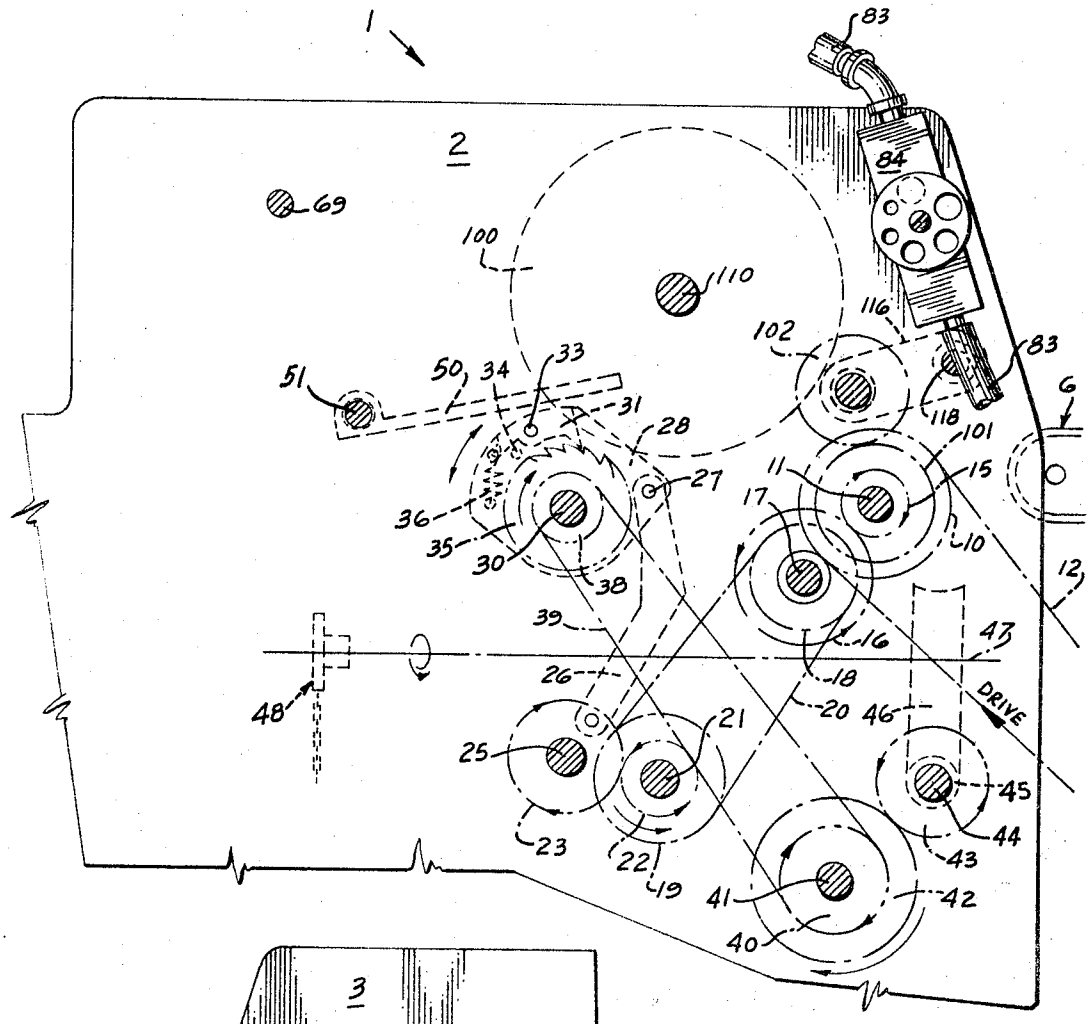


FIG-1

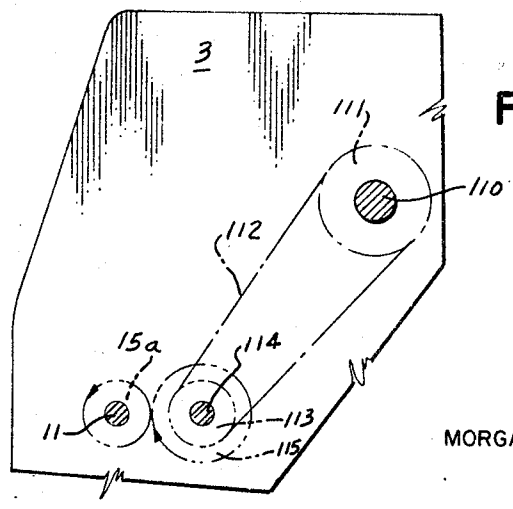


FIG-2

INVENTOR.
GEORGE A. GIBSON

BY
MORGAN, FINNEGAN, DURHAM & PINE
ATTORNEYS

June 10, 1969 G. A. GIBSON 3,448,978

PAPER-FEEDING METHOD AND MACHINE

Filed March 13, 1967 Sheet 2 of 5

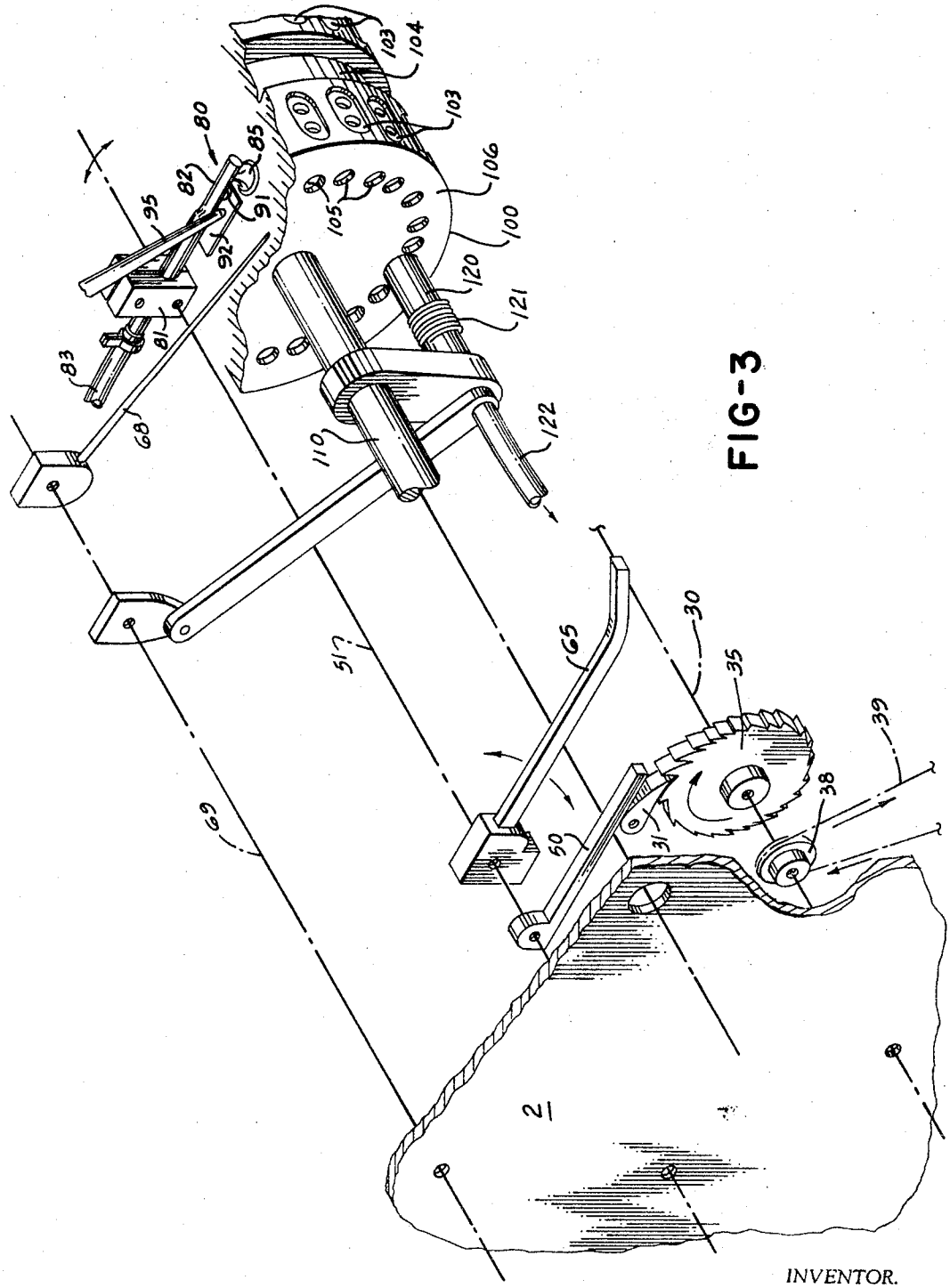


FIG-3

INVENTOR.
GEORGE A. GIBSON

BY
MORGAN, FINNEGAN, DURHAM & PINE
ATTORNEYS

June 10, 1969 G. A. GIBSON 3,448,978

PAPER-FEEDING METHOD AND MACHINE

Filed March 13, 1967 Sheet 3 of 5

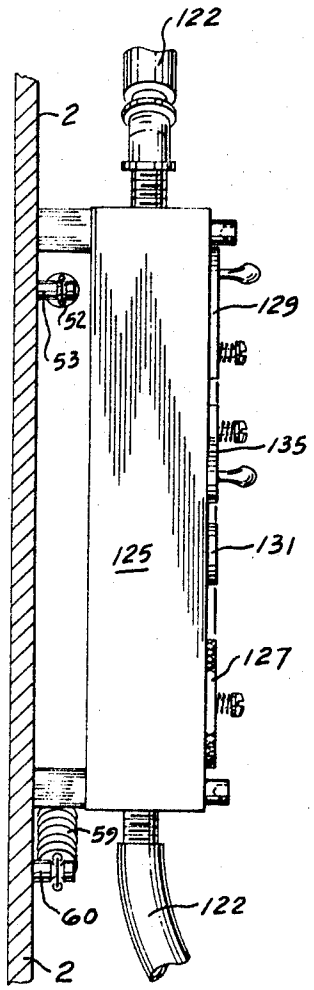


FIG-5

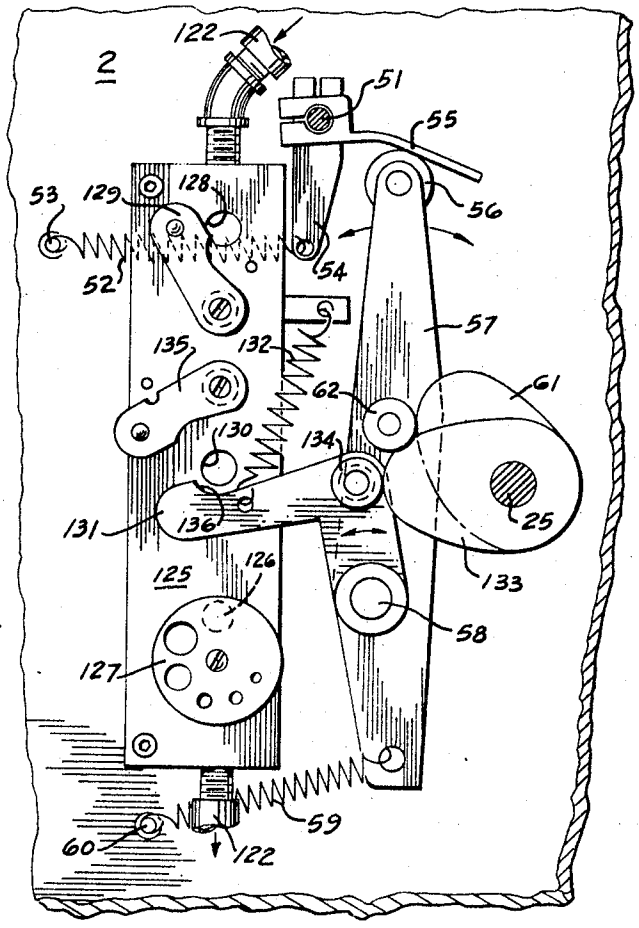


FIG-4

INVENTOR.
GEORGE A. GIBSON
BY
MORGAN, FINNEGAN, DURHAM & PINE
ATTORNEYS

June 10, 1969 G. A. GIBSON 3,448,978

PAPER-FEEDING METHOD AND MACHINE

Filed March 13, 1967 Sheet 4 of 5

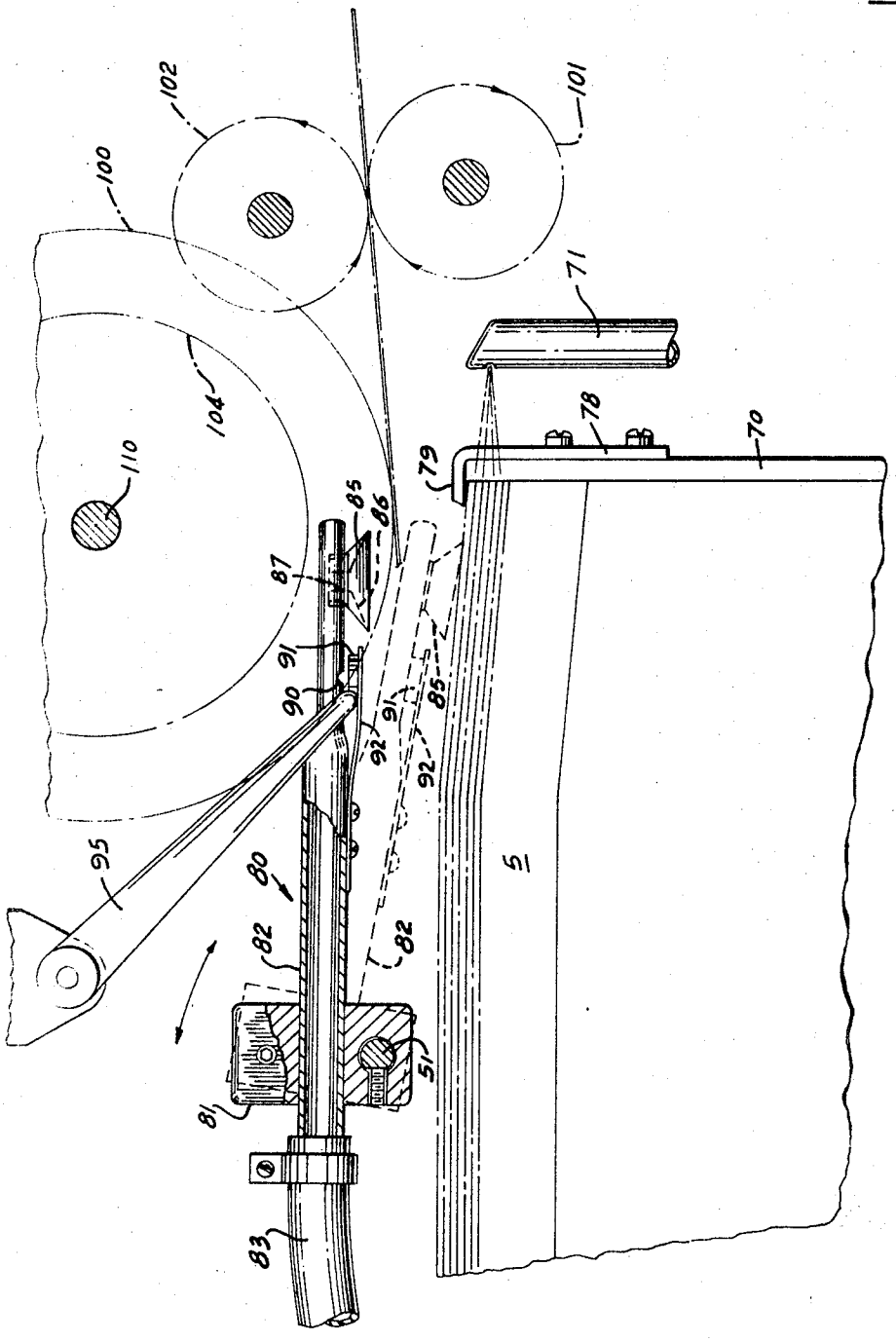


FIG-6

INVENTOR.
GEORGE A. GIBSON

BY
MORGAN, FINNEGAN, DURHAM & PINE
ATTORNEYS

June 10, 1969 G. A. GIBSON 3,448,978

PAPER-FEEDING METHOD AND MACHINE

Filed March 13, 1967 Sheet 5 of 5

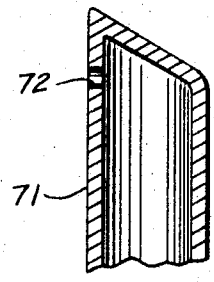


FIG-8

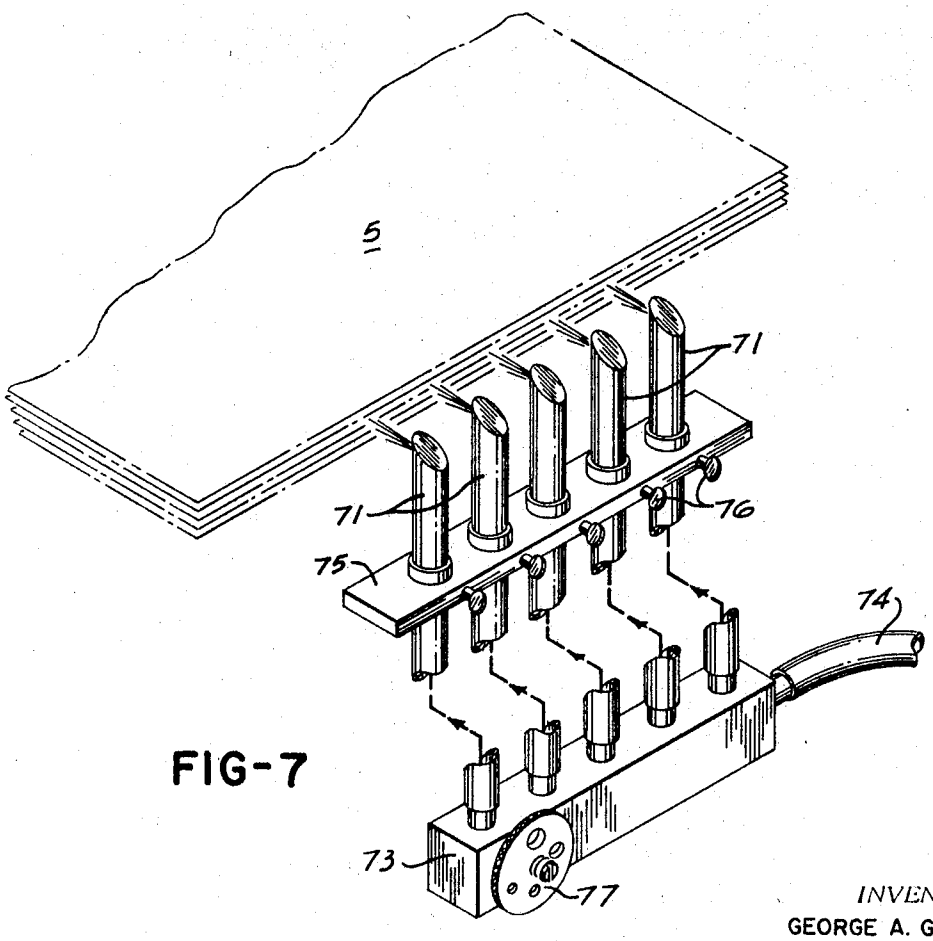


FIG-7

INVENTOR.
GEORGE A. GIBSON

BY
MORGAN, FINNEGAN, DURHAM & PINE
ATTORNEYS

United States Patent Office 3,448,978
Patented June 10, 1969

3,448,978

PAPER-FEEDING METHOD AND MACHINE

George A. Gibson, 365 W. 20th St.,
New York, N.Y. 10011

Filed Mar. 13, 1967, Ser. No. 622,663
Int. Cl. B65h 5/08, 5/06, 3/08
U.S. Cl. 271—11 3 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus and method for feeding individual sheets of paper one at a time from a sheet supply. Several of the uppermost sheets are held in suspended separation by an air blast, the topmost sheet bearing against an overhanging lip. An oscillating suction arm picks up the topmost sheet on its downward stroke and carries it to a suction wheel on its upward return stroke, whereupon vacuum to the suction arm is broken and the suction wheel and pull-out rollers transport the sheet away from the paper supply. Each sheet is flexed as it is drawn past the overhanging lip, so as to break any suction force permeating the topmost sheet of paper and thereby individually separate the sheets of paper from one another.

The paper supply is carried on a table which is elevated through gearing mechanism in response to a change in the paper level to thereby maintain the paper supply at a substantially constant level. A stopcock valve automatically opens and closes in synchronization with the suction arm to apply a vacuum to the suction wheel only at predetermined intervals of time.

Background and objects of the invention

The present invention relates generally to paper feeding machines and methods and relates more particularly to a novel method for feeding paper and to a novel paper feeding machine for carrying out the novel method having certain new and improved mechanisms for automatically controlling the level of the paper supply carried by the machine and for picking and transferring the successively topmost sheet of paper from the supply to a desired location.

It is desirable in many facets of the paper and printing industries to be able to automatically feed one sheet of paper at a time from a supply of sheet paper stock so that other operations may be carried out on the individual sheets, as desired. Heretofore, automatic paper feeding machines have suffered from unreliable operation in that two or more sheets are often removed together, jamming subsequent operations, or awkward and unreliable mechanisms have been employed in attempts to separate the paper sheets so that they may be removed individually.

It is therefore an object of this invention to provide a new and improved paper feeding method and apparatus.

Another object of this invention is to provide a new and improved paper feeding method which transfers a single sheet of paper at a time from a supply of sheet paper stock with improved ease and reliability of operation.

Another object of this invention is to provide a new and improved paper feeding method for separating the individual sheets in a pile of sheet paper stock and for positively feeding the sheets, one at a time, to the desired location.

Another object of this invention is to provide a new and improved paper feeding method whereby sheet paper stock is fed from a supply by firstly, suspending the uppermost sheets in the supply with an air blast; secondly, picking and transferring the topmost sheet from the supply to transport means, flexing the sheet as it is transferred; and, thirdly, transporting the picked sheets, one at a time, to the desired location.

Another object of this invention is to provide a new and improved paper feeding method wherein the sheet paper supply is automatically maintained at a substantially constant level.

Another object of this invention is to provide a new and improved paper feeding machine which automatically picks up and transfers a single sheet of paper at a time from a supply of sheet paper stock with improved ease and reliability of operation.

Another object of this invention is to provide a new and improved paper feeding machine having new and improved means for separating the individual sheets in a pile of sheet paper stock and for providing a positive pick-up and transfer of the topmost sheet to transport means which deliver the individual sheets to the desired location.

Another object of this invention is to provide a new and improved paper feeding machine having means for automatically controlling the level of the supply of sheet paper stock, such that the topmost sheet is continuously maintained at a substantially constant level.

Another object of this invention is to provide a new and improved paper feeding machine which includes valve means which automatically open and close in synchronization with suction paper pick-up and transport means only at predetermined intervals.

Another object of this invention is to provide, in a paper feeding machine having new and improved positive paper pick-up means and transport means for delivering individual sheets of paper to a desired location, means for causing the pick-up means to release the sheet of paper upon its being transferred to the paper transport means.

Objects and advantages of the invention are set forth in part herein 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, steps, processes and combination pointed out in the appended claims.

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

Summary of the invention

Briefly described, the method of the present invention for feeding paper from a supply of sheet paper stock is primarily characterized by firstly suspending the uppermost sheets in the supply with an air blast; secondly, picking and transferring the topmost sheet from the supply to transport means, flexing the sheet as it is transferred; and, thirdly, transporting the picked sheets, one at a time, to the desired location. Also, the method contemplates automatically maintaining the sheet paper supply at a substantially constant level and automatically synchronizing the application of vacuum to a transport suction wheel with the transfer of a sheet of paper thereto by the paper picker.

The paper feeding machine of the present invention is primarily characterized by novel means for individually separating the sheets of paper in a sheet paper supply; for feeding individual sheets one at a time from the supply, including means for positively picking up and carrying the successive top sheets to transport means which, in turn, deliver the sheets to the desired location; for automatically controlling the sheet paper supply at a substantially constant level; and for automatically transmitting a vacuum to the transport means at predetermined intervals in synchronization with the pick-up means.

A plurality of air jet tubes direct a blast of air against the forward edge of the sheet paper supply so as to up-

wardly lift and suspend the several uppermost sheets. The forward edge of the topmost sheet bears against the underside of an overhanging lip located below the lowest level of the transport means. The successive topmost sheet in the supply is picked up by an oscillating suction arm and drawn past the overhanging lip as it is carried to the transport means, whereupon the vacuum to the arm is broken and the sheet is delivered by the transport means to the desired location. The oscillating suction arm provides a positive pick-up of the topmost sheet of paper on each of its downward strokes and the flexing of the paper sheet as it is drawn past the lip breaks any suction force which may permeate the topmost sheet, thereby reliably transferring only a single sheet at a time to the transport means.

The transport means include a rotating suction wheel and two or more sets of pull-out rollers. The suction wheel firmly grasps the sheet of paper upon its release from the suction arm and transports it to pull-out rollers which, in turn, deliver the sheet to the desired location.

The sheet paper supply is maintained at a substantially constant level by stacking the sheets on a table which is elevated by gearing mechanism driven by a ratchet-and-pawl in response to a change in the level of the paper. A paper feeler finger and dog-arm depressor are secured to the same oscillating shaft on which the suction arm is mounted, the dog-arm in vertical alignment, but normally out of contact, with the pawl. Upon a lowering of the paper supply level, due to the removal of one or more sheets therefrom, the paper feeler finger permits the oscillating shaft to rotate over a greater arcual distance, whereupon the dog-arm contacts and depresses the pawl into engagement with the ratchet wheel, actuating the table elevation mechanism.

Advantageously, the application of a vacuum to the transport suction wheel is automatically synchronized with the oscillating suction arm so as to apply a vacuum only from a time shortly prior to the time the suction arm reaches the end of its upward stroke to a time just after the sheet of paper is passed to the pull-out rollers.

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.

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.

Brief description of the drawings

FIGURE 1 is a fragmentary elevation view, partly diagrammatic and partly in section, of a side frame panel of a paper feeding machine embodying the apparatus of this invention, the view illustrating, in particular, an embodiment of the drive mechanism for automatically raising the paper storage table and for driving the paper transport rollers;

FIGURE 2 is a fragmentary elevation view, partly diagrammatic and partly in section, of the opposite side frame panel for the paper feeding machine of FIGURE 1, the view illustrating the drive mechanism for the paper transport suction wheel;

FIGURE 3 is an exploded, fragmentary perspective view, partly diagrammatic, of the paper feeding apparatus of FIGURES 1 and 2, the view depicting the transverse arrangement of the ratchet-and-pawl mechanism, paper feeler finger, paper transport suction wheel, and the paper pick-up mechanism;

FIGURE 4 is a view in front elevation of an embodiment of the air manifold unit for regulating the suction applied to the paper transport suction wheel, and of the mechanism for driving the paper pick-up finger and controlling the level of the paper storage table of the paper feeding machine of this invention;

FIGURE 5 is an elevation view, taken from the left side of FIGURE 4;

FIGURE 6 is a fragmentary elevation view, partly diagrammatic and partly in section, illustrating the details and operation of the positive paper pick-up finger;

FIGURE 7 is a fragmentary perspective view, partly diagrammatic, illustrating the air manifold unit and air jets for propelling a blast of air against the upper, forward edge of the paper supply carried by the paper storage table depicted diagrammatically in FIGURE 1; and

FIGURE 8 is a longitudinal sectional view illustrating the details of a typical air jet of FIGURE 7.

Description of the preferred embodiment

Referring now more particularly to the embodiment of the apparatus of the invention shown in the accompanying drawings, there is illustrated a paper feeding machine, indicated generally by reference numeral **1**, having opposed, upright side frame panels **2**, **3** between which a paper storage table (not shown), carrying a supply of sheet paper stock **5** (see FIGURE 6), is suitably supported for upward and downward movement, more fully described hereinafter. Advantageously, suitable conveyor means, indicated generally by reference numeral **6**, is provided immediately forwardly of the machine for carrying the individual sheets of paper delivered thereto to desired locations for the performance of subsequent operations thereon.

The driving means for the paper feed and elevator mechanism, as best depicted diagrammatically in FIGURE 1, and as here preferably embodied, comprises a primary sprocket wheel **10**, suitably mounted for rotation with a primary drive shaft **11** which, in turn, is suitably journalled at its outer ends for rotation in bearing housings (not shown) carried by the side frame panels **2**, **3**. Sprocket wheel **10** is chain driven by a suitable motor (not shown) and roller chain **12**, at the desired rotational speed.

A pinion gear **15** is also mounted on primary drive shaft **11** so as to be driven thereby and, in turn, meshes with and serves to drive idler gear **16**, mounted for rotation with an idler stud shaft **17**, suitably mounted to frame panel **2**. Idler shaft **17** also carries a sprocket **18** operatively coupled with and serving to drive a sprocket **19** by means of roller chain **20**. Sprocket **19** is similarly mounted for rotation with a second idler stud shaft **21**, suitably mounted to frame panel **2**. Idler shaft **19** also carries a pinion gear **22** which meshes with and serves to drive pinion gear **23** secured to drive shaft **25**, the latter suitably journalled for rotation in a bearing housing (not shown) carried by frame panel **2**. Thus, the rotation of drive shaft **11** is transmitted through the idler shafts **17** and **21** to thereby drive the shaft **25** at a uniform rotational speed. It will be understood that the desired speed of rotation of shaft **25** may be obtained by varying the gear ratios of pinion gears **22**, **23**.

In accordance with the invention, means are provided for automatically controlling the level of the supply of sheet paper stock, such that the topmost sheet is continuously maintained at a substantially constant level. To this end, a crankshaft **26** is pivotally connected at one end by suitable linkage (not shown) secured to drive shaft **25** so as to be driven thereby in a generally up and down reciprocating movement. The opposite end of crankshaft **26** is pivotally connected by a pin member **27** to a pawl holder **28**, advantageously in the form of a generally rectangular plate. Pawl holder **28** is mounted for rotation about a shaft **30**, the latter being suitably journalled for rotation in a bearing housing (not shown) carried by frame panel **2**. It will thus be seen that reciprocating crankshaft **26** continuously drives pawl holder **28** in a back-and-forth oscillating motion about shaft **30**.

A pawl **31** is pivotally mounted on pawl holder **28** about pivot pin **33** and is adapted to engage and thereby drive ratchet wheel **35**, secured to shaft **30** adjacent pawl holder **28**. Pawl **31** is normally urged out of engagement with ratchet **35** by means of tension spring **36**, the latter pivoting the pawl upwardly and outwardly away from the

ratchet wheel. At predetermined times, in response to a change in the level of the paper supply 5 carried by the machine, a dog arm 50 contracts and depresses pawl 31 into engagement with ratchet 35, as will be more fully described hereinafter, whereby the oscillating motion of pawl 31 intermittently unidirectionally rotates ratchet 35 and, consequently, shaft 30. A stop pin 34 prevents dog arm 50 from further depressing pawl 31 after the latter has engaged ratchet 35.

A sprocket wheel 38 is also mounted on shaft 30 so as to be driven thereby and is operatively coupled with and serves to drive a sprocket 40, mounted for rotation on idler shaft 41, through roller chain 39. Shaft 41 also carries and serves to drive a pinion gear 42 in meshing engagement with a pinion gear 43 secured to a worm shaft 44. The worm gear 45 of shaft 44 in turn meshes with and serves to drive worm wheel 46, secured to one end of an elevator shaft 47. A sprocket-and-chain arrangement is mounted to the other end of shaft 48 in operative association with a similar sprocket (not shown) on the paper storage table (not shown), whereby rotation of shaft 48 serves to elevate the paper storage table. Advantageously, worm shaft 44 terminates in a crank for manual setting of the paper table at the beginning of a run, more fully described hereinafter.

It will be apparent from the foregoing that the elevation of the paper storage table, and consequently the level of the supply of sheet paper stock being fed by the machine, is controlled by the intermittent, unidirectional, rotation of ratchet 35, driven by oscillating pawl 31. Pawl 31 is, in turn, actuated into engagement with, and thereby serves to drive, ratchet 35 at predetermined intervals, in response to a change in the level of the paper supply 5.

To this end, as previously indicated, there is provided a dog arm 50 secured to a pick-up shaft 51, the latter being suitably journalled for rotation in bearing housings (not shown) carried by side frame panels 2, 3. As best seen in FIGURES 1 and 3, dog arm 50 is secured in a position longitudinally of shaft 51 so as to be in vertical alignment with pawl 31.

Shaft 51 is normally urged to rotate in a clockwise direction by the force of tension spring 52, fixed at one end to a pin 53 mounted on the side frame panel 2, against clip 54 secured to the shaft 51 (FIGURE 4). Also secured for rotation with shaft 51 is a follower arm 55, the latter being in substantially continuous engagement with a roller 56 carried at the upper end of a vertically extending lever 57.

Lever 57 is pivotally mounted near its lower end about a stud shaft 58 extending from the side frame panel 2 and, similarly to shaft 51, is normally urged in a clockwise direction by the tension force of spring 59 extending between a pin 60 mounted on frame panel 2 and the lower end thereof. A rotating cam 61 is secured to driven shaft 25 so as to bear against a roller 62 mounted on lever 57 and serves to drive the lever, in combination with the action of tension spring 59, in an oscillating motion about stud 58. It will be seen that as lever 57 oscillates about stud shaft 58, roller 56 swings back and forth in an arcual path beneath follower arm 55. Thus, on alternate strokes of the lever, roller 56 works against the tension of spring 52 to thereby, in turn, drive pick-up shaft 51 in an oscillating motion about its axis of revolution.

A paper feeler finger 65 is also secured to pick-up shaft 51 with its free end resting on the topmost sheet of the supply of paper carried by the machine. Feeler 65 is secured to shaft 51 in a predetermined circumferential position with respect to the circumferential position of dog arm 50 on shaft 51 such that, when the topmost sheet of paper is at the desired level, feeler 65 stops the rotation of shaft 51 and dog arm 50 does not depress pawl 31, whereby the latter remains out of engagement with ratchet wheel 35. Upon the removal of a few sheets of paper from the supply 5, finger 65 must reach a lower level before the rotation of shaft 51 is stopped and, consequently, dog arm 50 contacts and depresses pawl 31 into driving engagement with ratchet wheel 35, thereby elevating the paper storage table in the manner previously described.

Advantageously, and as here preferably embodied, feeler finger 65 is located on pick-up shaft 51 near the side frame panel 2, so as to minimize the effect of the disturbance caused by the paper pick-up and transfer mechanism located centrally of the machine, as will be more fully described hereinafter.

In accordance with the invention, means are provided for separating the individual sheets of the supply of sheet paper stock and for providing a positive pick-up and transfer of the topmost sheet to transport means which, in turn, deliver the individual sheets to the conveyor 6, or to any other desired location.

To this end, the sheet paper supply 5 is carried on the storage table with the forward edges of the individual sheets substantially fully exposed, the sheets advantageously being held in place by two or more upstanding rails, one such rail illustrated at 70 in FIGURE 6. A plurality of vertically extending tubes 71 are located opposite the forward edges of the sheet paper supply and generally centrally thereof, and are each provided with small openings 72 near their upper ends. Tubes 71 terminate at their lower ends in a manifold 73, in turn connected to a source of air pressure (not shown) by flexible hose conduit 74. It will thus be seen that tubes 71 conduct and direct a blast of air against the forward edges of the upper portion of the sheet paper supply, thereby slightly separating the top few sheets of paper from each other (FIGURES 6 and 7). Advantageously, a paper contact finger 68 may be provided, suitably mounted on horizontal shaft 69, so as to ride on the surface of the topmost sheet of paper and thereby tend to hold down the individual sheets of paper in the supply stock and guide them as they are picked up and transported away, as is more fully described hereinafter.

Tubes 71 extend through openings in a horizontal bracket 75 provided with transverse set screws 76 so as to be vertically adjustably mounted opposite the paper supply. Also advantageously, manifold 73 is provided with a manually rotatable regulator disc 77 for regulating the force of the air blast emitted by tubes 71, as will be understood to those of ordinary skill in the art.

A bracket 78, having a horizontal lip 79 overhanging the supply of sheet paper 5, is suitably secured to the upper end of one of said rails 70 so as to limit the distance the topmost sheets are raised by the force of the air blast from tubes 71. Preferably, lip 79 is located in direct alignment with pick-up arm 80, the latter more fully described hereinafter. Lip 79 also serves a significant part in assuring that only a single sheet at a time is withdrawn from the supply, as will be more fully described hereinafter.

As previously indicated, positive pick-up means are provided for picking up and transferring the topmost sheet of paper from supply 5 to transport means. To this end, a pick-up arm, indicated generally by reference numeral 80, is secured to oscillating pick-up shaft 51 by clamp 81. Pick-up arm 80 comprises a generally tubular member 82 extending forwardly of clamp 81, the hollow interior thereof communicating with a flexible hose conduit 83 connected to a source of vacuum (not shown). Intermediate of pick-up arm 80 and the vacuum source, a pressure regulable manifold 84 is provided for regulating the vacuum communicated to the pick-up arm, as will be understood to those of ordinary skill in the art.

Pick-up arm 80 is provided with two openings on the underside of the tubular member 82, the first opening being located near the forward end thereof and receiving a suction cup 85 having a conically recessed face 86 terminating in a conduit 87 which extends through the base of the cup to communicate the interior of arm 80 with the cup face 86. The second opening is located at 90 and is normally closed by a disc pad 91 mounted on

the end of a flat spring clip **92**, the latter in turn being suitably secured to the undersurface of member **82**.

It will be understood from the foregoing that pick-up arm **80** is driven in an oscillating motion by shaft **51** and that, by reason of the vacuum communicated thereto, at the end of each downward stroke, suction cup **85** picks up the topmost sheet of paper from the supply **5**. On the upward, return stroke of arm **80**, the sheet held by the suction cup is drawn past the overhanging lip **79** and transferred to the transport means. As the sheet is drawn past lip **79**, it is caused to flex or bend, thereby insuring that any vacuum permeating the topmost sheet is broken and that only a single sheet at a time is carried to the transport means.

Advantageously, suction cup **85** is formed from a material, such as rubber or an equivalent thereto, having sufficient flexibility so as to substantially fully conform to the bending or flexing of the sheet as it is drawn past lip **79**, thereby insuring that a vacuum is continuously maintained on the surface of the sheet.

Immediately prior to the end of each upward stroke of pick-up arm **80**, the vacuum created on the face of the suction cup **85** is broken, thereby releasing the sheet of paper to transport means, more fully described hereinafter. To this end, as here preferably embodied, a rod **95** is suitably secured to horizontal shaft **69**, extending between frame panels **2**, **3**, so as to extend angularly downwardly adjacent pick-up arm **80**. Rod **95** terminates at a point slightly below the upper limit of travel of pick-up arm so as to contact and depress spring clip **92**, thereby forcing pad **91** away from opening **90** in tubular member **82** and breaking the vacuum applied to the sheet by suction cup **85**.

As here preferably embodied, the transport means for receiving the individual sheets from pick-up arm **80** and delivering the sheets to the desired location comprises a suction wheel **100** and two sets of pull-out rollers, one such set being shown at **101**, **102**. Advantageously, suction wheel **100** has a hollow interior communicating a double row of slotted openings **103**, located on either side of a diametrically recessed portion **104** on the peripheral surface thereof, with a plurality of holes **105**, arranged in a circular row on one side **106** of the wheel.

Suction wheel **100** is secured for rotation with a drive shaft **110** which, in turn, is suitably journalled at its outer ends for rotation in bearing housings (not shown) carried by the side frame panels **2**, **3**. A sprocket wheel **111** is also secured to, and serves to drive, shaft **110** by means of roller chain **112**, operatively coupling sprocket **111** with a sprocket **113**, the latter being mounted to an idler shaft **114** suitably journalled for rotation in side frame panel **3**. Shaft **114** is driven by pinion gear **115** in meshing engagement with pinion gear **15***a* secured to the primary drive shaft **11** (FIGURE 2).

Each set of pull-out rollers includes a lower, driver roller **101**, secured to primary drive shaft **11**, and an upper, idler roller **102**. Roller **102** is suitably journalled for rotation in a bracket **116** linked to horizontal shaft **118** extending between the side frame panels of the machine. Advantageously, driven roller **101** is constructed from a steel material while idler roller **102** has a rubber material formed about its periphery so as to insure positive delivery of the sheet paper to the desired destination. Also advantageously, suction wheel **100** and pull-out rollers **101**, **102** are driven at the same surface speed whereby as soon as each sheet of paper is passed to the pull-out rollers the suction applied thereto by wheel **100** may be terminated in a manner to be described hereinafter.

An open-ended conduit member **120** is spring-pressed by compression spring **121** into tight-fitting abutment at a radial position on side **106** of suction wheel **100** so as to communicate a source of vacuum (not shown) from flexible hose conduit **122** to holes **105** and, thence, peripheral slots **103**.

Intermediate conduit **120** and the vacuum source, a manifold **125** is provided for regulating the amount of the vacuum and for turning the vacuum on and off. To this end, manifold **125** is provided with an opening **126** covered by a rotatable disc **127** having a plurality of holes therein of varying diameter. It will be apparent that the amount of vacuum conducted through the manifold may be progressively decreased by rotating the disc from a position completely covering opening **126** (FIGURE 4) to a position wherein the largest hole in the disc is in registry with opening **126**.

A second opening **128** is provided in manifold **125** and is adapted to be opened or closed by manually rotating stopcock **129** into and out of registry therewith. It will be understood that with stopcock **129** in registry with opening **128**, a vacuum is continuously created at the surface of suction wheel **100**.

Advantageously, and as here preferably embodied, the suction at the peripheral surface **103** of suction wheel **100** is applied from a time shortly prior to the time pick-up arm **80** reaches the end of its upward stroke to a time just after the sheet of paper is passed from the suction wheel to the pull-out rollers **101**, **102**. To this end, manifold **125** is provided with a third opening **130** adapted to be automatically opened and closed by a rocker stopcock **131** in synchronization with the oscillating motion of pick-up arm **80**. Thus, rocker stopcock **131** is pivotally mounted at one end to stud shaft **58** and is normally urged into a positon of registry with opening **130** by tension spring **132**. A rotating cam **133** is fixed to driven shaft **25** forwardly of cam **61** and is adapted to engage roller follower **134** mounted to stopcock **131** and thereby pivot the stopcock out of registry with opening **130**, breaking the vacuum applied to suction wheel **100**. It will be understood that, when it is desired to manually control the vacuum applied to the suction wheel, opening **130** may be permanently closed by locking stopcock **135** against the upper, curved lip **136** of rocker stopcock **131**, stopcock **135** thereby covering the opening.

It will be apparent from the foregoing that the operation of the previously described embodiment of the paper feeding machine of the present invention is as follows.

The primary drive shaft **11**, through chain and gear mechanisms, continuously rotates the suction wheel **100** and pullout rollers **101**, **102**, preferably at the same surface speed. Drive shaft **25**, also driven by shaft **11** through chain and gear mechanisms, serves to continuously oscillate both pawl holder **28**, through reciprocating crankshaft **26**, and pick-up shaft **51**, through cam **61**, lever arm **57** and lever cam follower **55**. The plurality of air jet tubes **71** directs a blast of air against the forward edge of the sheet paper supply **5** so as to upwardly lift and suspend the several uppermost sheets, the forward edge of the topmost sheet bearing against the underside of overhanging lip **79**.

Suction arm **80** is continuously driven in an oscillatory motion by oscillating shaft **51**, picking up the topmost sheet in the supply **5** on its downward stroke and carrying the sheet to suction wheel **100** on its upward, return stroke. As the forward edge of the sheet is drawn past the overhanging lip **79**, the sheet is caused to flex or bend, which breaks any suction force permeating through the sheet to the next sheet. In this manner, only a single sheet at a time is carried to the suction wheel to be subsequently fed from the machine.

The upward stroke of suction arm **80** advantageously terminates within the diametrically recessed portion **104** of suction wheel **100**, whereupon rod **95** deflects spring clip **92** to break the vacuum applied to suction cup **85** and release the sheet to the bottom peripheral surface of the suction wheel. The continuously rotating suction wheel propels the sheet in a substantially horizontal direction to pull-out roller **101**, **102** which, in turn, transport the sheet to the desired location.

Upon the removal of a few sheets of paper from the supply, feeler finger **65** must reach a lower level before

it contacts the paper supply and consequently, dog arm **50** depresses oscillating pawl **31** into engagement with ratchet wheel **35**, thereby elevating the paper storage table until the topmost sheet is again at the desired level.

Also, as preferably operated, suction wheel **100** and pull-out rollers **101**, **102** are driven at corresponding surface speeds and the vacuum to wheel **100** is applied only during the predetermined interval of time previously mentioned, providing a quieter and smoother feeding action.

The invention in its broader aspects is not limited to the specific embodiment herein 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. In an apparatus for feeding individual sheets of paper from a supply of sheet paper stock, the improvements therein which comprise:

means for individually separating the sheets of paper in said sheet paper supply;

means for feeding said individual sheets of paper one at a time from said supply to a desired location, including

means for positively picking up and carrying the successive top sheets to transport means,

said transport means including a rotatable suction wheel and a pair of pull-out rollers for delivering said sheets to said desired location; and

means for automatically transmitting a vacuum to said suction wheel at predetermined intervals in synchronization with said positive pick-up means.

2. Apparatus for feeding individual sheets of paper from a supply of sheet paper stock comprising:

table means receiving said paper supply,

said table means including lip means extending inwardly from an edge of said table means and in spaced relation thereto;

means directing a blast of air against said paper supply so as to at least partially separate several of the uppermost sheets therein, one edge of the topmost sheet bearing against said lip means;

means for feeding said individual sheets of paper one at a time from said supply to a desired location, including first and second suction means,

said first suction means picking up and carrying said topmost sheet to said second suction means, drawing said edge of said sheet past said lip means,

said first suction means comprising a continuously oscillating hollow arm member having a suction cup at the distal end thereof and a source of vacuum communicated to said suction cup,

said oscillating arm picking up said topmost sheet on each downward stroke and carrying said sheet to said second suction means on each upward stroke;

said second suction means comprising a rotatable wheel and a source of vacuum communicated to the peripheral surface thereof, and

further including at least a pair of pull-out rollers for receiving said sheet from the suction wheel and delivering said sheet to said desired location;

means for breaking the vacuum applied to said first suction means simultaneously with the arrival of said topmost sheet at the suction wheel of said second suction means;

means responsive to a change in the level of said paper supply for elevating said table means a corresponding distance, thereby maintaining said paper supply at a substantially constant level; and

valve means automatically transmitting said vacuum to said suction wheel only from a time just prior to the arrival of said sheet thereto until said sheet is transported thereby to said pull-out rollers.

3. A method for feeding individual sheets of paper from a supply of sheet paper stock comprising the steps of:

directing a blast of air against said paper supply so as to at least partially separate several of the uppermost sheets therein;

applying a first source of vacuum to the topmost sheet of said paper supply so as to pick up said sheet;

flexing said sheet as it is picked up from said paper supply;

applying a second source of vacuum to said sheet so as to transport said sheet to a desired location;

breaking said first source of vacuum simultaneously with the application of said second source of vacuum to said sheet;

automatically providing said second source of vacuum at predetermined intervals in synchronization with the breaking of said first source of vacuum; and

automatically controlling said sheet paper supply at a substantially constant level.

References Cited

UNITED STATES PATENTS

951,074	3/1910	Hren	271—62
1,166,004	12/1915	Reifsnyder	271—62 X
1,629,874	5/1927	Kelly	271—62
2,347,254	4/1944	Cox	271—11 X
2,350,511	6/1944	Lake	271—11

EDWARD A. SROKA, *Primary Examiner.*

U.S. Cl. X.R.

271—25, 31, 62