United States Patent [19]

Gazzola et al.

[11] **3,749,330**

[45] **July 31, 1973**

[54] **APPARATUS FOR DELIVERING SHEETS ONTO A MOVING STRIP OF MATERIAL**

[75] Inventors: **Ivaldo Gazzola,** Lausanne, Switzerland; **Salvatore F. D'Amato,** Floral Park; **Ghauncey P. Foote, Jr.,** Katonah, both of N.Y.

[73] Assignee: **American Bank Note Company,** New York, N.Y.

[22] Filed: **Nov. 3, 1971**

[21] Appl. No.: **195,364**

[52] **U.S. Cl.** ..... **242/67.3 R,** 242/75.4, 271/74, 271/76

[51] **Int. Cl.** **B65h 39/14**

[58] **Field of Search** ..... 242/67.3 R, 67.1 R, 242/67.2, 54 R, 55, 75, 57, 75.4; 271/79, 79 SR, 74, 76, 46

[56] **References Cited**

UNITED STATES PATENTS

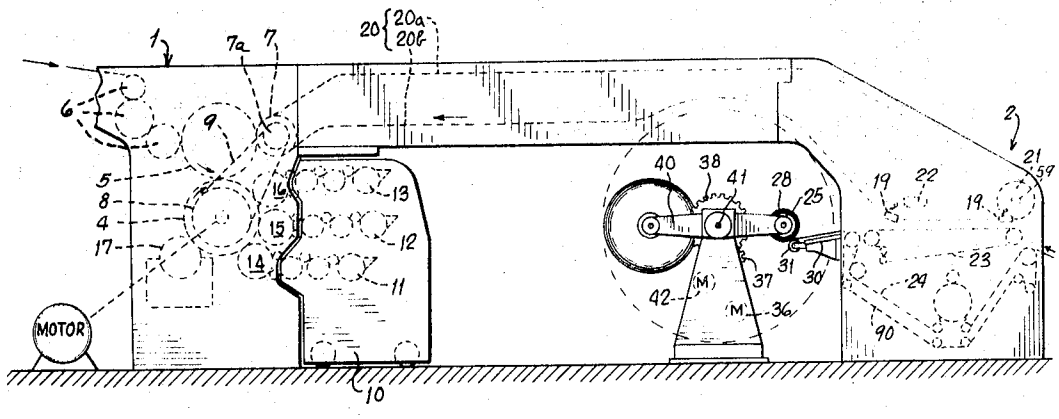
1,049,413	1/1913	Sheldon	242/67.3 R
2,679,986	6/1954	Fridolph	242/75.4 X
3,477,323	11/1969	Osborn	271/46 X
2,924,453	2/1960	Peyrebrune	271/79
2,852,256	9/1958	Faulls	271/76
2,339,268	1/1944	Huffman	271/74

Primary Examiner—George F. Mautz
Assistant Examiner—Edward J. McCarthy
Attorney—Lester W. Clark et al.

[57] **ABSTRACT**

This sheet delivery apparatus for use with an intaglio printing press takes sheets from a conventional conveyor running at press speed, and on which the sheets are widely spaced as determined by the press operation, and passes them along a decelerating conveyor to a continuously running strip on which they are deposited in closely spaced relation. The strip and sheets together are then wound into a roll and allowed to stand for a period of time long enough to allow the ink to dry on the sheets. The decelerating conveyor includes perforated conveyor belt means running over a manifold which is connected to a vacuum pump. The pressure difference between the atmosphere and the evacuated manifold holds the sheets lightly on the perforated belt, thereby decelerating the sheets to the speed of the perforated belt, which is running slower than the press speed. At the end of the deceleration belt, the sheets pass on to a moving strip of paraffin coated paper which is being driven at a predetermined ratio with respect to the press speed by means of a continuous belt drive which runs along with the strip for a substantial distance. The tension on this strip is controlled by driving the strip take-up reel with a motor having a limited maximum torque characteristic, driving the strip between the reels at a preselected speed, and braking the strip supply reel with a limited maximum torque brake. The sheets pass from the decelerating belt onto a reach of the strip which is inclined slightly downward and extends to a reel on a double reel stand. The take-up reel position is controlled by the position of the strip so as to maintain that reach of the strip within a small angle of the horizontal throughout the winding process.

14 Claims, 7 Drawing Figures



PATENTED JUL 31 1973

3,749,330

SHEET 1 OF 3

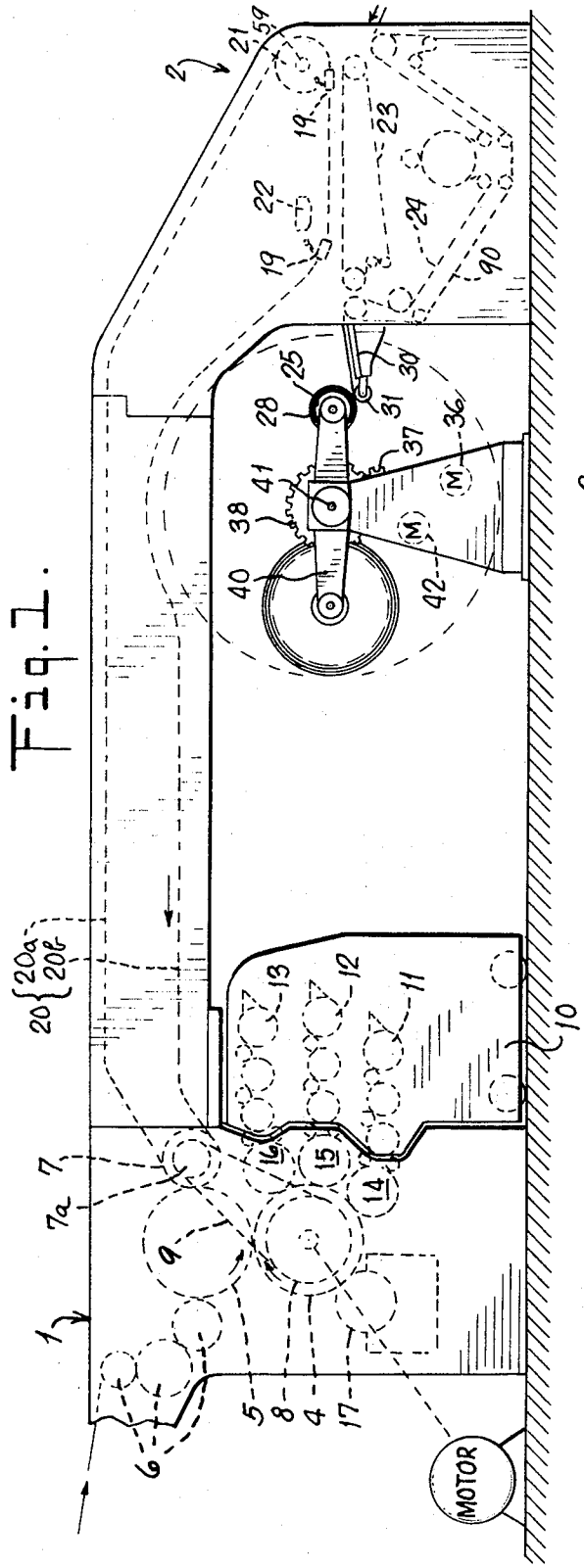


Fig. 1.

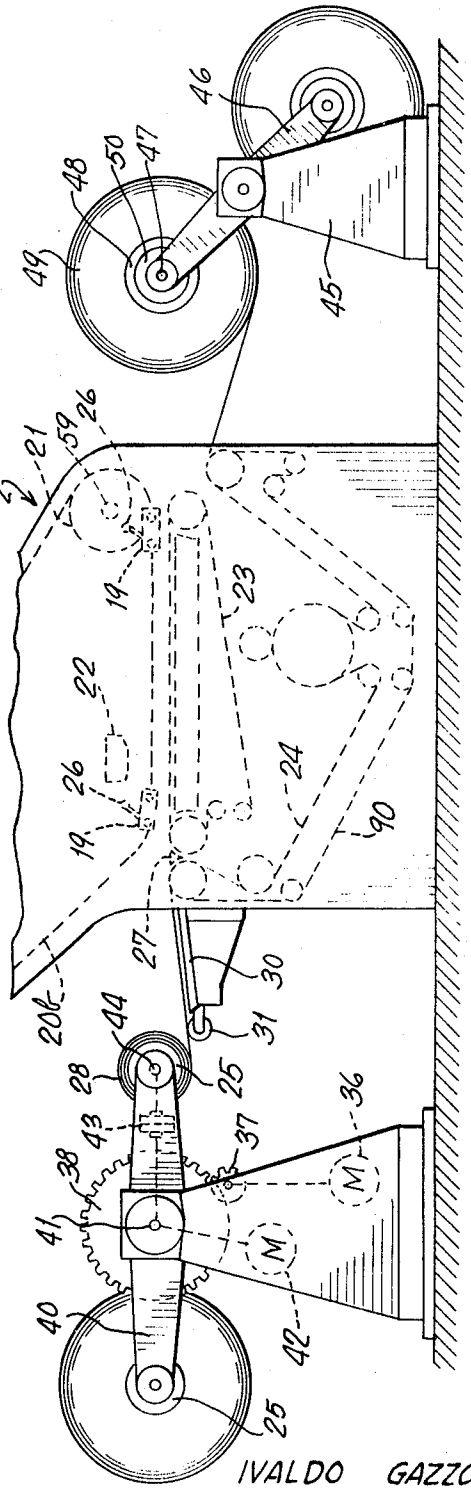


Fig. 2.

IVALDO GAZZOLA
SALVATORE F. D'AMATO
CHAUNCEY P. FOOTE
INVENTORS

BY Lester W. Clark

ATTORNEY

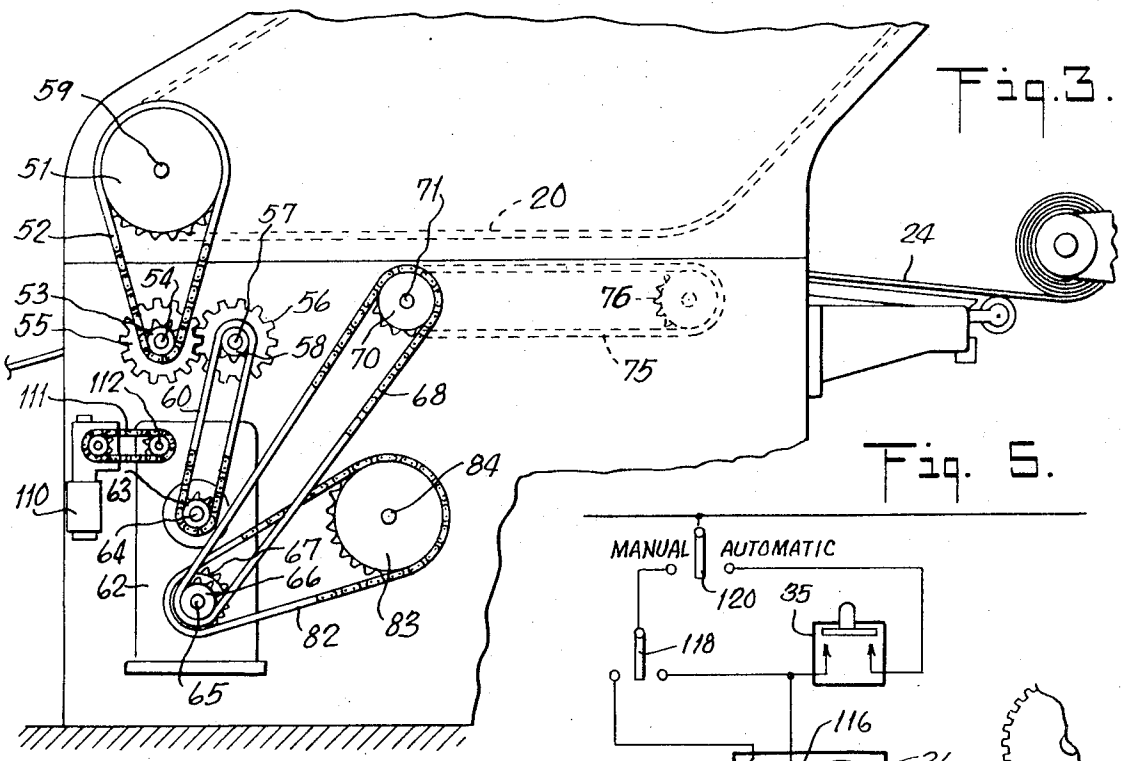


Fig. 3.

Fig. 5.

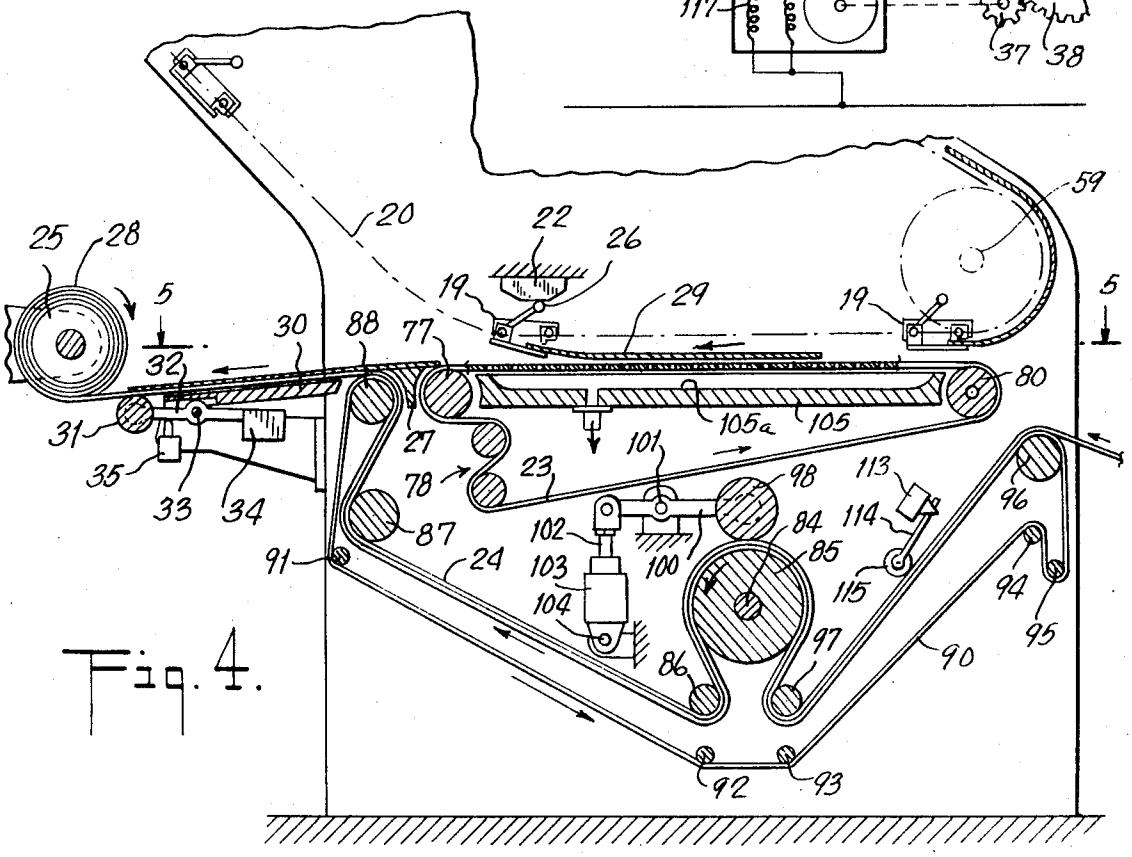
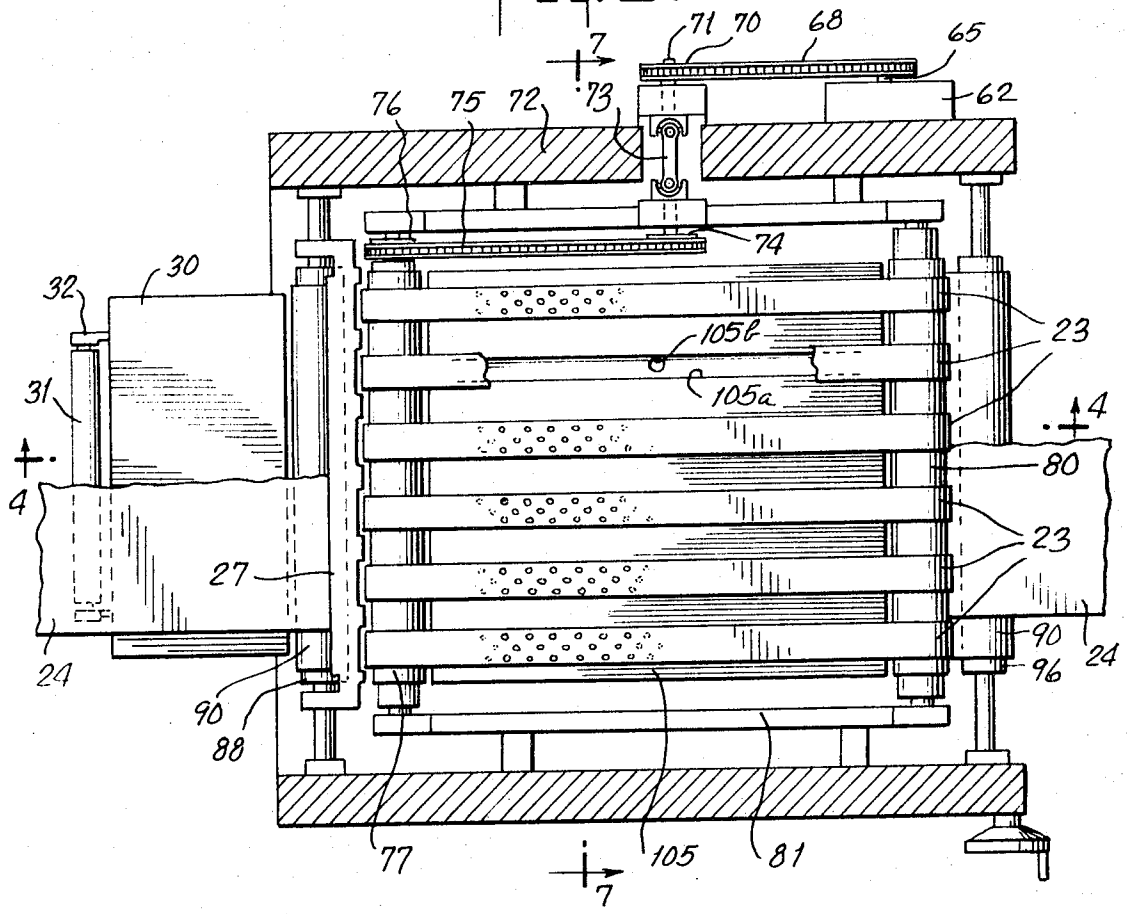


Fig. 4.

Fig. 6.


7
71
70
68
65
62
76
75
72
73
74
32
30
105b
23
31
105a
4
4
80
23
27
90
24
24
90
96
88
77
105
81
7

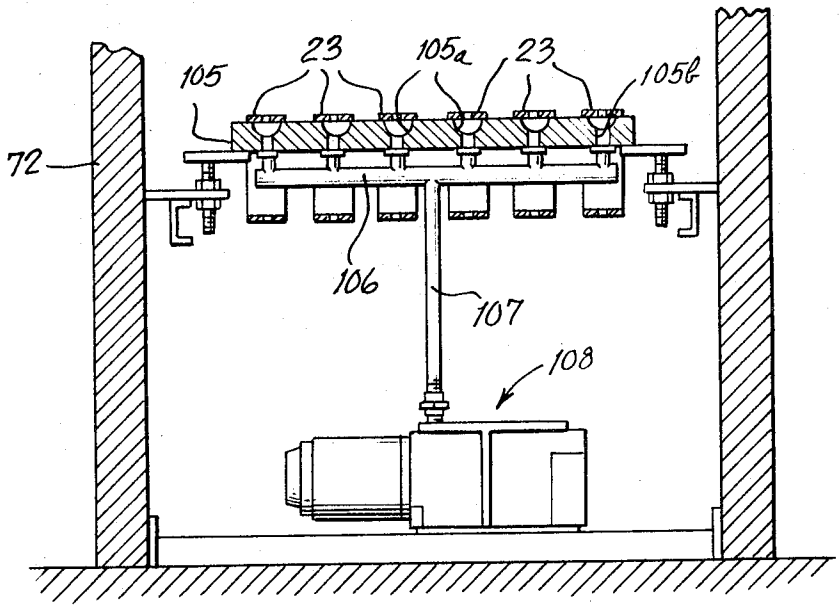

105
23
105a
23
105b
72
106
107
108

Fig. 7.

APPARATUS FOR DELIVERING SHEETS ONTO A MOVING STRIP OF MATERIAL

BRIEF SUMMARY OF THE INVENTION

The inks used in intaglio printing are slow drying. Furthermore, the ink layer is thicker than the ink layers employed in other types of printing. This thick ink layer contributes to the slowness of the drying process.

Because of the slow drying characteristics, it has been customary to deliver the sheets from an intaglio press either to a stack in which the printed sheets are alternated with slip sheets, or to a continuous strip of non-absorbent material, such as paraffin coated paper. and to wind the strip and sheets together in a roll. The roll is then stored for a period of time, usually a matter of hours or days, until the ink is dry. The sheets may then be withdrawn from the roll and printed on the reverse side, whereupon another drying cycle in a similar roll takes place. See, for example, the U.S. Pat. to Marquardt, No. 2,035,903.

The present invention is concerned with improved apparatus for transferring intaglio printed sheets from a printing press to a continuously running strip of material and winding the material with the sheets on it into a roll.

The printed sheets travel from the press on a conveyor belt or chain which necessarily must be running at the same linear speed as the periphery of the plate cylinder of the press. The leading edges of the sheets are separated on the conveyor by a distance equal to the circumference of the plate cylinder, if only one plate is employed on that cylinder, or by a fraction of the cylinder circumference, if more than one plate is employed. There is always substantial spacing between the sheets on the conveyor, since less than the entire circumference of the plate cylinder is taken up by the plate. On the paraffin coated paper strip, it is desirable to position the sheets as closely together as possible (with ½ inch to 1 inch spacing) so as to economize in the use of the strip material, and also to make the roll of strip material and sheets more uniform. In order to shorten the spacing between the sheets as they come from the press speed conveyor, it is necessary to decelerate the sheets. In the present invention, this is done by a decelerating conveyor consisting of a perforated belt arrangement running over an evacuated manifold and located below a reach of the press speed conveyor where the sheets are traveling below that conveyor. The printed sheets are released from the press speed conveyor and are moved toward the perforated belt conveyor by the combined effect of gravity and of the pressure difference between the atmosphere and the evacuated manifold. The sheets are slowed to the decelerating conveyor speed by the effect of the air streams without the occurrence of any frictional contact between the upper, freshly printed side of the sheets and any solid material. This prevents wrinkling of the sheets during deceleration. At the end of the decelerating conveyor, the sheets pass on to the continuously running strip, which is moving at the same linear speed as the declerating conveyor.

The strip is driven, between the supply reel and the take-up reel by passing it around a drum running at a preselected speed. A clamping roller holds the strip on the periphery of the drum. The clamping roller pressure may be adjusted.

Since the strip is of relatively weak material, it is not capable of standing any substantial tension. The prior art apparatus has devoted much effort to providing tension control systems which would keep the tension in the moving strip at a substantially constant and desirably low value. In accordance with the present invention, the tension in the strip is kept low by the use of a relatively simple control system including the drive for the strip, described above, a limited constant torque motor drive for the take-up reel and a limited maximum torque brake on the strip delivery reel.

The final reach of the strip between the deceleration conveyor and the take-up reel moves at a slight downward angle with respect to the horizontal, so that any effect of gravity on the sheets is to move the sheets in the direction of strip movement. The take-up reel is mounted on a double reel stand, which can accommodate two reels at the diametrically opposite ends of a pair of spaced arms. The arms are pivoted at their midpoint. The whole assembly, including the arms and the two reels may be turned about the midpoint by a suitable motor. In accordance with the present invention, that motor is controlled so that as the strip winds up on the take-up reel, the reel is lifted to accommodate the increase in diameter of the roll, so that the final reach of the strip approaching the take-up reel is within a predetermined range of the desired slight downward angle.

THE DRAWINGS

FIG. 1 is a somewhat diagrammatic illustration of a printing press including the sheet delivery apparatus of the invention.

FIG. 2 is a fragmentary view similar to FIG. 1, but on a larger scale, showing the sheet delivery apparatus only.

FIG. 3 is a fragmentary elevational view taken from the back of FIG. 2, and on a larger scale, showing the driving mechanism for various parts of the apparatus.

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 6, showing the strip driving apparatus and the decelerating conveyor.

FIG. 5 is a wiring diagram of a system for controlling the motor which determines the elevation of the take-up reel.

FIG. 6 is a sectional view taken on the line 5—5 of FIG. 4, showing the decelerating conveyor.

FIG. 7 is a sectional view taken on the line 7—7 of FIG. 6.

FIG. 1

This figure is an overall, partly diagrammatic view of a printing press constructed in accordance with the invention, including a printing station 1 and a sheet delivery station 2. The printing station includes a plate cylinder 4, a pressure cylinder 5 located vertically above the plate cylinder, sheet supply means including an array of sheet supply rolls 6 and sheet delivery means including a delivery roll 7. The delivery roll 7 is driven from the shaft of plate cylinder 4 through a sprocket 8 on that shaft, a chain 9, and a sprocket 7*a* on the shaft of the delivery roll 7. Any other suitable drive for roll 7 may be used, as long as its peripheral speed is the same as that of plate cylinder 4. For example, the shafts of cylinder 4 and roll 7 could be connected by bevel gears and a connecting shaft.

The press illustrated is a multicolor intaglio press. Ink supply means are provided including a carriage 10 sup-

porting three ink supply trains **11, 12** and **13**, terminating in inking rolls **14, 15** and **16**, respectively, which cooperate with the plate cylinder **4**. An ink wiping mechanism is shown at **17** for removing surplus ink from the surface of the plate on the cylinder **4**.

Sheets are delivered from the sheet delivery roll **7** to a chain conveyor **20**, which is located overhead, above the ink supply carriage **10**. The conveyor **20** includes an upper reach **20***a* which moves away from the printing station **1** and a lower return reach **20***b* which moves back toward the printing station **1**. At the end of the upper reach **20***a*, the conveyor **20** moves around conventional reversing sprockets **21** and thereafter passes a sheet delivery station including gripper release means **22** for engaging sheet grippers **19** spaced along the conveyor. Each gripper **19** holds s sheet which it has picked up at the printing station **1**. Sheets released by the grippers **19** fall onto a deceleration conveyor **23** which slows the sheets and controls their spacing, delivering them to a strip of paraffin coated paper **24** which carries them onto a reel mechanism generally shown at **25**, so that the sheets are wound between turns of a roll or coil of the paper **24**. The roll is then stored long enough to allow the ink on the printed sheets to dry.

The conveyor **20** travels at the same linear speed as the periphery of the plate cylinder **4** in order that the sheets printed by that cylinder may be transferred to the conveyor **20** without any change in speed at the point of transfer. The conveyor **20** carries a plurality of grippers **19**, which are spaced apart by a distance equal to the spacing of the leading edges of the sheets passing around the plate clylinder **4**. Each gripper **19** engages a leading edge and holds a sheet on the conveyor, with the printed side facing down on the upper reach **20***a* of the conveyor and facing up on the lower reach **20***b*. As each gripper **19** passes through the delivery station **2**, its release lever **26** engages a stationary tripper cam **22**, thereby disengaging the gripper so that the sheet falls by the combined effect of gravity and vacuum to the decelerating conveyor **23**, shown in greater detail in connection with FIGS. **5** and **6**.

FIGS. 2–4

At the discharge end of the decelerating conveyor **23**, the sheets pass across a spacer **27** and move on to the surface of the continuous strip **24** which carries them into the roll **28** being formed on the reel **25**. The final reach of the strip **24** as it approaches the reel **25** is tilted slightly downward, and passes over a table **30**, also tilted slightly downward. Near the end of this final reach, the strip **24** passes over a roller **31** journaled on the ends of a pair of arms **32**, (FIG. 4) which are pivotally mounted at **33**. The arms **32** extend past the pivots **33** and at their opposite ends support a counterweight **34**, which biases the roller **31** upwardly into engagement with the underside of the strip **24**. Under one of the arms **32** is located a push button switch **35** controlling a motor **36** which drives through gears **37** and **38** (FIG. 2), a turret **40**, pivoted at its center on a shaft **41** and provided at its opposite ends with journals for receiving reels **25**. The operation of the motor **36** is described more completely below in connection with FIG. **7**.

The table **30** should be made as short as conveniently possible in the direction of movement of the strip, so as to minimize the distance traveled by each sheet between the decelerating conveyor **23** and the take-up reel. The table may be replaced by an idler roller of suitable construction.

Another motor **42** drives, through suitable gearing and a slip clutch **43**, a hub **44** connected to the reel **25**. The slip clutch **43** limits the maximum torque which the motor **42** can supply to the reel **25**. Other suitable forms of drive providing a limited maximum torque may alternatively be used.

The supply rolls for the strip **24** are mounted on a double roll stand **45**, which supports a turret **46** having a pair of opposed arms, provided at their ends with hubs **47** adapted to support supply reels **48**. Each hub **47** is provided with a brake **50** which constantly retards the rotation of the reel. The brake **50** may consist of a simple drum turning with the reel and encircled by a stationary brake band. The particular structure of the brake is not critical. It is only necessary that it provide a limited maximum retarding torque to the reel **48**. That retarding torque should be adjustable, since the tension in the strip varies inversely with the roll diameter, and the maximum tension must be less than the tensile strength of the strip. Hence, the maximum retarding torque should be adjusted so that the strip tension, at minimum roll diameter, is less than the tensile strength of the strip.

FIGS. 3–4

These figures illustrate the drive mechanism for the decelerating conveyor **23** and the strip **24**. As best seen in FIG. **3**, the chain conveyor **20** turns a shaft **59** on which is fixed a sprocket wheel **51** engaged by a chain **52**, which runs over another sprocket wheel **53** fixed on a shaft **54**. A gear **55** is also fixed on the shaft **54** and engages a gear **56** fixed on a shaft **57** carrying a sprocket wheel **58** connected by a chain **60** to a Reeves variable ratio drive **62**. Such a drive is used, for a different purpose, in the Marquardt U.S. Pat. No. 2,035,903, mentioned above, where it is described as a differential speed reducing mechanism. The chain 60 runs over a sprocket 63 fixed on an input shaft 64 of the Reeves drive. An output shaft 65 of the Reeves drive carries sprockets 66 and 67. Sprocket 66 engages a chain 68 running over another sprocket 70 fixed on a shaft 71 which extends through a frame 72 of the press and through a pair of universal joints 73, (FIG.6). The inner end of the shaft 71 carries another sprocket 74. A chain 75 runs over the sprocket 74 and over another sprocket 76 on a shaft carrying a roller 77. A plurality of perforated belts, constituting the conveyor 23, run over the roller 77, over another roller 80, and over a slack take-up mechanism 78. The shafts of the rollers 77 and 80 are journaled in a frame 81 suitably mounted on the frame 72 of the press.

The sprocket **67** on shaft **65** drives a chain **82** which runs over a sprocket **83** fixed on a shaft **84**. The shaft **84** carries a driving roller **85** for the strip **24**. The strip **24** is clamped against the surface of the drive roller **85** by another roller **98** mounted at the end of a pivot arm **100**. The arm **100** is pivoted at **101** to a fixed support and has its opposite end pivotally connected to a piston rod **102** actuated by a cylinder **103** whose lower end is pivoted to a fixed support **104**. The pressure in cylinder **103** may be manually controlled.

The path of the strip **24** through the apparatus illustrated in FIG. **4** may be traced over an entrance guide roller **96**, an idler roller **97**, around the driving roller **85** and thence over idler rollers **86, 87** and **88**. The idler

roller 88 defines the upstream end of the final reach of the strip 24 as it approaches the take-up reel 25.

A conventional type of web threading mechanism is provided for introducing the leading end of a new strip 24 into the apparatus. This mechanism includes a pair of chains, one of which is shown diagrammatically at 90. The chains 90 are located on either side of the strip 24. At appropriate locations along the chains 90 they are connected by transverse bars which carry sets of grippers for engaging the leading edge of a strip. The chains 90 pass over suitable sprockets concentric with and rotatable on the rollers 96, 97, 85, 86, 87 and 88, mentioned above, and also over sprockets on rollers 91, 92, 93, 94 and 95. At least one of the sprockets on the latter group of rollers is fixed to its roller, and that roller is provided with a suitable drive, e.g., a hand crank, so that after the grippers are engaged with the leading edge of the strip 24, the chains 90 may be operated to draw the strip 24 through the apparatus and deliver it at the roller 88, where the grippers may be released and the strip 24 may be manually grasped and drawn toward the take-up reel 25, where it is attached.

The sprockets on the rollers 96, 97, 85, 86, 87 and 88 may remain stationary while those rollers turn. After the strip is threaded and the apparatus is operating, the chains 90 remain stationary until it is necessary to thread a new strip through the apparatus.

The ratio of the speeds of the decelerating conveyor 23 and of the strip 24 are determined by the ratios of the chain drives 68, 82. Typically, the speed of the conveyor will be the same as that of the strip 24, although some other ratio of those speeds may be slected.

The ratio between the speeds of the input shaft 64 and the output shaft 65 of the Reeves variable speed transmission 62 is determined by a conventional speed varying mechanism shown as including a motor 110 driving, through a chain 111, a shaft 112 in the Reeves drive which serves to vary the speed ratio between the shafts 64 and 65. By actuation of the motor 110, the speed of the decelerating conveyor 23 may be adjusted with respect to that of the conveyor 20 to accommodate changes in the length of the sheets being printed by the press, or changes in the number of sheets being printed on each revolution of the plate cylinder 4.

A web break detector mechanism may be provided, including a bracket 113 supporting an arm 114 carrying a roller 115 which rides against the strip 24 between the rollers 96 and 97. When the web breaks, the roller 115 moves by gravity to a vertical position. In so doing, it actuates a switch which is effective to stop the motor 42, and may also stop the main motor of the press, and actuate suitable alarms.

The strip 24 is structurally weak, being essentially a strip of paper, and it cannot stand any appreciable tension. In the apparatus illustrated, the driving force to the strip 24 is transmitted primarily through the roller 84. The brake 50 on the supply reel is arranged to subject that reel to a small retarding torque. This results in the application to the strip of a greater tension when the supply reel is nearly all gone and so has the small diameter, than when the supply reel is fresh and has a large diameter. Nevertheless, this braking force applied by the brake 50 is made to be so small that the maximum tension occasioned thereby in the strip, i.e., the tension at minimum diameter of the roll 49, is not enough to damage the strip. The tension needs only to be enough to prevent the formation of slack in the strip, which might cause damage to the strip when the slack is suddenly taken up.

Similarly, the torque drive on the take-up reel 28 subjects the strip to a higher tension when the take-up reel diameter is small than when the take-up reel diameter is large. The tension created by the take-up reel drive motor 42 is designed to be small enough so that it cannot tear the strip, even if the strip is held stationary. It has been found that this drive arrangement for the strip 24 provides a satisfactory control over the tension in the strip, without the necessity for complex and sensitive tension controls such as are commonly used in similar systems of the prior art.

FIG. 5

This figure illustrates a control circuit for the motor 36 which drives the gears 37 and 38 and determines the elevation of the take-up roll 28. When a master switch 120 is in the "automatic" position shown in the drawing, the motor 36 is controlled by switch 35. As the diameter of the take-up roll 28 increases due to the winding of the strip 24 and sheets 29 thereon, the left end of the final reach of the strip 24 moves downwardly carrying with it the roller 31, until a point is reached where the arm 32 closes the push button switch 35. This completes a circuit, obvious in FIG. 5, for energizing the motor 36 for operation in a direction to rotate the turret 40 counterclockwise, thereby raising the roll 28 and restoring the final reach of the strip 24 approaching that roll to the desired small angle below the horizontal. As the strip 24 reaches its desired angle, the switch 35 is opened and the motor 36 stops until the diameter of the roll 28 again increases and actuates the switch. The motor 36 is provided with two field windings 116 and 117. Energization of field winding 116 causes rotation of the turret 40 in the counterclockwise direction. Energization of winding 117 causes rotation of the motor 36 to drive the turret 40 in the clockwise direction. In addition to the strip position responsive switch 35, there is provided a manual switch 118, by which the windings 116 and 117 may be selectively energized to determine the direction of operation of motor 36.

When the master switch 120 is in the "manual" position, the switch 118 controls the motor 36. The switch 118 is used when changing reels on the turret 40, which becomes necessary after each reel is filled.

While a very simple circuit for the motor 36 is shown, it will be readily understood that other equivalent motor control circuits may be substituted for the one shown.

The device for sensing the strip portion may be any suitable device, as long as it is actuated by the strip when the elevation of the strip at the device differs by a predetermined distance from the elevation of the point of tangency of the strip where it leaves the guide roll 88.

FIGS. 6–7

Each of the belts 23 runs along the surface of a plate 105, and covers a channel 105*a* in the upper surface of that plate. The channels 105*a* are connected to a manifold 106 which is in turn connected by means of a supply pipe 107 to a vacuum pump 108.

When a sheet 29 moves into the horizontal reach above the decelerating conveyor belts 23, it is being pulled by the grippers 19 which are engaging its leading

edge. The difference between atmospheric pressure and the slight vacuum maintained in the channels **105***a* forces the sheet lightly down against the belts **23.** This pressure difference may be adjusted as required by the sheet size, and the speed ratio between the sheet and the conveyor **20.** Since those belts are traveling more slowly than the conveyor **20,** the sheet is smoothly stretched out along the top of the belts. When the sheet reaches the tripper cam **22** and the grippers **19** are released, the sheet **29** is smoothly and quickly decelerated to the speed of the conveyor belt **23.** Along this reach of the conveyor **20,** the effect of gravity is to aid the pressure difference in holding the sheets **29** against the conveyor belts **23.**

When a sheet approaches the end of the decelerating conveyor **23,** its speed has become equal to that of the conveyor **23.** Thus, each sheet **29** is decelerated from the speed of conveyor **20** to the lower speed of conveyor **23,** without any contact between the freshly printed top side of sheet **29** and any solid part of the apparatus. The deceleration is accomplished without wrinkling the sheet and without smearing any ink which is printed on the top side thereof.

We claim:

1. Apparatus for delivering sheets onto a moving strip of material and winding the strip and sheets together in a roll, comprising:

a. strip supply means;

b. strip and sheet take-up means including a take-up reel rotatable about a horizontal axis and vertically movable means supporting the take-up reel;

c. means defining a path for the strip from the strip supply means to the take-up reel, said path defining means including a guide roll over which the strip passes as it approaches the take-up reel;

d. means for depositing sheets on the upper surface of the strip;

e. motor means for driving said vertically movable means; and

f. control means for the motor means including:

1. a sensing device adjacent the moving strip between the guide roll and the take-up reel, said device being actuatable by the strip when the elevation of the strip at the device differs from that of the point of tangency of the strip leaving the guide roll by a predetermined distance; and

2. means responsive to actuation of the device to energize the motor means to drive the movable means in a direction to reduce said distance until the device is no longer actuated by the strip, so that the reach of the strip approaching the reel and carrying the sheets remains at an angle within a predetermined range of the horizontal as the diameter of the roll on the take-up reel increases.

2. Apparatus as in claim **1,** in which:

a. the sensing device is actuated when the strip at the device is below said point of tangency; and

b. the motor means is deenergized before the strip moves above the elevation at the point of tangency, so that the strip between the point of tangency and the take-up reel is always traveling slightly downward.

3. Apparatus as in claim **1,** including a table supporting the strip between the guide roll and the take-up reel.

4. Apparatus as in claim **2,** in which the table is tilted with its edge nearest the take-up reel below its edge nearest the guide roll.

5. Apparatus as in claim **1,** in which said sensing device comprises:

a. a lever;

b. a roller journaled at one end of the lever and engaging the under side of the strip; and

c. a weight on the other end of the lever biasing the roller into engagement with the strip.

6. Apparatus as in claim **5** in which said sensing device further comprises an electric switch operated by said lever and connected in said control means.

7. Apparatus for delivering printed sheets from a press to a strip of material and winding the strip and sheets together in a roll, comprising:

a. conveyor means for carrying the sheets from the press to a transfer station;

b. strip supply means;

c. strip and sheet take-up means including a take-up reel and vertically movable means supporting the take-up reel;

d. means defining a path for the strip from the strip supply means past the transfer station to the take-up reel, said path defining means including a guide roll over which the strip passes as it approaches the take-up reel;

e. means at the transfer station for transferring sheets from the conveyor means to the upper surface of the strip;

f. motor means for driving said vertically movable means; and

g. control means for the motor means including:

1. a sensing device adjacent the moving strip between the guide roll and the take-up reel, said device being actuatable by the strip when the elevation of the strip at the device differs from that at the point of tangency of the strip leaving the guide roll by a predetermined distance; and

2. means responsive to actuation of the device to energize the motor means to drive the movable means in a direction to reduce said distance until the device is no longer actuated by the strip, so that the final reach of the strip approaching the reel and carrying the printed sheets remains at an angle within a predetermined range of the horizontal as the diameter of the roll on the take-up reel increases.

8. Apparatus for moving printed sheets from a press to a strip of material running at a slower speed than the press and winding the strip and sheets together in a roll, comprising:

a. conveyor means running at press speed for carrying the sheets from the press to a transfer station, said conveyor means having spaced grippers for engaging individual sheets and positively advancing them, said conveyor including a reach at the transfer station where the sheets are carried below the conveyor;

b. gripper release means at the transfer station for releasing the grippers; and

c. decelerating conveyor means below said reach at the transfer station, comprising:

1. belt means running in the same direction as said press speed conveyor means but at a slower speed, said belt means having apertures therein;

2. means, including evacuated manifold means under said belt means, for attracting sheets released from the first conveyor means and holding them on the belt means;

d. strip supply means;

e. strip and sheet take-up means; and

f. means defining a path for the strip from the supply means past the discharge end of the declerating conveyor means to the take-up means, so that the decelerated sheets move onto the strip adjacent said discharge end.

9. Apparatus for moving printed sheets from a press to a strip of material running at a slower speed than the press and winding the strip and sheets together in a roll, comprising:

a. conveyor means running at press speed for carrying the sheets from the press to a first transfer station, said conveyor means having spaced grippers for engaging individual sheets and positively advancing them, said conveyor including a reach at the transfer station where the sheets are carried below the conveyor;

b. gripper release means at the transfer station for releasing the grippers; and

c. decelerating conveyor means below said reach at the transfer station comprising:

1. belt means running in the same direction as said press speed conveyor means but at a slower speed, said belt means having apertures therein;

2. means, including evacuated manifold means under said belt means, for attracting sheets released from the first conveyor means and holding them on the belt means;

d. strip supply means;

e. strip and sheet take-up means including a take-up reel and vertically movable means supporting the take-up reel;

f. means defining a path for the strip from the strip supply means past the discharge end of the decelerating conveyor means where the sheets are discharged onto the strip, to the take-up reel, said path defining means including a guide roll over which the strip passes as it approaches the take-up reel;

g. motor means for driving said upwardly movable means; and

h. control means for the motor means including:

1. A sensing device adjacent the moving strip between the guide roll and the take-up reel, said device being actuatable by the strip when the elevation of the strip at the device differs from that at the point of tangency of the strip as it leaves the guide roll by a predetermined distance; and

2. means responsive to actuation of the device to energize the motor means to drive the movable means in a direction to reduce said distance until the control device is no longer actuated by the strip, so that the final reach of the strip approaching the reel and carrying the printed sheets remains at an angle within a predetermined range of the horizontal as the diameter of the roll on the take-up reel increases.

10. Apparatus as defined in claim **9**, in which:

a. said strip supply means includes:

1. a supply reel;

2. a roll of strip thereon;

3. brake means applying a substantially contant retarding torque to the supply reel; and

4. strip drive means engaging the strip between the reels for driving the strip at a linear speed having a fixed ratio to the linear speed of the decelerating conveyor means; and

b. said strip and sheet take-up means includes limited maximum torque motor means driving the take-up reel.

11. Apparatus for delivering sheets onto a moving strip and winding the strip and sheets together into a roll, comprising:

a. strip supply means including a supply reel and a roll of strip thereon;

b. strip and sheet take-up means including a take-up reel;

c. means, including maximum torque limiting means, driving the take-up reel;

d. brake means applying a substantially contant retarding torque to the supply reel;

e. continuously running sheet supply means for delivering sheets onto said strip at intervals separated in time;

f. strip drive means engaging the strip throughout a substantial length thereof between the reels, and

g. motion transmitting means connecting said sheet supply means and said strip drive means, said motion transmitting means including means for varying the ratio between the linear speeds of the strip drive means and the sheet supply means.

12. Apparatus as in claim **11**, in which the strip drive means includes a rotating drive cylinder over which the strip passes, and clamp means to force the strip against the periphery of the cylinder.

13. Apparatus as in claim **12**, in which said clamp means comprises:

a. a lever;

b. a roller carried at one end of said lever and rotatably engaging said strip on the surface thereof opposite said drive cylinder; and

c. fluid motor means engaging another point on said lever and effective to force said roller toward said drive cylinder to tightly clamp the strip between the roller and the cylinder.

14. Apparatus as in claim **11**, in which the strip drive means includes:

a. a positively driven cylinder over which the strip passes;

b. guide rollers defining a tortuous path for the strip, said path extending around more than one-half the circumference of the positively driven cylinder; and

c. clamp means to force the strip against the periphery of the cylinder.

* * * * *