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[54] **APPARATUS FOR COATING AND STACKING PRINTED SHEETS**

[75] Inventors: **Willard R. Bonwit,** Rydal, Pa.; **Valdis Shaurins,** Palisades Park; **Roger W. Young,** Upper Montclair, both of N.J.

[73] Assignee: **John Dusenbery Co., Inc.,** Clifton, N.J.

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[52] **U.S. Cl.** **118/6,** 118/50, 118/62, 118/236, 118/239, 118/262

[51] **Int. Cl.** **B05c 1/02**

[58] **Field of Search** 118/262, 68, 249, 46, 239, 118/236, 6, 62, 50, 245; 271/211, 215, 127

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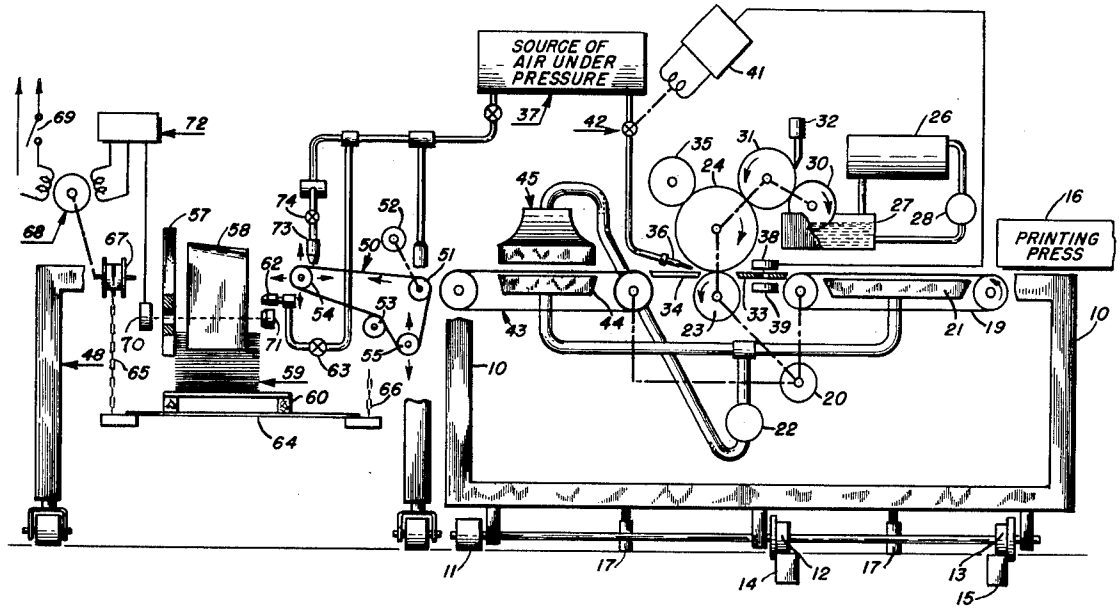
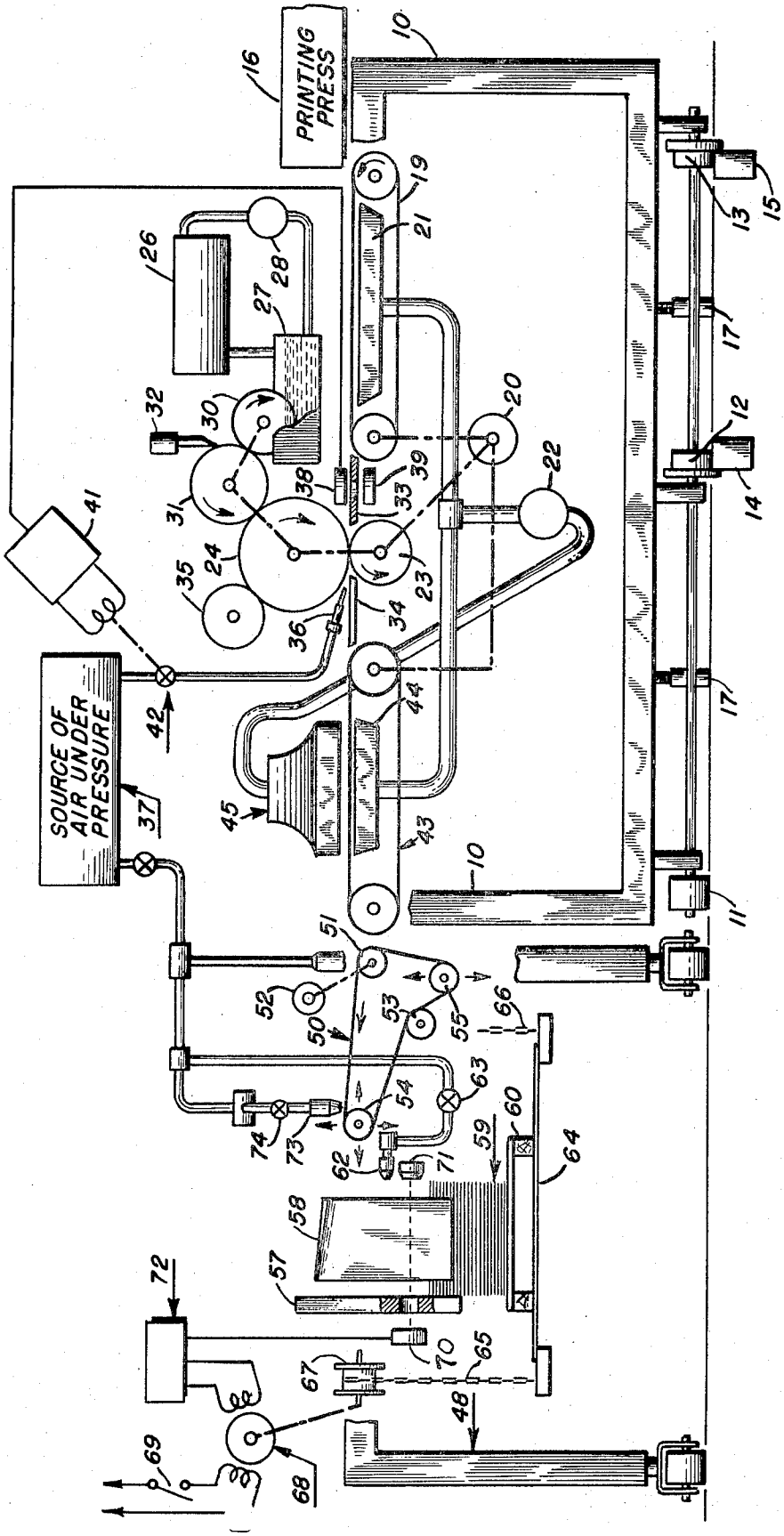
Primary Examiner—John P. McIntosh
Attorney, Agent, or Firm—Rudolph J. Jurick

[57] **ABSTRACT**

Apparatus for receiving freshly printed sheets directly from the delivery end of a sheet-fed press, applying a film-forming coating to the printed surfaces of the sheets, and piling the coated sheets in a stack.

11 Claims, 2 Drawing Figures




PRINTING PRESS
16
10
19
21
26
28
27
32
30
20
22
38
39
33
31
41
24
23
35
34
36
SOURCE OF AIR UNDER PRESSURE
42
37
44
45
43
10
11
51
52
50
53
55
66
54
63
60
74
73
62
71
59
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72
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67
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69
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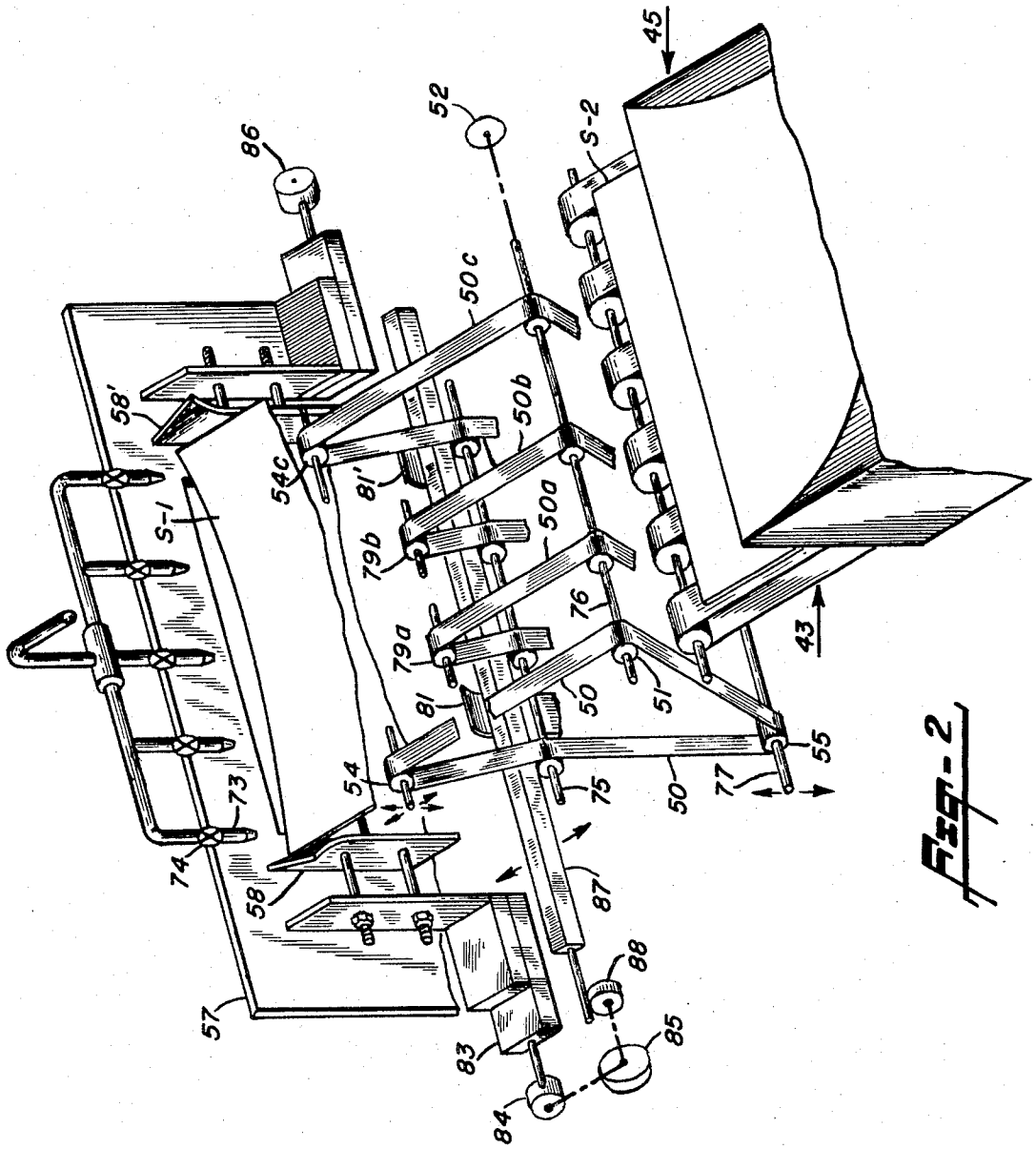
Fig-1


45
52
86
S-2
50c
58'
50b
54c
81'
S-1
79b
50a
76
79a
43
81
50
51
54
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75
77
73
74
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87
88
57
85
83
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Fig-2

APPARATUS FOR COATING AND STACKING PRINTED SHEETS

BACKGROUND OF THE INVENTION

In a web press, a continuous web of paper is fed through the press and rewound into a roll at the delivery end of the press. The web, being continuous, is under control at all times. Such presses use solvent-type inks which are dried by running the printed portion of the web through high velocity dryers prior to the re-winding of the web. The dryers can be incorporated in a web press because space is available for this purpose between the various printing stages and the continuous web is always under control between the stages.

On the other hand, in a sheet-fed press, the material to be printed upon is fed to the press in individual sheets and delivered in sheet form at the delivery end of the press. Therefore, it is essential to provide means for maintaining control of the sheets as they pass through the various printing stages. Because of this need for precise control of the sheets, all components of the press are bunched together and, therefore, space is not available for mechanical dryers. Consequently, the ink on the printed sheets must be allowed to dry for some 8 – 10 hours while they remain in a pile on a skid. Sometimes, depending upon ink coverage, character of the particular inks and the sheet itself, in order to prevent offsetting of wet inks, the sheets are placed on racks about 10 inches high, with six racks on each skid. Since the inks dry by oxidation, periodic repiling of the sheets is necessary so that fresh air can reach the inked surfaces. If this is not done, offset occurs, that is, the ink on one sheet is transferred to the back surface of the overlying sheet in the pile. In order to minimize offset, it is the general practice to spray a very fine starch powder onto the printed surface of each sheet just before it reaches the pile at the delivery end of the press. The powder does not completely eliminate offset and it has numerous disadvantages. It accumulates on working parts of the press and electrical components, and spreads throughout the room, thereby presenting a costly maintenance problem. Also, the powder affects product quality in that it gives a rough finish to the printed surface. Furthermore, the powder presents problems in subsequent operations such as, for example, the application of a wax or lacquer coating required on some folding cartons.

The problem has been to provide an arrangement for applying a clear, thin protective coating over printed sheets as they come from the delivery end of a high speed, sheet-fed press and then allowing the inks to dry over a period of time without offsetting. Attempts have been made to apply a protective coating over each sheet as it passes through the last stage of the press. These attempts have not been successful as the coating apparatus could not feasibly be installed on the most prominent press designs for the sheet-fed printing industry, particularly in paperboard printing for folding cartons. Also, the cost of each color stage in a modern sheet-fed press is so high that the loss of a stage for the coating apparatus is not practicable.

Apparatus made in accordance with this invention comprises a unit mechanically separate from the press and therefore, such apparatus can be applied to existing sheet-fed presses. The apparatus receives freshly printed sheets directly from the press, applies a protective coating over the printed surfaces and stacks dried sheets without scuffing.

SUMMARY OF THE INVENTION

Apparatus supported on a framework and movable into operative position at the delivery end of a sheet-fed press. A first vacuum belt transports the freshly printed sheets to a coating station where a fast-setting, film-forming coating is applied over the printed surfaces by a rotating cylinder. A second vacuum belt transports the coated sheets through a dryer and then onto inclined belts of a delivery unit, which inclined belts propel the sheets against a vertical backstop. Air streams are directed against the propelled sheets to control the sheets as they leave the inclined belts and strike the backstop. Thereafter, the sheets pass downwardly between vibrating joggers to form a smooth pile.

An object of this invention is the provision of apparatus for coating freshly printed sheets received directly from a sheet-fed press and stacking the coated sheets in an orderly pile.

An object of this invention is the provision of coating apparatus movable as a unit into position to receive printed sheets from the delivery end of a sheet-fed press.

An object of this invention is the provision of apparatus for applying a protective coating over the freshly printed surfaces of sheets received directly from a sheet-fed press and for stacking the coated sheets without scuffing.

An object of this invention is the provision of apparatus for coating and stacking printed sheets, in which apparatus the coated sheets are propelled against a backstop while in a bowed configuration, after which the sheets drop between vibrating joggers to form a pile.

The above-stated and other objects and advantages of the invention will become apparent from the following description when taken with the accompanying drawings. It will be understood, however, that the drawings are for purposes of illustration and are not to be construed as defining the scope or limits of the invention, reference being had for the latter purpose to the claims appended hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings wherein like reference characters denote like parts in the several views:

FIG. **1** is a diagrammatic representation, in side elevation, of apparatus made in accordance with this invention; and

FIG. **2** is an isometric, diagrammatic representation showing the arrangement for propelling the sheets against a backstop and for guiding the sheets to form a pile.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to FIG. **1**, the coating apparatus is carried by a framework generally identified by the reference numeral **10**, which framework is supported on a plurality of wheels, only the forward wheels **11**, **12** and **13** being visible in this particular view. The wheels **12** and **13**, and other similar wheels, ride on rails **14** and **15** which extend along a bank of sheet-fed presses, one such press being represented by the block identified by the numeral **16**. This arrangement facilitates movement of the apparatus into operative alignment with another press if so desired or when the press **16** is shut down for

cleaning or repairs. A plurality of jack screws **17** are provided for leveling of the apparatus.

A freshly printed sheet moves onto an endless vacuum belt **19** driven by a variable speed motor **20,** the belt being punctuated by a plurality of holes and passing over a vacuum chamber **21** connected to a pump **22.** A portion of this belt extends under the press so that the forward portion of a sheet is firmly drawn to the belt before the sheet is released by the delivery grippers of the press. The belt runs at a linear speed equal to, or slightly higher than the linear speed of the press grippers, and the sheet is brought under the control of the belt a fraction of a second before it is released by the grippers. The released sheet is carried by the belt until its forward edge portion is gripped between an impression cylinder **23** and a coating cylinder **24,** which cylinders are mechanically coupled together through a gearing system driven by the motor **20.** It is here pointed out that the apparatus includes a plurality of vacuum belts similar to the belt **19,** such belts being disposed in spaced, parallel relationship and running at the same speed. Individual vacuum chambers are associated with each belt.

A reservoir **26** contains a suitable fast-setting, film-forming solution, various such solutions being available to eliminate offset in stacked sheets. The solution is supplied to an elongated container **27** and is continuously recirculated by a pump **28.** A cylinder **30,** having a hard rubber surface, transfers solution from the container onto a conventional anilox roll **31** which spreads a proper amount of the solution evenly over the surface of the coating cylinder **24.** A reverse doctor blade **32** removes excess solution from the anilox roll and a rubber coated smoothing roll **35** serves to spread such of the coating solution as may remain on the coating cylinder after the transfer of solution to the sheet passing through the coating station, that is, between the cylinders **23** and **24.** As the sheet passes between the cylinders **23** and **24** it is supported by the fixed plates **33** and **34.** A plurality of small nozzles, such as the nozzle **36,** are connected to a source of air pressure **37** and are spaced along the coating cylinder **24.** Air jets from these nozzles prevent the leading edge of the sheet from curling around the coating cylinder. These air jets, which are particularly desirable for use with relatively thin sheets, are controlled by a photocell **38** receiving a light beam from a light source **39** through an opening formed in the fixed plate **33.** When a sheet interrupts the light beam, the controller **41** opens the normally-closed solenoid valve **42.**

The coated sheet passes onto a second endless, vacuum belt **43** which is similar to the belt **19** and has associated therewith a vacuum chamber **44** connected to the pump **22.** The driving pulley of the belt **43** is driven by the motor **20** so that the belts **19** and **43** run at the same linear speed. The belt **43** transports the coated sheet under a dryer **45** and onto the inclined belt **50** of the delivery unit, said dryer being a plenum supplied with air at room temperature coming from the exhaust of the vacuum pump **22.**

The delivery unit is carried by a generally rectangular framework **48** having four legs supported by casters. Coated sheets coming from the coating apparatus are transferred onto the inclined portion of the belt **50** which passes around four pulleys. The pulley **51** is secured to a drive shaft driven by a variable speed motor **52,** and the idler pulley **53** is supported on a fixed-position shaft. The pulley **54** is carried by a shaft which is mounted for adjustment in both the horizontal and vertical planes, the horizontal adjustment being provided to accommodate the belt to a sheet of given size, and the vertical adjustment being provided to change the inclination angle of the upper portion of the belt. The fourth pulley **55** is carried by a shaft which is mounted for adjustment in a vertical plane, thereby to provide a taut belt. Only a single belt **50** is shown in FIG. **1,** but the delivery unit contains four or more such belts, as will be described below with reference to FIG. **2.**

The inclined belt **50** may travel at a linear speed exceeding that of the vacuum belt **43.** Consequently, when the sheet leaves the belt **50** it is propelled against a backstop **57.** After striking the backstop, the sheet drops down between vibrating jogger plates, only one such plate **58** being visible in FIG. **1.** Succeeding sheets form a pile **59** on a skid **60.** Shown in FIG. **1,** is a horizontally disposed nozzle **62** connected to the air supply **37** through piping which includes a manually-operable valve **63.** A plurality of such nozzles are positioned along the four sides of the delivery unit. Horizontal air streams from these nozzles provide an air cushion to prevent the sheet from dropping too quickly onto the pile, thereby preventing scuffing of the coated surface on the underlying sheet.

The skid **60** is supported on a metal plate **64** suspended by four cables, such as the visible cables **65** and **66.** Referring specifically to the cable **65,** the cable is wound around a drum **67** secured to a shaft which is driven by a reversible motor **68.** The other three cables are wound around associated drums, all of the drums being mechanically-coupled together for simultaneous rotation, whereby the skid can be lowered or raised upon rotation of the motor **68** in one or the other direction. Operation of the motor for lowering the skid is controlled by a photocell **70** receiving a light beam from a light source **71.** As the height of the pile increases, the stacked sheets eventually interrupt the light beam, thereby causing a controller **72** to energize the motor **68** for rotation in a direction to lower the skid a predetermined distance. The controller includes time delay means to prevent energization of the motor by a single sheet dropping through the light beam. When the skid is fully loaded, the supporting plate **64** rests upon the floor and a lift truck can be used to remove the loaded skid and replace it with an empty one. The motor **68** then is energized for rotation in the reverse direction by closure of the manually-operable switch **69** until the skid is raised to the proper starting position. Also shown in FIG. **1** is a vertically-disposed nozzle **73** connected to the air supply **37** through a manually-operable valve **74.** A plurality of such nozzles are spaced across the delivery unit, for purposes which will be explained hereinbelow.

Reference now is made to FIG. **2** showing a sheet **S-2,** emerging from the dryer **45,** and four sheet-propelling belts **50, 50***a*, **50***b* and **50***c*. All of the belts pass around idler pulleys carried by the shafts **75** and **77,** as well as around driving pulleys secured to the shaft **76** driven by the motor **52.** All of the belts also pass around individual pulleys **54, 54***c*, **79***a* and **79***b*. Each of these pulleys are mounted on individual supports, not shown, which supports are adjustable in the vertical plane. These supports are mounted on a crossbar which is adjustable in the horizontal plane. The vertical adjustments of the

pulleys determines the inclination angle of the belts, while the horizontal adjustment determines the effective lengths of the upper portions of the belts. The five vertical nozzles, all similar to the nozzle identified by the numeral **73,** lie in a substantially vertical plane over the belts. Assuming that the inner pulleys **79***a* and **79***b* are set lower than the outer pulleys **54** and **54***c*, the sheet will assume a bowed configuration as shown by the sheet S-**1.** Air streams from the nozzles **73** maintain the sheet in contact with the belt surfaces until the sheet is propelled against the backstop **57.** Since the sheet is propelled from the belts at a fairly high speed, it retains the bowed configuration until its forward edge strikes the backstop **57.** A sheet having a bowed configuration offers increased resistance to buckling upon impact with the backstop. After striking the backstop, the sheet drops between the two side jogger plates **58** and **58'** and the two rear jogger plates **81** and **81'**, all of which plates have outwardly flared upper end portions.

Referring to the guide plate **58,** this plate is carried by a bracket secured to a bar **83** which is slidably mounted on the machine framework for vibration by the eccentric cam **84** rotated by the motor **85.** The guide plate **58'** is similarly mounted and is vibrated by the eccentric cam **86,** which cam also is drivdn by the motor **85.** The two guide plates are adjustable to space them apart a distance determined by the width of the particular sheet. The rear guide plates **81** and **81'** are secured to a bar **87** vibrated by the eccentric cam **88.** This bar is mounted for manual adjustment along a plane normal to the direction of travel of the sheet, such adjustment being made to accommodate a sheet having a given length. The vibrating jogger plates serve to align the sheets to form a smooth pile.

The described coating and stacking apparatus has the following practical advantages,

1- it is not physically connected to the press and can be moved quickly and conveniently into operating position with an existing press,
2- it does not limit the press speed,
3- it affords a very substantial saving of time and money as it eliminates the need for temporary stacking of the freshly printed sheets and the use of a spray powder,
4- the coated sheets are dried and stacked, ready for subsequent operations, thereby resulting in a very substantial reduction in in-process production time, and
5- the sheets are stacked without scuffing.

Having now described the invention what we desire to protect by letters patent is set forth in the following claims.

We claim:

1. Apparatus for coating and stacking printed sheets as they come from the delivery end of a sheet-fed press, which apparatus comprises,

a. a coating cylinder adjustable in proximity to an impression cylinder,
b. a container containing a coating solution,
c. transfer means transferring solution from said container and spreading it evenly over the surface of said coating cylinder,
d. first power-driven vacuum belt means positioned to receive sheets directly from the press and feeding the leading edges of the sheets between the impression and coating cylinders,
e. second, power-driven vacuum belt means receiving sheets after they pass between the impression and coating cylinders,
f. drying means drying the coated sheets as they are transported by said second vacuum belt means,
g. inclined belt means receiving sheets from said second vacuum belt means,
h. a backstop,
i. means driving said inclined belt means at a speed to propell the sheets against the backstop, and
j. means stacking the sheets as they drop along the backstop.

2. Apparatus as recited in claim **1,** wherein the said transfer means comprises a rubber-coated cylinder rotatable in the solution and an anilox roll in peripheral engagement with both the rubber-coated cylinder and the coating cylinder.

3. Apparatus as recited in claim **1,** wherein the said first power-driven vacuum belt means comprises a plurality of spaced, parallel belts having apertures formed therein, the sheet-receiving portions of the belts passing over individual vacuum chambers connected to a vacuum pump; and wherein the said second power-driven belt means comprises a plurality of spaced, parallel belts having apertures formed therein, the sheet-receiving portions of these belts passing over individual vacuum chambers connected to the said vacuum pump.

4. Apparatus as recited in claim **3,** wherein the said drying means comprises a plenum connected to the exhaust end of said vacuum pump.

5. Apparatus as recited in claim **1,** wherein the said means stacking the sheets includes a plurality of vibrated jogger plates.

6. Apparatus as recited in claim **5,** including a support plate, means mounting the support plate for movement in a vertical plane, a skid carried by the support plate and positioned to receive the sheets after they pass between the said jogger plates, and means automatically lowering the support plate in correspondence with stack height of the sheets piled on the skid.

7. Apparatus as recited in claim **5,** including a first set of nozzles connected to a source of air under pressure, said nozzles positioned to direct air streams in a substantially vertical plane and against the said inclined belt means.

8. Apparatus as recited in claim **7,** including a second set of nozzles connected to the said source of air under pressure, said nozzles positioned to direct air streams in a substantially horizontal direction and below the said jogger plates.

9. Apparatus as recited in claim **1,** wherein the said inclined belt means comprises a plurality of spaced, parallel belts, and including means for adjusting the inclination angle of each of such belts.

10. Apparatus as recited in claim **1,** wherein the apparatus is carried by a framework supported on wheels.

11. Apparatus as recited in claim **1,** including a plurality of nozzles connected to a source of air under pressure through a normally-closed valve, said nozzles positioned to direct air streams against the coating cylinder at points close to the mutual contact surfaces of the coating and impression cylinders, and control means actuated by a sheet as it approaches the coating and impression cylinders, said control means opening the said valve.

* * * * *