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[54] **SHEET FEEDING APPARATUS**
6 Claims, 3 Drawing Figs.

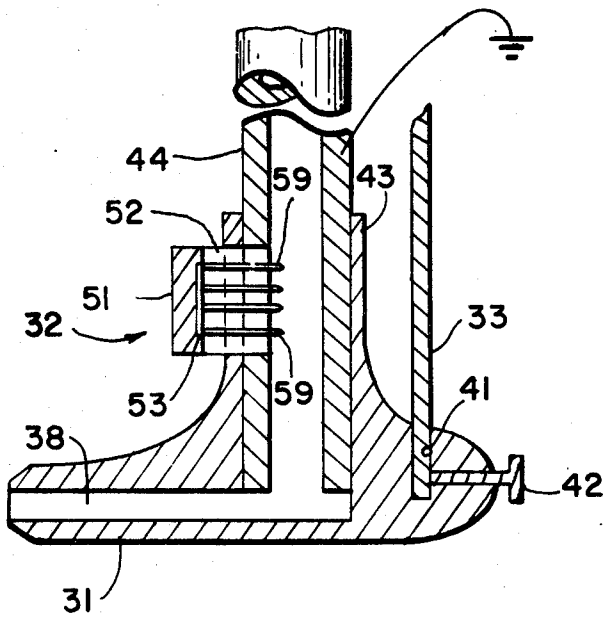
[52] **U.S. Cl.** **271/26**
[51] **Int. Cl.** **B65h 3/03, B65h 3/18**
[50] **Field of Search** 271/26, 30, 27

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ABSTRACT: Sheet-feeding apparatus including suction cups for lifting a portion of a top sheet of a stack, and moving it laterally, and a presser foot for pressing on the remaining stack, and for blowing ionized air into the space between the top sheet and the next sheet. The presser foot has air passages through it, and an ion generator including concentric arcuate elements of insulating material with a conductive foil between them, and ionizing points extending into the presser foot from the foil.



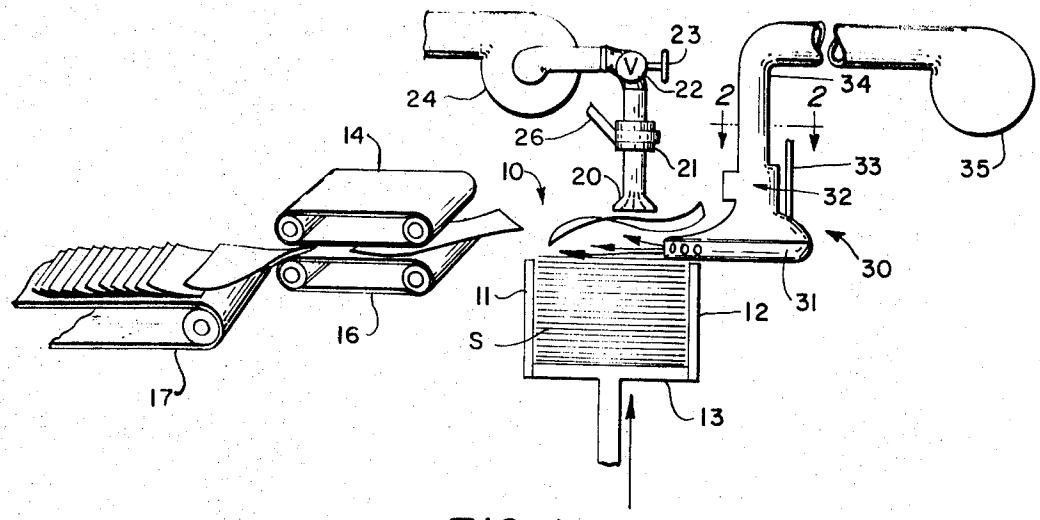


FIG. 1

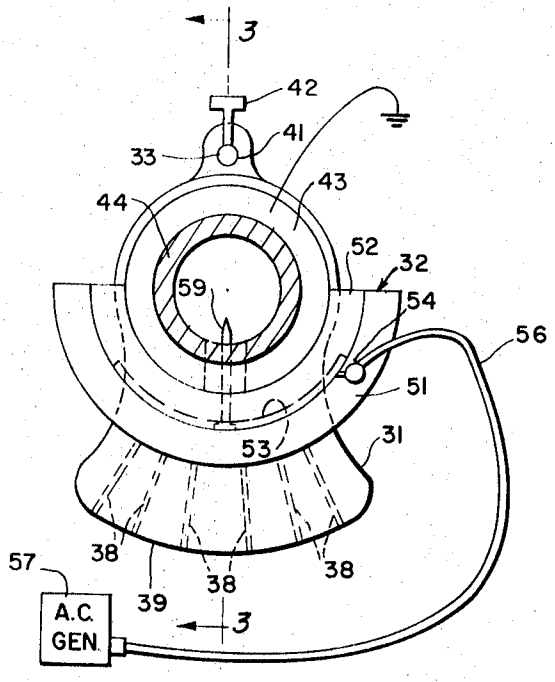


FIG. 2

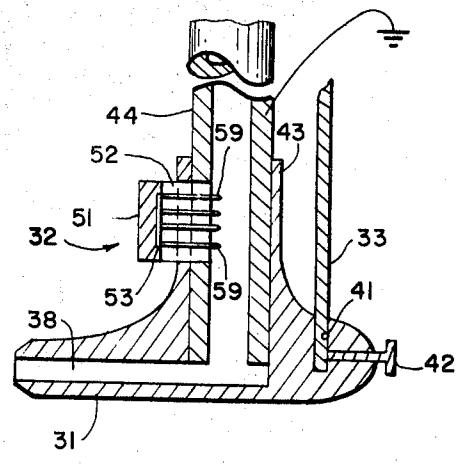


FIG. 3

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SHEET FEEDING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to sheet-feeding apparatus in which suction cups raise a portion of a top sheet of a stack, and feeds that sheet laterally of the stack into sheet-advancing apparatus.

In many industries, such as the printing industry, it is desired to remove sheets of paper or the like from a stack and to feed them at a very rapid rate. To this end, there has been provided apparatus in which suction cups elevate a portion of a top sheet of a stack of paper sheets, and then gives this sheet lateral motion off of the stack, where it is received in other apparatus which cause it to move at a rapid rate away from the stack. Such apparatus has been improved by the addition of a presser foot which engages the stack beneath the portion of the top sheet which has been lifted, and which thereby holds the stack in place, including especially the few top sheets, so as to prevent the delivery of these additional sheets along with the top sheet which has been engaged by the suction cups.

However, despite this advance in sheet-feeding apparatus, the apparatus has not operated as problem-free and as rapidly as desirable. Careful analysis has shown that this is due to the fact that as the top sheet is given its lateral motion, and slides over the sheet beneath it, the friction between the two sheets generates static electricity which causes the sheets to adhere to each other, and this results in the inability to feed the sheets as rapidly as desirable, sometimes causing a buckling of the top sheet, which causes such actions as jamming the equipment.

While it has been suggested in the prior art to provide for the elimination of static in a sheet-feeding apparatus, such suggestions have been in the nature of a grounding bar adjacent an apparatus including suction cups for feeding plastic sheets, or have contemplated ionizing air generators for directing ionized air across paper sheets being fed by pairs of conveyor belts. These constructions of the prior art do not provide for static removal between sheets being fed from a stack, however.

SUMMARY OF THE INVENTION

The present invention provides sheet-feeding apparatus in which suction cups lift one portion of a sheet of a stack, and then gives this sheet a lateral motion across the top of the stack, to sheet-advancing apparatus; a presser foot engages the sheet underlying the topmost sheet, a portion of which has been lifted by the suction cups, this presser foot having connected with it an ion generator and a source of air under pressure. The presser foot is provided with outlets, so that as it engages the second sheet of the stack, ionized air is blown between the top sheet and the second sheet in order to prevent the generation of static electricity forces which would cause adherence of these sheets.

The ion generator is connected directly to the presser foot, and includes a pair of concentric arcuate nonconductive elements having a conductive foil between them, which does not extend to any exterior surface. A connection is provided to the foil from an external source of alternating current. A plurality of ionizing points extend through the inner arcuate member, each having one end in engagement with the foil and the other end extending into an air passage in the presser foot. An air supply is connected with the air passage in the presser foot, thereby causing air to flow past the ionizing points, and outwardly through openings in the presser foot.

Among the objects of the present invention are to provide an improved sheet-feeding apparatus, to provide a sheet-feeding apparatus which will prevent the electrostatic attraction of sheets being fed from sheet-feeding apparatus, to provide sheet-feeding apparatus of economical construction and efficient operation; further objects of the present invention are to provide an improved ion generator in combination with a presser foot for a sheet-feeding apparatus, of safe, compact construction and lightness of weight.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevational view of a sheet-feeding apparatus in accordance with the present invention.

FIG. 2 is an enlarged cross-sectional view taken on the line 2—2 of FIG. 1.

FIG. 3 is a cross-sectional view taken on the line 3—3 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein like or corresponding reference numerals are used to designate like or corresponding parts throughout the several views, there is shown in FIG. 1 a sheet-feeding apparatus generally designated **10** and comprising stack-supporting members **11**, **12** within which is a follower bottom **13**. A pair of endless belt conveyors **14**, **16** receive sheets of the stack S and deliver them to an offtake conveyor **17**. It will be seen that the sheets on the conveyor **17** are arranged in so-called "ripple" array, for rapid delivery from the stack S.

The sheet-feeding apparatus **10** further includes one or more suction cups **20** connected by a hose **21** through a valve **22** under the control of a control element generally designated **23**, tube **21** leading to a source of negative pressure, such as the intake of a blower **24**. The suction cup **20** is carried by a suitable linkage **26** which causes it to descend so as to engage the topmost sheet of the stack S, while connected through the valve **22** to the source of suction **24**, is then raised, so as to lift a portion of the top sheet from engagement with the sheet there below, and then is moved laterally to the left, as shown in FIG. 1, in order to cause one edge of the top sheet of the stack S to enter into the bight between the conveyors **14** and **16**. This construction is known in the art.

A presser foot apparatus **30** includes a presser foot **31**, an ion generator **32** and a support rod **33**, which latter serves to give the presser foot **30** a motion to be described herein below. The presser foot has connected with it a conduit **34** connected with a source of air under pressure, such as the blower **35**. As is known, the presser foot **30** moves between the position shown in which it is pressing upon the second sheet of the stack S, and thereby transmits force downwardly through the stack to the follower **13**, and a withdrawn position generally to the right of the stack S and out of the path of the suction cup **20**.

Referring now to FIG. 2, there may be seen the presser foot **31** having a plurality of diverging air passages **38** which lead from an air supply passage, to be described hereinbelow, to the outer face **39** of presser foot **31**.

Referring now to FIG. 3, there is shown presser foot **31** with one of the air passages **38** extending therein. At its rear, the presser foot **31** is provided with a bore **41** for receiving the support rod **33**, which may be held in assembled relationship with the presser foot **31** by a suitable holding screw **42**. The presser foot **31** has a tubular extension **43** which receives an air supply conduit **44**, which is preferably in the form of a metal tube. The metal tube **44** is grounded and suitably joined to the presser foot **31**, it extends downwardly thereinto, so that air supplied through the tube **44** will pass through the passage **38**.

Referring again to FIG. 2, the ion generator generally designated **32** includes a pair of concentric arcuate elements **51** and **52** of insulative material, such as plastic. A thin sheet of foil **53** of a conductive material, such as silver, tin, copper, etc. is provided at the arcuate interface between the elements **51** and **52**. Preferably the foil **53** is adhered to one or both of the engaging surfaces of the elements **51** and **52**. These elements are joined by a suitable adhesive, such as epoxy or the like. The foil **53** is carefully dimensioned and positioned so that it is remote from all of the exterior surfaces of the arcuate elements **51** and **52**. A bore **54** in element **51** receives a conductor **56**, which is appropriately connected with the conductive foil **53**, and with a suitable source of alternating current, such as the alternating current generator **57**.

Extending through the plastic element **52**, and having their outer ends in engagement with the conductive foil **53** are a plurality of ionizing points **59**, four being shown by way of example. In practice, the foil **53** may be placed upon the outer arcuate surface of the element **52**, and then the ionizing points **59** forced through the foil **53** and the arcuate element **52**. The inner extremities of the ionizing points **59** lie generally along the axis of the tube **44**. The tubular extension **43** and the metal tube **44** are suitably cut away, so as to provide a passage for the ionizing points **59**, and the inner surface of the arcuate element **52** is in mating engagement with the outer surface of the tubular extension **43**.

In operation of the sheet-feeding apparatus **10**, with the presser foot **30** withdrawn to the right from its position in FIG. **1**, the suction cup **20** will descend, and being connected with the source of vacuum, will engage the topmost sheet of the stack S. It will thereupon lift the right-hand portion of the topmost sheet, thereby providing a space between the topmost sheet right-hand portion and the sheet therebelow. The presser foot apparatus **30** will then be moved to the left, and downwardly, so as to press against the second sheet of the stack, and the suction cup **20** will be given a motion to the left, by the linkage **26**, to thereby move the topmost sheet of stack S to the left, and into the bight between the conveyors **14** and **16**. The presser foot apparatus **31** will introduce air beneath the top sheet of the stack S while the parts are in the position in FIG. **1** and this air will contain ions so as to prevent the generation of electrostatic charges and forces between the topmost sheet of the stack S and the next sheet, thereby avoiding adherence of these sheets.

The presser foot apparatus **30** shown in detail in FIGS. **2** and **3** includes the lightweight, economical and effective ion generator **32** including the concentric arcuate elements **51** and **52**, with the metal foil **53** of conductive material between them. Ions will be generated from the ionizing points **59**, which ions will be conducted through the passages in the presser foot **31** by the air flowing therethrough from the blower **35**.

There has been provided a simple, effective and high-speed sheet-feeding apparatus which eliminates the problems heretofore experienced of adherence of sheets due to the generation of static electricity. Further there has been provided a lightweight and effective ion generator readily adopted to presser foot constructions currently used, and which do not impose significantly harmful additional stresses or the like on the operating elements to which the presser foot is connected.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and theretofore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

I claim:

1. Sheet-feeding apparatus comprising:
- means for supporting a stack of sheets,
- means for lifting the uppermost sheet and for moving said sheet transversely of said stack,
- presser means for pressing downwardly of the stack of sheets beneath said uppermost sheet, air passage means in said presser means extending to a surface of said presser means,
- and ion-generating means extending into said air passage means.

2. Sheet-feeding apparatus in accordance with claim **1**, said generating means comprising ionizing point means extending into said air passage means.

3. In sheet-feeding apparatus, a presser member having a bottom surface usable for pressing on a stack of sheets, an air passage in said presser member extending to a face thereof and having at least a portion thereof generally parallel to said bottom surface for discharging air generally parallel to said bottom surface, and ion-generating means extending into said air passage, whereby air-containing ions may be discharged from said presser member.

4. The apparatus of claim **3**, said presser member having a tubular surface, arcuate support means engaging at least part of said tubular surface, said ion-generating means comprising ionizing points supported by said support means.

5. The presser member of claim **4**, said arcuate means being of nonconductive material having a conductive element therewithin, said ionizing point means extending from said arcuate means and engaging said conductive element.

6. The presser foot of claim **3**, said last-mentioned means comprising a first arcuate element of insulating material, a second arcuate element of insulating material having the outer diameter thereof of substantially the same size as and in substantial engagement with the inner diameter of said first member,
- a conductive sheet intermediate said arcuate elements and spaced from the exterior surfaces thereof,
- an ionizing point having its base in engagement with said conductive sheet and extending through said second element,
- said presser member having a tubular surface with a transverse opening therethrough, communicating said tubular surface with a said air passage,
- said ionizing point extending through said opening and into said air passage.