United States Patent

Robertson

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[45] **Dec. 26, 1972**

[54] SHEET GUIDE APPARATUS

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[52] **U.S. Cl.**.....**355/106,** 355/110, 95/94 R

[51] **Int. Cl.**.....**G03b 27/30**

[58] **Field of Search**.....355/104, 106, 107, 108, 110, 355/64; 95/89 R, 94 R

[56] **References Cited**

UNITED STATES PATENTS

3,484,168	12/1969	Toby	355/110 X
1,900,878	3/1933	Hopkins	355/64
3,386,730	6/1968	Hyosaka	355/110 X

FOREIGN PATENTS OR APPLICATIONS

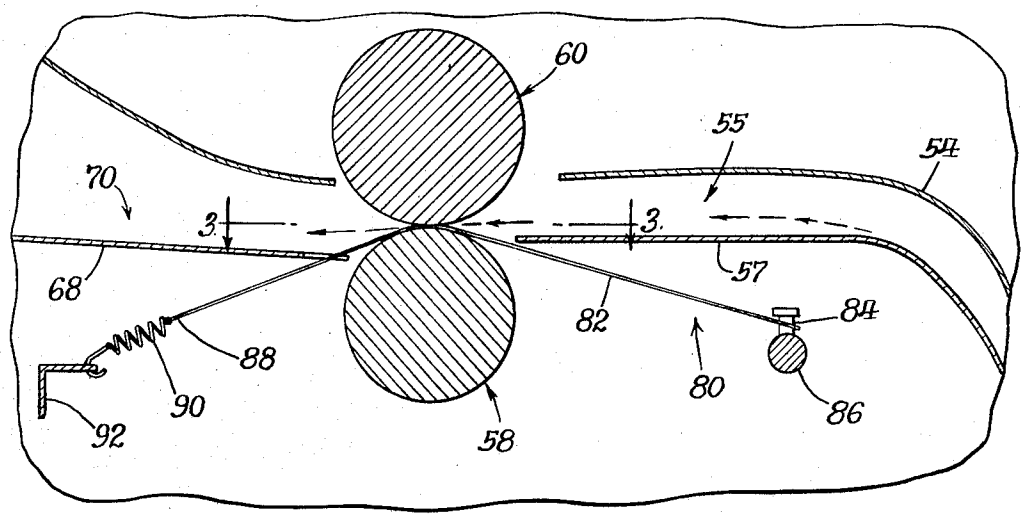
861,541	2/1961	Great Britain	355/110

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[57] **ABSTRACT**

A guide arrangement for guiding sheet material through a developer unit over and in contact with a roller, the surface of which is wetted with a liquid developer solution, includes a plurality of fine, filament-like guide wires strung taut across the roller in the direction of movement of the sheet material. The wires prevent the sheet material from becoming wrapped about the roller member.

2 Claims, 3 Drawing Figures

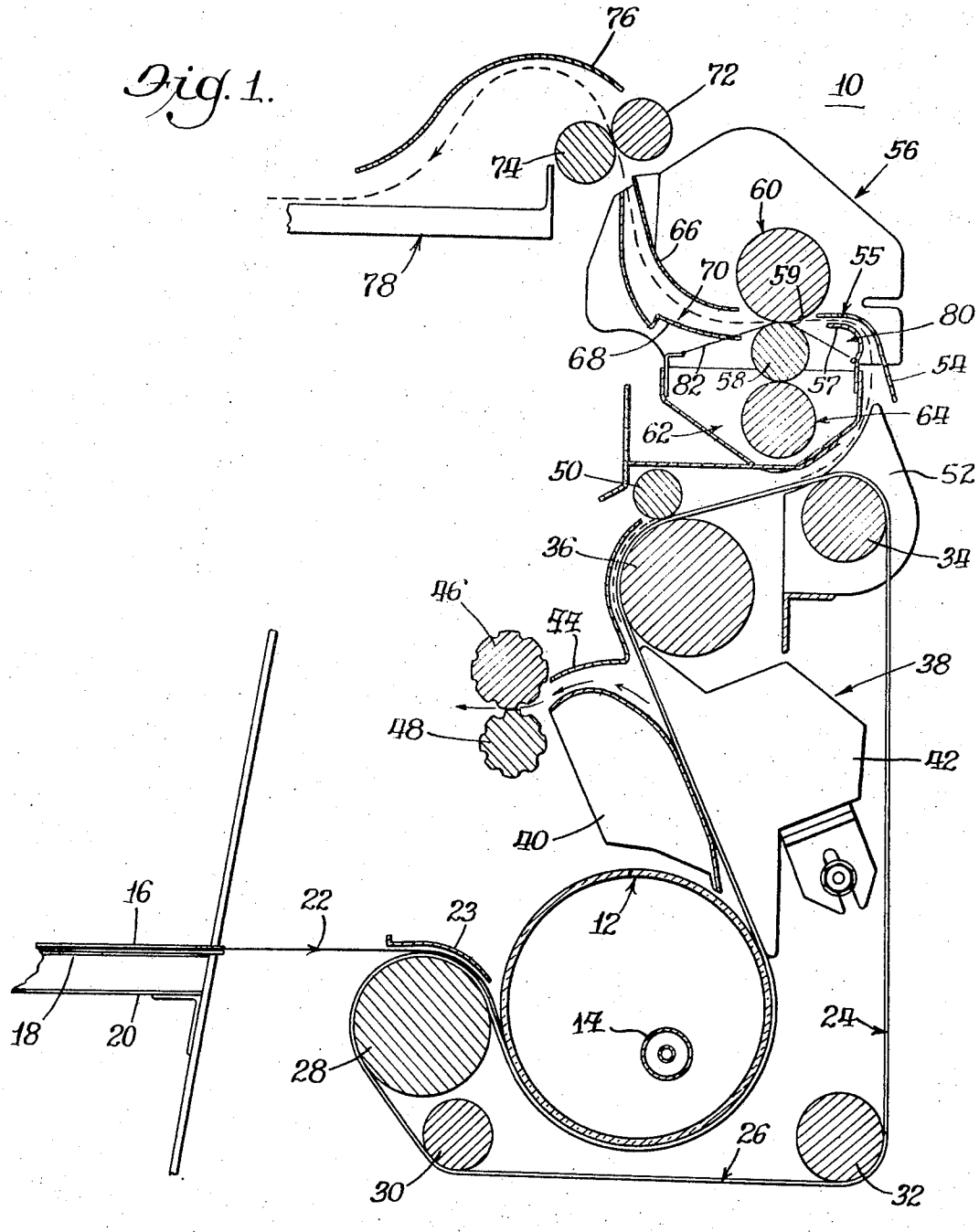


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SHEET 1 OF 2

Fig. 1.



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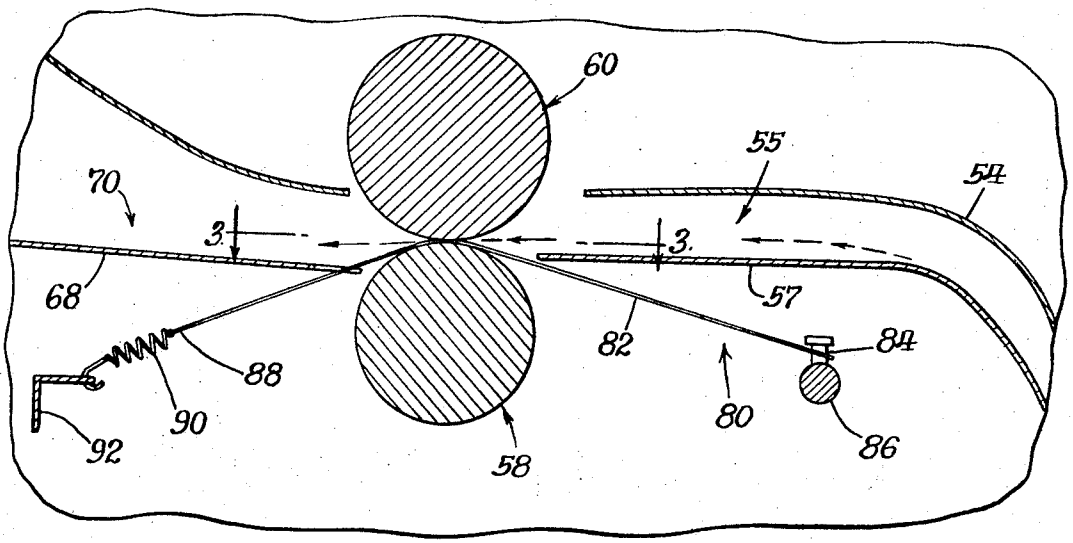


Fig. 2.

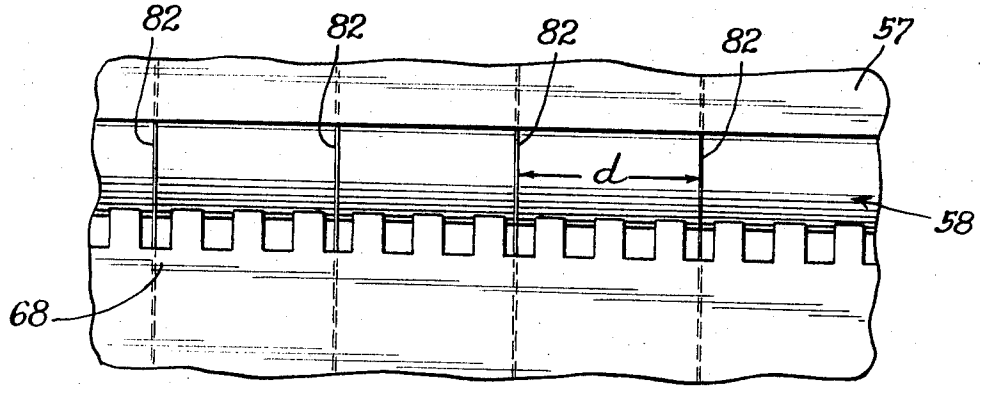


Fig. 3.

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SHEET GUIDE APPARATUS

BACKGROUND OF THE INVENTION

This invention relates generally to direct contact type copying machines including developer units wherein copy sheets have applied thereto, by means of a roller member, a quantity of developer liquid, and more particularly to means for guiding the copy sheets safely through the developer unit.

In direct contact copy machines, such as, for example, of the type shown and described in U.S. Pat. No. 3,484,168, assigned to the same assignee, wherein a superimposed copy sheet and original tracing are exposed and subsequently separated, and the copy sheet continues to be transported through a developer unit whereat a liquid developer solution is applied to the copy sheet as the latter is carried over a rotating applicator roller, there exists the possibility that the copy sheet, rather than merely passing over the roller, will adhere to the wetted roller surface and become wrapped thereabout. Also, if the original and copy sheet are not separated after passing through the exposure station, there is a possibility that the original will become wrapped about the liquid applicator roller. If the above occurs, the copy sheet and original could be damaged. Also, it becomes a difficult and time consuming matter to easily release the wrapped sheets from the roller.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide, in a copying machine of the above described type, apparatus for preventing the wrapping of copy sheets and/or original sheets about the liquid applicator roller of the developer unit.

It is another object of the present invention to provide apparatus of the above described type, which serves to guide copy sheets safely through a developer unit in contacting relation with a liquid applicator roller without interfering with the developing process.

Briefly, a preferred embodiment of the guide apparatus of the present invention includes a plurality of extremely fine, filament-like guide wires having a diameter of 0.004 inches or less, preferably about 0.002 inches, strung taut across the wetted applicator roller between the entrance and exit of the developer unit in a copying machine in contact with the surface of said roller. The wires are in spaced relation to each other along the axis of the roller. Each of the guide wires is tensioned at least at one end so that the rotational movement of the applicator roller is impeded minimally by the wires and so the wires are able to accommodate any irregularities in the surface of the roller without breaking. The wetted surface of the roller minimizes the friction between the wires and the roller surface.

Copy sheets entering the developer unit are guided along the wires over the surface of the developer applicator roller for development and are prevented by the wires from becoming wrapped about the roller. The wires provide little, if any, interference with the developing process.

DESCRIPTION OF THE DRAWINGS

A better understanding of the present invention and its organization and construction may be had by referring to the description below in conjunction with the accompanying drawings, wherein:

FIG. 1 is a fragmentary, sectional view of a copying machine including a developer arrangement employing a liquid applicator roller and including sheet guide apparatus according to the invention;

FIG. 2 is an enlarged, fragmentary view of the developer arrangement of the copying machine of FIG. 1 illustrating in greater detail the sheet guide apparatus of the invention; and

FIG. 3 is a fragmentary, plan view of the developer apparatus of FIG. 2 taken along the line 3—3.

DETAILED DESCRIPTION

Referring now to FIG. 1 of the drawings there is illustrated therein an automatic copying machine **10** similar to the type shown and described in U.S. Pat. No. 3,484,168, embodying the features of the present invention.

The copying machine **10** includes a rotating transparent drum **12** containing a light source in the form of a lamp **14** to which a superimposed original **16** and copy sheet **18** are fed from feed board **20** along a path **22** beneath guide member **23**. The superimposed copy sheet and original are fed past the light source **14** to expose the copy sheet through the cooperation of the rotating drum **12** and a flexible guiding assembly, indicated generally as **24**, serving to hold the superimposed sheets in engagement with drum **12** through a portion of the path. The flexible guiding assembly **24** includes a plurality of laterally spaced flexible, endless belts **26** supported by transparent drum **12** and by a plurality of rollers **28, 30, 32, 34** and **36**. The superimposed original and copy sheet are nipped between the rotating drum **12** and the endless belts **26** and rotate with the drum past the light source **14** where the copy is exposed by light passing through transparent or translucent areas of the original.

After exposure of the copy sheet **18**, the superimposed original and copy sheet enter the separating station **38** where they are separated from each other by a pair of vacuum chests **40, 42**, each including a perforated plate respectively adjacent the original and copy sheet. The force provided by the vacuum chest **40** separates the original from the copy sheet and causes it to be moved into engagement with a guide **44**, serving to channel the original between a pair of original delivery rollers to a tray (not shown) disposed at the front of the machine.

The vacuum chest **42** holds the copy sheet in engagement with the endless belts **26** and the sheet is moved between a guide roller **50** and belts **26** carried along roller **36** toward a curved guiding structure **52**. From there the sheet is carried between guide plate **54** and guide plate **57** forming an entrance **55** to the developer unit **56**. The exposed copy sheet **18** is passed through entrance **55** of the developer unit into the nip **59** of an applicator roller **58** and a pressure roller **60**, where it is wetted with a developer liquid contained in a tray **62**, which liquid is applied to the surface of the applicator roller **58** by means of a fountain roller **64**.

The copy sheet **18** is guided from the developer unit **56** by upper guide plate **66** and guide comb **68**, forming exit **70** of the developer unit, through a pair of copy sheet delivery rollers **72**, **74**, and along a guide **76** to the copy receiving tray **78** disposed at the front of the copy machine.

On some occasions during the developing of the copy sheets passing through developer unit **56**, a copy sheet will adhere to the wetted applicator roller **58**. When the latter occurs the copy sheet becomes wrapped about the roller **58** and continues to rotate thereabout indefinitely. This wrapping of the copy sheet about the roller **58** could damage the copy sheet, and make it impossible to process subsequent copies through the developer unit until the sheet is removed. Furthermore, it is difficult and time consuming to free the wrapped copy sheet from the roller.

In addition to the above, occasionally an original document fails to separate from a copy sheet in the separator station **38**. When this happens both the original and copy sheet are carried into the developer unit. Since the thickness of the two sheets is greater than the copy sheet alone, and since the original document is usually of a relatively light weight and rather flimsy, as in the case of translucent tracings, the original document which is delivered to the developer unit in contacting relation with the applicator roller **58**, adheres to the wetted roller surface and becomes wrapped about the roller. The latter not only presents the problem of having to dismantle the machine to free the wrapped original from the roller, but may result in the destruction of an original of which there may only be a single copy.

To prevent the above situations from occurring, there has been provided in the developer unit **56** of the copying machine **10**, a guide arrangement **80**, best seen in FIGS. **2** and **3**.

The guide arrangement **80** includes a plurality of extremely fine, filament-like wires **82**, each having a diameter less than 0.004 inches and preferably about 0.002 inches, which are strung taut across the applicator roller **58**, beneath the pressure roller **60** and between the entrance **55** and exit **70** of the developer unit **56**, in the direction of movement of the copy sheet. The wires are spaced from each other at a distance *d* (FIG. **3**) of approximately 2 inches along the length of the applicator roller to accommodate varying widths of copy sheets passing through the developer unit. It is to be understood that the use of the term "wire" as used herein is not restricted to a metallic member, but refers to other materials as well, such as, for example, synthetic or organic fibers, rubber and the like, which are suitable for use in the environment of a developer unit of the type described. A preferred "wire" material is, however, a fine metallic or nylon strand. The latter has been found to be able to withstand the frictional forces applied thereagainst by the action of the pressure and applicator rollers, and the moving sheet material.

The guide wires **82** positively prevent a copy sheet or original tracing which might not have been separated, from wrapping about the wetted applicator roller. The wires guide the sheet across the applicator roller **58** and provide little, if any, interference with the development of the copy sheet.

The developer unit **56** of the copying machine **10** described heretofore includes a metering system (not shown) for regulating the amount of developer liquid applied to a copy sheet passing between the applicator and pressure rollers **58** and **60**, respectively. In fact, the amount of developer liquid applied by the applicator roller **58** is less than 3.0 grams per square meter and preferably between 0.5 and 1.0 grams. A more complete description of the construction and operation of the metering system may be had by referring to copending Pat. application, Ser. No. 831,399 filed June 9, 1969, which is a continuation-in-part application of earlier filed U.S. patent application, Ser. No. 606,332, filed Dec. 30, 1966.

Because so little developer liquid is applied to a copy sheet in the copying machine **10**, one would predict that the guide wires used to guide the copy sheet safely through the developer zone, would leave striations or marks on the developed copy sheet after development. Surprisingly, this does not occur. It is believed that the combination of the fine, filament-like wires and the use of developer liquid of a proper consistency compensates for any tendency to leave striations on the developed sheet. As the copy sheet passes through the developer station between applicator and pressure rollers **58**, **60**, any striations formed by the guide wires quickly disappear due to the flow of developer liquid thereinto. Upon exiting from the machine, the striations are not evident, and the copy sheet is uniformly developed.

The particular mounting arrangement for the guide wires **82** shown in FIGS. **1–3** of the drawings is illustrated in FIG. **2**. One end **84** of each of the guide wires is attached to a mounting post **86** which can be affixed to an existing wall or the like structure of the developer unit. The other end **88** of the wire **82** is attached to a resilient member, herein taking the form of a coiled spring **90** which in turn is connected to a mounting bracket **92**, also affixed to an existing structure in the developer unit. The spring **90** provides the tension required for the wire **82** across applicator roller **58**, as well as being a safety release to prevent the wire from snapping due to excessive forces applied thereagainst.

The guide wire arrangement **80** according to the invention is a positive but simple means to prevent copy sheets and/or original tracings from becoming wrapped about the liquid applicator roller in a copying machine of the type described. The guide arrangement is very effective and needs little, if any, maintenance. In the event a wire of the guide arrangement should require replacement, it is a simple matter to release the wire from its mountings and affix a new wire in its place.

While a particular embodiment of the invention has been shown and described, it should be understood that the invention is not limited thereto since many modifications may be made. It is therefore contemplated to cover by the present application any and all such modifications as fall within the true spirit and scope of the appended claims.

What is claimed is:

1. In a direct contact copying machine for making a copy of an original document on a copy sheet, including an exposure station whereat a superimposed original and copy sheet are illuminated to create an image of the former on the latter, a separating station

whereat the original and copy sheet are separated, and a developing station including a developer unit comprising an entrance and an exit and having therebetween an applicator roller, the surface of which is wetted with a liquid developer solution for application to the surface of a copy sheet transported thereover in contact therewith, and

a pressure roller mounted in driving engagement with said applicator roller,

sheet guiding means for guiding sheet material including said copy sheet and original documents which have failed to be separated from said copy sheet, safely over said applicator roller while preventing the wrapping of said sheet material about said wetted applicator roller, said sheet guiding means including a plurality of fine guide wires strung taut between the entrance and the exit of said developer unit over and in contact with said roller member and between said applicator and pressure rollers, said wires further being spaced from each other axially along said applicator roller over the length thereof so as to accommodate sheets of varying widths, wherein each of said guide wires is of a diameter of less than 0.004 inches.

2. In a direct contact copying machine for making a copy of an original document on a copy sheet, including an exposure station whereat a superimposed original and copy sheet are illuminated to create an image of the original on the copy sheet, and a developing station including a liquid developer unit comprising an entrance and an exit through which said copy sheet is passed for development, having a supply of liquid developer solution, an applicator roller for use in applying a predetermined amount of developer liquid to said copy sheet passing through said unit, and metering means for metering a predetermined quantity of developer liquid from said supply to said applicator roller, said roller applying less than 3.0 grams per square meter of liquid to said copy sheet, wherein the improvement comprises

sheet guiding means for guiding the original document and the copy sheet safely through said developer unit in contacting relation with said applicator roller while preventing the wrapping of either or both of said document and copy sheet about said roller, said sheet guiding means including a plurality of fine, filament-like guide members extending between the entrance and exit of said developer unit, over and in contact with said roller member, said guide members comprising wires, each having a diameter less than 0.004 inches, strung taut between the entrance and the exit of said developer unit, wherein each said wire is held at one end by a spring member to provide a tension to said wire while avoiding breakage thereof due to forces applied thereagainst.

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