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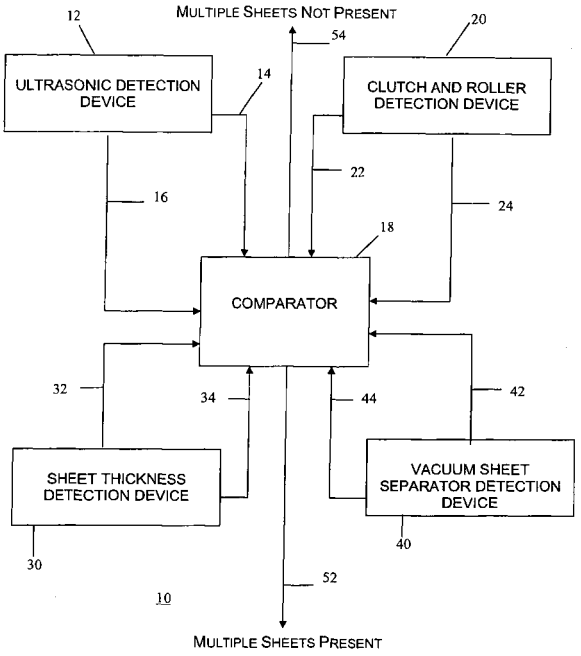
(54) Multiple sheet detection system

(57) A multiple feed document detection system for use with a document transport for detecting the presence of multiple documents utilizes multiple doubles detection devices wherein each device detects the presence of doubles. The output signals of each device are applied to a comparator which compares the signals obtained from each device. If each device indicates the presence of doubles, then the comparator provides an output that multiple sheets are present. The system thereby eliminates the reading of false doubles by the comparison of the output signals from two or more doubles detection devices.



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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to document transports, and more particularly to a detector for detecting multiple feed sheets.

BACKGROUND OF THE INVENTION

[0002] For efficient document processing along a document transport, a preferred method of feeding documents into the transport is via an automated document feeder. On occasions, however, an automated document feeder may feed more than one document at a time. In the event that more than one document is fed, there is a need to detect that "doubles" or multiple documents are present.

[0003] One system for detecting multiple feed documents is by measuring the thickness of the document. However, in applications of feeding a mixture of different types of documents, measuring the thickness of the documents is not a viable solution. Also, a thickness detector is a contact method of sensing multiple documents and has a disadvantage that paper jams can result. The contact method also requires calibration using the maximum thickness document that will be fed through the document transport.

[0004] Another device for detecting multiple feed documents is utilizing a vacuum system. In a vacuum system, detection of multiple feed documents of different thicknesses is possible. A vacuum system is fairly reliable; however, the vacuum sensors must be placed in close proximity to each side of the document in order to detect multiple feed documents. A vacuum is placed on both sides of the document path. If a single item is fed, then that item blocks only one vacuum. If two or more documents are fed simultaneously, then both vacuums are blocked. For an open track document transport, the use of a vacuum doubles detect system is not desirable. In an open track document transport, a doubles detection system must not interfere with the open track design.

[0005] Another contact device for detecting sheet doubles utilizes rollers on each side of the document path and the rotation of the rollers is monitored, such as in a magnetic clutch and roller device. One roller, or a set of rollers is controlled by a drive mechanism. The opposing roller or set of rollers, is connected to a mechanical clutch and the speed of this roller set is controlled by contact with the driven rollers, or the documents that pass between them. If a single item is passed between this type of detector, then the opposing rollers will match the speed of the driven roller and no multiple sheets are detected. If two or more sheets are fed simultaneously through the device, then the magnetic brake will cause slippage between the multiple sheets, creating a speed mis-match between the opposing rollers and the driven rollers. Detection of doubles is then realized. However, where a chemical reaction occurs between laser printed items and carbonless coatings, known as "sticky checks", the multiple items are glued together, and slippage between the items is not likely to occur. Therefore, a magnetic clutch and roller device is not itself a reliable device for detecting doubles.

[0006] A non-contact device for multiple document detection utilizes ultrasound signals which pass through the document to determine if more than one document is present. Sending ultrasound waves through paper results in attenuation of the ultrasound signal. It is possible to determine the presence of multiple documents by the change in attenuation of the signal received. An ultrasound detector is independent of the thickness of the individual documents and detection made without making contact with these documents. A continuously transmitted sonic wave causes vibrations in the first sheet which is then transmitted via the intervening air to the second sheet, which also begins to vibrate. The receiver unit of an ultrasonic detection system is able to detect these weakened signals via the air. While an ultrasonic multiple document detector can accurately detect doubles even if the documents are stuck together, a disadvantage of such detectors is that the apparatus will register a false positive when items such as envelopes are fed. Also the presence of folded corners, sometimes known as "dog ears", will yield a false positive.

[0007] A need has arisen for a document doubles detection system.

SUMMARY OF THE INVENTION

[0008] In accordance with the present invention, a multiple feed document detection system for use with a document transport for detecting the presence of multiple documents is provided. The system utilizes multiple doubles detection devices wherein each device detects the presence of doubles. The output signals of each device are applied to a comparator which compares the signals obtained from each device. If each device indicates the presence of doubles, then the comparator provides an output that multiple sheets are present. The present system thereby eliminates the reading of false doubles by the comparison of the output signals from two or more doubles detection devices.

BRIEF DESCRIPTION OF THE DRAWING

[0009] For a more complete understanding of the present invention and for further advantages thereof, reference is now made to the following Description of the Preferred Embodiments taken in conjunction with the accompanying Drawing which is a block diagram of the present system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] Referring to the Figure, the present multiple

sheet detection system is illustrated, and is generally identified by the numeral 10. System 10 includes an ultrasonic detection device 12 which provides a first output signal 14 indicating the presence of multiple sheets and a second output signal 16 indicating that no multiple sheets are detected. Ultrasonic detection device 12 may include, for example, devices described and shown in U.S. Patent Nos. 4,066,969 and 6,511,064, which descriptions are hereby incorporated by reference. Signals 14 and 16 are applied to a comparator 18 whose operation will be subsequently described.

[0011] Detection system 10 further includes a magnetic clutch and roller detection device 20. Detection device 20 generates a first signal 22 indicating the presence of multiple documents, and a second signal 24 indicating that no multiple documents are present. Signals 22 and 24 are applied to comparator 18. Clutch and roller detection device 20 may comprise, for example, the device described and shown in U.S. Patent Application Serial No. 10/962,739 filed October 12, 2004, which description is hereby incorporated by reference.

[0012] Detection system 10 further includes a sheet thickness detection device 30. Detection device 30 generates a first output signal 32 indicating the presence of multiple documents, and a second output signal 34 indicating that no multiple documents are present. Signals 32 and 34 are applied to comparator 18. Detection device 30 may comprise, for example, a device such as that described in U.S. Patent No. 5,204,537, which disclosure is hereby incorporated by reference.

[0013] A fourth doubles detection device is included within detection system 10 and includes a vacuum sheet separator detection device 40. Vacuum detection device 40 applies a vacuum to both sides of a document transport and generates a first output signal 42 indicating the presence of multiple documents, and a second signal 44 indicating that no document doubles are present. Signals 42 and 44 are applied to comparator 18.

[0014] Comparator 18 receives the output signals of each detection device 12, 20, 30 or 40 utilized within detection system 10. Comparator 18 functions to generate a multiple sheet present signal 52 or a multiple sheet not present signal 54. Comparator 18 functions to determine whether two or more first signals generated by a detection device 12, 20, 30 or 40 are present. The presence of two document doubles signals are required in order to generate a multiple sheet present signal 52. Because detection system 10 utilizes two or more detection devices 12, 20, 30 or 40, a false doubles indication by one detection device will not result in a multiple sheet present signal. For example, when an envelope passes through ultrasonic detection device 12, first signal 14 will typically be generated, but will be a false doubles indication. When utilizing detection device 10 with a thickness detection device 30, where no doubles detection occurs for the envelope, since the output of the thickness device 30 will produce signal 34, the output of comparator 18 will indicate that multiple sheets are not present by generating signal 54. System 10 may utilize any combination of detection devices 12, 20, 30 or 40, so long as two or more devices are utilized in order to compare the data output of each detection device with that of another detection device.

[0015] Other alteration and modification of the invention will likewise become apparent to those of ordinary skill in the art upon reading the present disclosure, and it is intended that the scope of the inventions disclosed herein be limited only by the broadest interpretation of the appended claims to which the inventors are legally entitled.

Claims

1. A system for detecting the presence of multiple sheets moving along a path, the system comprising:

   a first doubles detection device disposed at a first position along the path, said first doubles detection device generating a first output signal upon detection of multiple sheets and a second output signal upon detection of a single sheet at the first position;
   a second doubles detection device disposed at a second position along the path, said second doubles detection device generating a first output signal upon detection of multiple sheets and a second output signal upon the detection of a single sheet at the second position; and
   a comparator for receiving said output signals of said first and said second doubles detection devices and for generating an output signal indicating the presence of multiple documents along the path when said first output signal of said first doubles detection device and said first output signal of said second doubles detection device are present.

2. The system of claim 1 wherein said first doubles detection device includes an ultrasonic detection device.

3. The system of claim 2 wherein said second doubles detection device includes a clutch and roller detection device.

4. The system of claim 2 wherein said second doubles detection device includes a thickness detection device.

5. The system of claim 2 wherein said second doubles detection device includes a vacuum detection device.

6. A system for detecting the presence of multiple sheets moving along a path, the system comprising:

an ultrasonic detection device disposed at a first position along the path, said ultrasonic doubles detection device generating a first output signal upon detection of multiple sheets and a second output signal upon detection of a single sheet at the first position;

a first doubles detection device disposed at a second position along the path, said first doubles detection device generating a first output signal upon detection of multiple sheets and a second output signal upon detection of a single sheet at the second position;

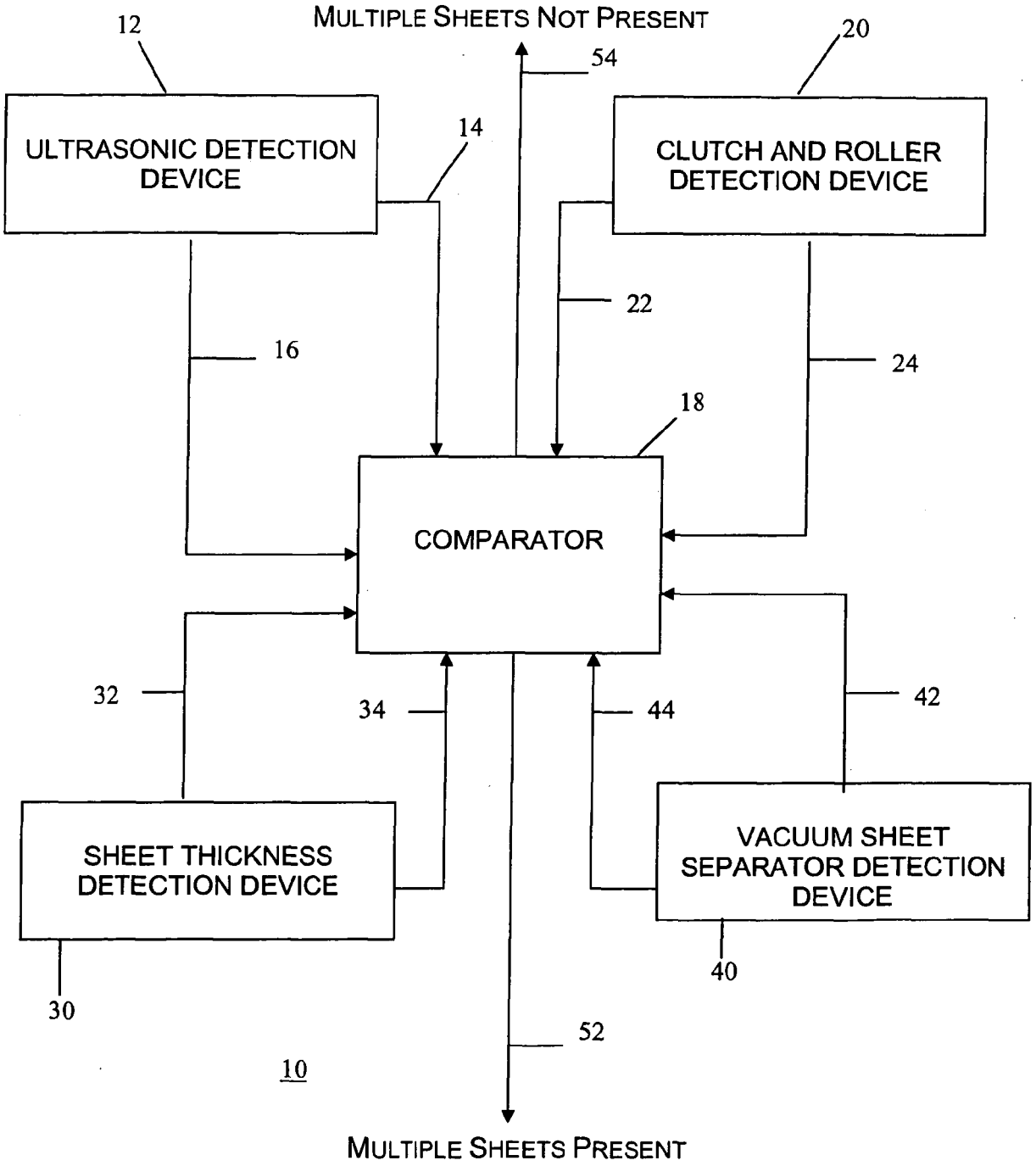
a second doubles detection device disposed at a third position along the path, said second doubles detection device generating a first output signal upon detection of multiple sheets and a second output signal upon the detection of a single sheet at the third position; and

a comparator for receiving said output signals of said ultrasound detection device and said first and said second doubles detection devices and for generating an output signal indicating the presence of multiple documents along the path when said first output signals of said doubles detection devices are present.

7. The system of claim 6 wherein said first doubles detection device includes a thickness detection device and said second doubles detection device includes a clutch and roller detection device.

8. The system of claim 6 wherein said first doubles detection device includes a thickness detection device and said second doubles detection device includes a vacuum detection device.

9. The system of claim 6 wherein said first doubles detection device includes a clutch and roller detection device and said second doubles detection device includes a vacuum detection device.


MULTIPLE SHEETS NOT PRESENT
12
54
20
ULTRASONIC DETECTION DEVICE
14
CLUTCH AND ROLLER DETECTION DEVICE
22
16
24
18
COMPARATOR
32
34
44
42
SHEET THICKNESS DETECTION DEVICE
VACUUM SHEET SEPARATOR DETECTION DEVICE
40
30
52
10
MULTIPLE SHEETS PRESENT

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4066969 A **[0010]**
- US 6511064 B **[0010]**
- US 96273904 A **[0011]**
- US 5204537 A **[0012]**