United States Patent [19]

McCarthy

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[54] **COUNTING SYSTEM FOR ARTICLES IN A STREAMLINED STACK**

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[52] **U.S. Cl.** ..... **235/98 R,** 235/98 C, 209/111.9

[51] **Int. Cl.** **G06m 7/06**

[58] **Field of Search** ..... 235/92 FL, 98 R; 209/111.9; 340/38 S; 73/67.7

[56] **References Cited**

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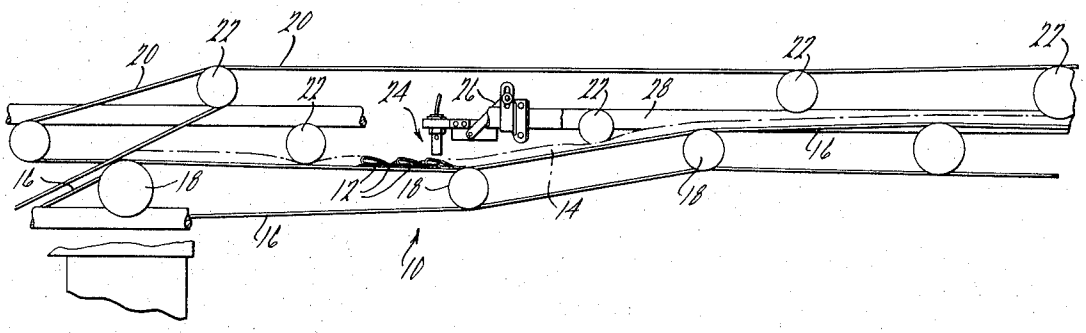
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[57] **ABSTRACT**

A newspaper counting system wherein a streamlined stack of papers passes beneath a sensor, the sensor directing a jet of air toward the stack and senses disruption of the jet each time the leading edge of a paper passes the sensor. Each disruption is counted to provide an accurate count of newspapers passing below the sensor.

8 Claims, 3 Drawing Figures



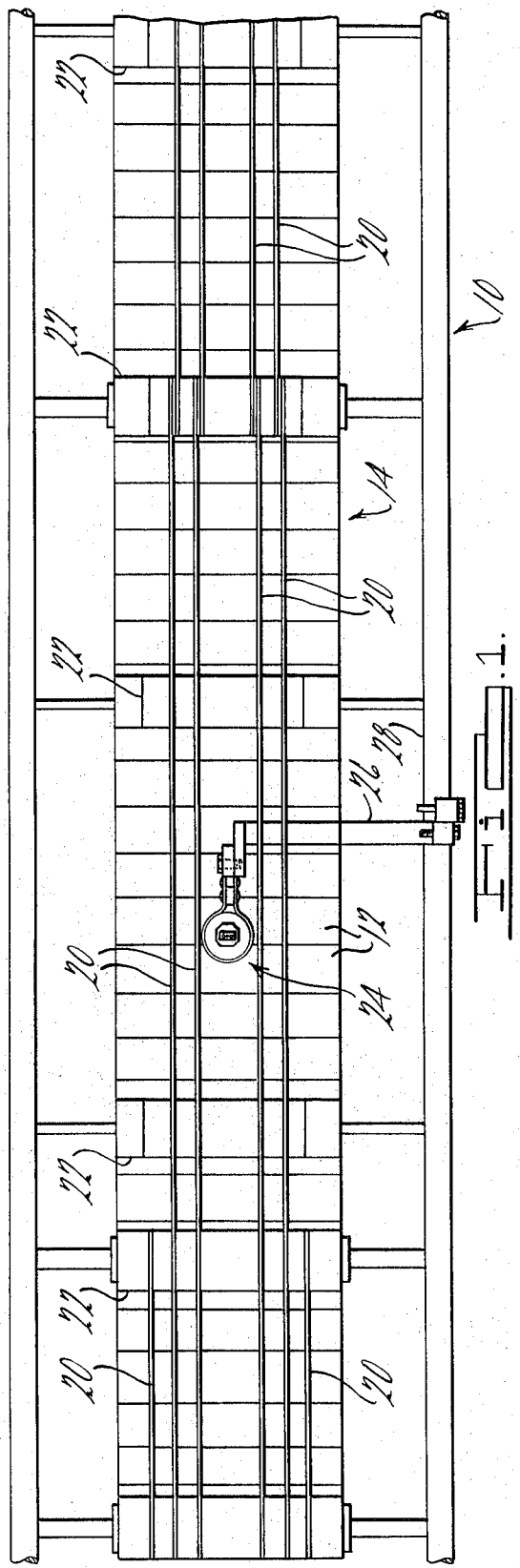


Fig. 1.

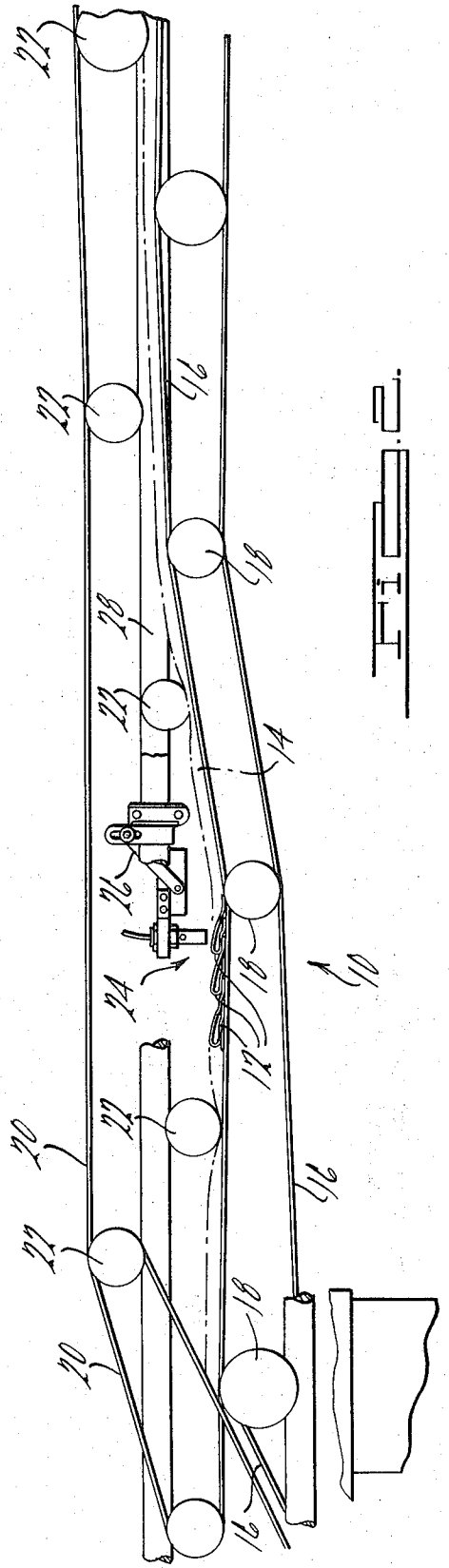


Fig. 2.

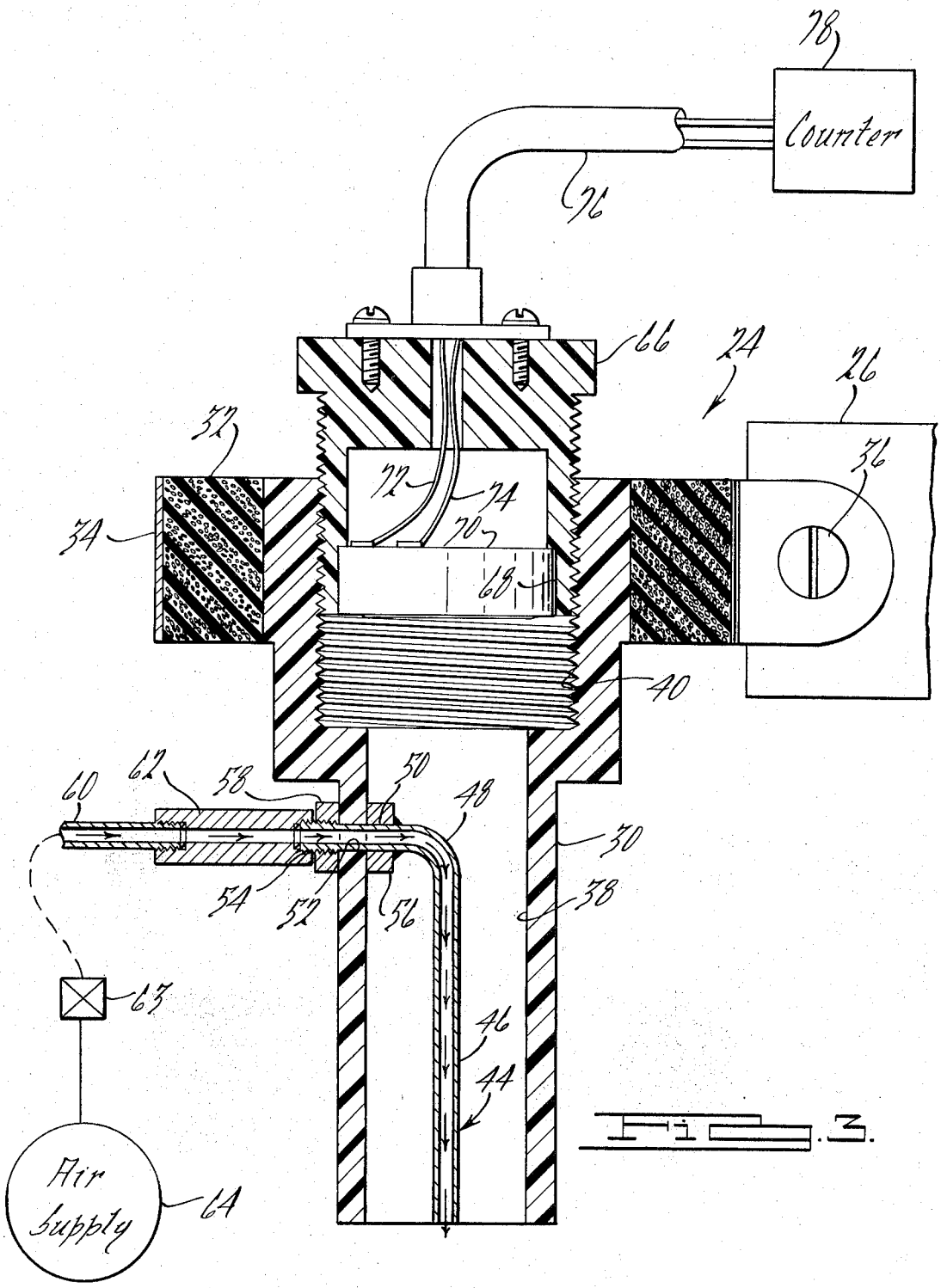

78
Counter
76
66
24
26
32
72
74
36
34
70
68
40
60
62
58
50
48
30
54
52
56
38
63
46
44
Air
Supply
64

Fig. 3.

COUNTING SYSTEM FOR ARTICLES IN A STREAMLINED STACK

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates generally to apparatus for counting articles such as newspapers and the like and is especially useful in counting newspapers, magazines, etc., which travel in a streamlined stack.

In the printing field, a problem has existed for a number of years in how to count the articles traveling from the press. Typically, the articles travel in a streamlined stack which presents a series of edges to be counted. Prior systems have been suggested and used but the nature of the articles being counted and the manner in which they are conveyed from the press has precluded an accurate count. In systems which propose the use of a sensor in contact with the stack, modern inks have caused problems in adhering to the sensor. This problem has become particularly acute with the use of color inks on the outer page or sheet. Further, the nature of the article, in that newspapers are non-magnetic and relatively flimsy, do not readily adapt the counting system to counting by magnetic sensors or limit switches. Moreover, when the articles travel at relatively rapid rates, or in a streamlined stack, it is difficult to individually detect and count each article.

Among the objects of the present invention are to provide apparatus and method for reliably and accurately counting moving articles such as newspapers and the like; and a novel sensor for reliably and accurately counting articles.

The foregoing as well as additional objects, advantages and benefits will be seen in the ensuing description and claims which are to be taken in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

The drawings illustrate a preferred embodiment of the invention in accordance with the best mode presently contemplated for carrying out the invention.

FIG. 1 is a plan view of a newspaper conveyor line with which the present invention is used.

FIG. 2 is an elevation view of FIG. 1.

FIG. 3 is a vertical sectional view through a preferred sensor used in FIGS. 1 and 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1 and 2 illustrate portions of a newspaper conveyor and stacker line 10 along which individual newspapers 12 travel in a streamlined stack 14. The particular details of line 10 are not critical as far as the present invention is concerned in that it is a typical conveyor used in transporting newspapers from the presses. Therefore, line 10 may be briefly described as having a plurality of groups of endless carrier wires 16 arranged in loops on various driving and driven rollers 18. Wires 16 travel counterclockwise as viewed in FIG. 2 to support and convey stack 14 from right to left in FIGS. 1 and 2. Subsequently the newspapers are deposited in stacks for bundling. A plurality of groups of endless hold-down wires 20 are arranged in loops on various driving and driven rollers 22 above stack 14. Wires 20 travel in the clockwise direction as viewed in FIG. 2 and confine newspapers 12 as they are conveyed on wires 16 so that stack 14 can travel at maximum speed without newspapers 12 becoming disarrayed on wires 16.

The counting system of the invention as used with line 10 includes a sensor 24 supported above stack 14 via a support 26. Support 26 is mounted on a pipe 28 and includes means for adjusting the orientation of sensor 24 relative to stack 14. Preferably sensor 24 is oriented so that its axis is perpendicular to and transversely centered with stack 14, and the lowermost portion of sensor 24 is spaced vertically above stack 14.

The details of sensor 24 are illustrated in FIG. 3. Sensor 24 comprises a generally cylindrical body 30 shock-mounted in an elastomeric ring 32 extending around the diametrically enlarged upper portion of body 30. A circular clamp 34 securely girdles ring 32 and is attached to support 26 by means of a screw 36. An axial bore extends completely through body 30 and comprises a smooth lower bore portion 38 and a diametrically enlarged, threaded upper bore portion 40. A conduit 44 is mounted on body 30 and is generally centrally located within lower bore portion 38. Conduit 44 is a continuous tubular piece comprising an axial segment 46 connected by means of a curved right angle bend at its upper end to a radial segment 50 which extends through a hole 52 in the sidewall of body 30. The radially outer end of segment 50 is threaded, at 54, and a collar 56 is soldered to the radially inner end of segment 50. A nut 58 is threaded onto the radially outer end of segment 50 by threads 54 to draw collar 56 against the sidewall of body 30 and thereby fixedly mount conduit 44 thereon. Conduit 44 is dimensioned so that when mounted on body 30 segment 46 is coaxial with bore 38 and the lower end of segment 46 is flush with the lower end of body 30.

An air supply line 60 is connected to conduit 44 by means of a coupling 62 threaded onto segment 50 at thread 54. Line 60 leads to a valve 63 which controls the flow of air from an air supply 64 to conduit 44. When valve 63 is operated away from its closed position, air flows from supply 64 through line 60 and conduit 44 to issue from the lower end of segment 46. Thus, sensor 24 can direct a jet of pressurized fluid toward stack 14 below the open end of tubes 30 and 44 and the valve 63 permits variation of the intensity of the jet by varying the setting of valve 63. With the above arrangement, the jet of air will create a low pressure signal within the tube 30, the signal having a frequency characteristic which may be varied by the passage of the articles to be counted. Also, the pressure within the tube 30 may be varied by the passage of the articles.

A threaded cap 66 is threaded into the open upper end of upper bore 40. A bore 68 extends upwardly within cap 66 from the lower end thereof, and an audio responsive sensing element 70, for example, a carbon microphone, is mounted in bore 68. The audio receptive portion of element 70 faces vertically downwardly toward the lower open end of body 30. Lead wires 72 and 74 connected to element 70 extend through cap 66 and emerge in a cable 76 which is connected to a counter 78. As will be seen, the counter may be of any type commonly available which responds to a change in frequency within a given range or, in the alternative, responds to a variation in pressure.

The system operates as follows. First the height of sensor 24 is adjusted so that the bottom of the sensor

is slightly above stack **14.** Valve **63** is opened so that a jet of air issues from sensor **24** toward stack **14.** Counter **78** is turned on to pick up signals from sensing element **70.** As stack **14** travels past sensor **24,** the leading edge of each newspaper **12** disrupts the jet of air issuing from sensor **24.** This disruption creates an audio disturbance which is picked up by sensing element **70.** Sensing element **70** supplies an electrical signal indicative of this disruption via leads **72** and **74** to counter **78.** Counter **78** counts each signal thus received to thereby provide an accurate count of newspapers passing across sensor **24.** The count in counter **78** may be used for various purposes including control of the number of papers deposited in individual bundles upon leaving line **10.**

While the details of the precise phenomenon (or phenomena) occurring upon disruption of the jet of air issuing from sensor **24** are not presently known in exact detail, experimental results have shown that the signal developed by sensing element **70** increases in both amplitude and frequency in response to disruption of the air jet by each passing newspaper. One possible explanation for these results is as follows. As the leading edge of each newspaper intercepts the air jet, a doppler effect occurs because the leading edge of each passing newspaper creates an apparent upward component of movement of stack **14** relative to sensor **24** during its passage through the jet. This component of movement causes the frequency of the audio signal detected by sensor **24** to increase (i.e., doppler shift), and this explains the increase in frequency. As far as the increase in amplitude is concerned, it is believed that this occurs because the leading edge of the newspaper is closer to sensor **24** than the trailing portion of the immediately preceeding newspaper. Therefore, the signal has less distance to travel to reach sensing element **70** and the signal developed by element **70** will be correspondingly greater in amplitude.

While it will be apparent that the preferred embodiments of the invention disclosed are well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. Apparatus for counting articles such as newspapers and the like passing through a counting station in a streamlined stack wherein each article presents a protruding edge adapted to be sensed, said apparatus comprising means positioned in proximity to the stack for directing a pressure jet of gaseous fluid into the path of travel of the articles such that the jet is perpendicular to each edge and is disrupted by each edge passing through the station to thereby create a corresponding signal disturbance without substantially disturbing the article edge, sensing means for sensing a characteristic of each signal disturbance thus created, and counting means operatively coupled with said sensing means for counting each disturbance.

2. Apparatus according to claim **1** wherein said characteristic is a change in audio frequency caused by each disruption.

3. Apparatus according to claim **2** wherein said characteristic is an increase in audio frequency caused by each disruption.

4. Apparatus according to claim **1** wherein said means for directing a pressure jet of gaseous fluid into the path of travel of the stack comprises conduit means perpendicular to the stack and positioned between the stack and said audio sensing means.

5. Apparatus according to claim **4** wherein said audio sensing means is aligned with said conduit means.

6. The method of counting articles such as newspapers and the like passing through a counting station in a streamlined stack which comprises directing a pressure jet of gaseous fluid into the path of passing articles such that the jet is perpendicular to the direction of travel of the edge and is disrupted by each passing article to create a corresponding audio disturbance, detecting a characteristic of said disturbance caused by each disruption and counting said disturbances.

7. The method according to claim **6** wherein the step of detecting a characteristic of each signal comprises detecting a frequency change in audio frequency caused by each disruption.

8. The method according to claim **7** wherein the step of detecting a change in audio frequency comprises detecting a frequency increase in audio frequency caused by each disruption.

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