United States Patent

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[54] **DOCUMENT FEEDING APPARATUS**
7 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **271/52**
[51] **Int. Cl.** **B65h 9/10**
[50] **Field of Search** 271/52, 49, 48, 59, 58

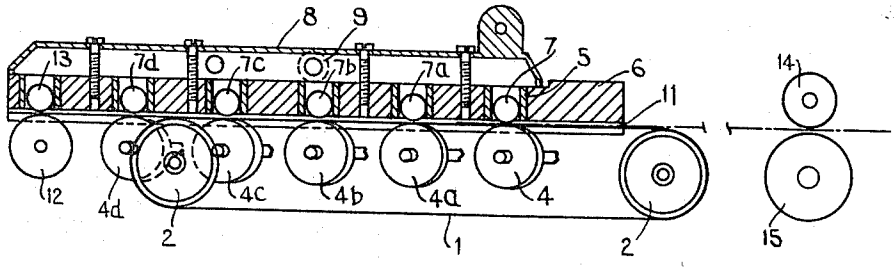
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ABSTRACT: Apparatus for feeding and aligning documents is described including a rotatable feeding roller, a ball in contact with the periphery of the roller and supported in a guide so as to move freely in a direction perpendicular to the periphery of the roller at the point of contact. The fluid under pressure is applied to the guide remote from the roller to urge the ball into contact with the roller. The roller axis may be angled to the direction of feed in order to align documents with an aligning surface.



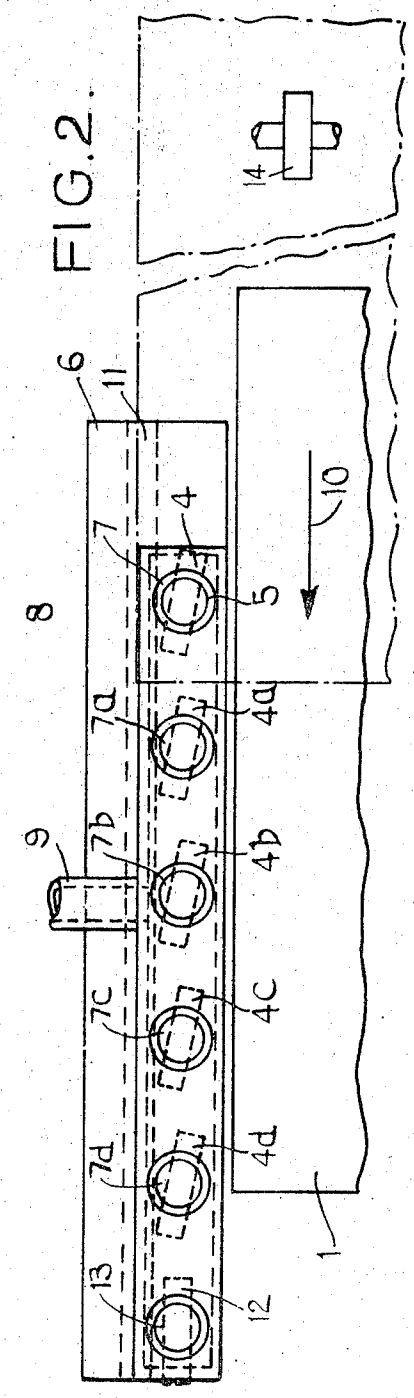


FIG. 2.

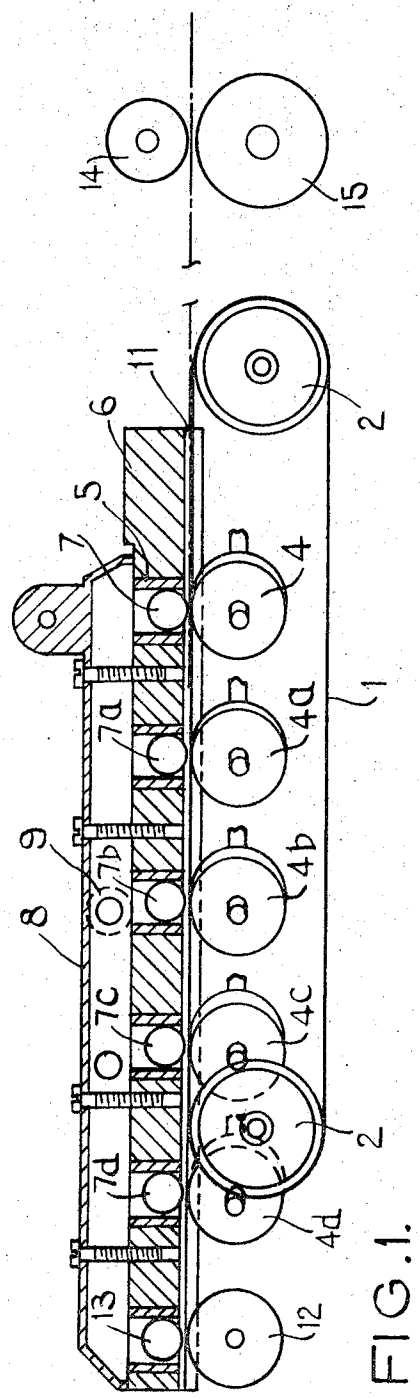


FIG. 1.

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DOCUMENT FEEDING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to document feeding apparatus.

SUMMARY OF THE INVENTION

Apparatus for feeding documents including a rotatable feeding roller, a ball, a guide for said ball to allow contact between said ball and the periphery of said roller and movement of the ball freely in a direction perpendicular to the periphery of said roller at the point of contact and means for applying fluid under pressure to urge said ball towards said roller.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevation partly in section of a document feeding and aligning apparatus, and

FIG. 2 is a partial plan view of the apparatus

DESCRIPTION OF PREFERRED EMBODIMENT

The feeding and aligning apparatus which is shown in FIGS. 1 and 2 is suitable for incorporation in, for example, apparatus in which documents, such as checks, are fed from a stack to a reading station. The documents bear information which may be read by an optical, or a magnetic, character reading system.

The documents are delivered one at a time from a document stack (not shown) on to a continuously running conveyor belt 1, which is carried by pulleys 2. The document is supported and carried along by the conveyor belt in a substantially horizontal plane. Thus, the leading edge of the document is moved forward until it reaches a constantly rotating feed roller 4.

A guide tube 5 is mounted in a plate 6 so that a steel ball 7 is located by the tube to rest on the periphery of the roller 4. The ball 7 is a loose fit in the tube 5, so that the ball is free to move in a direction perpendicular to the periphery of the roller at the point of contact with the ball. The end of the tube 5 which is remote from the roller opens into an air space formed by a cover 8, which is clamped to the upper surface of the plate 6. A tube 9, which passes through the cover 8 is connected to an air pump (not shown). The air pump produces an increased air pressure in the air space above the plate 6.

The ball must exert a certain minimum force towards the roller to ensure that the frictional force between roller and the document is sufficient to produce the requisite feeding action. The force exerted by the ball is the sum of that due to the weight of the ball and that due to the differential air pressure acting on the ball. It was found that in one practical example, using a steel ball of five-eighths inch diameter, a differential air pressure of about 2 p.s.i. was sufficient for the satisfactory feeding of punched card stock of approximately 0.007- inch thickness.

When paper of approximately 0.004- thickness was fed in the above practical example it was found that the differential air pressure could be reduced to about 0.5 p.s.i. while retaining satisfactory operation.

It was found that the weight, and consequently the size and inertia, of the ball had to be increased considerably to achieve feeding when the ball was not subjected to a differential air pressure. The impact of the leading edge of the document against the ball causes it to rise up the tube 5 and the required force is not exerted on the document until the ball has settled down again. For a given force exerted by the ball, the use of a small ball with differential air pressure reduced the settling time for the ball by a factor of about 30 as compared with the larger ball which is necessary without air pressure.

The application of air pressure has an additional advantage. The loose fit of the ball in the tube 5 allows sufficient airflow to provide an air bearing for the ball, so that it is free to rotate on any axis with a very low frictional restraint.

The roller 4 is at an acute angle to the main direction of document feeding as indicated by arrow 10. The ball 7 rotates about an axis parallel to the axis of the roller 4, in the absence of a document. It is preferred that the trailing edge of a document should still be gripped by a pressure roll 14 and a feed roll 15, when the leading edge of that document reaches the roller 4, in order to obtain positive feeding of the document. The document is fed in the direction of the arrow 10, so long as the feed on the trailing edge is effective. The ball 7 is driven by the document to rotate about an axis perpendicular to the direction of the arrow 10, and the roller 4 slips. A soon as the trailing edge is released, the roller 4 feeds the document forward in the direction of the arrow and also sideways towards an aligning surface formed by the inner wall of a slot 11 in the plate 6. The axis of rotation of the ball shifts to a position approximately parallel to the axis of the roller 4. Other means than the pressure roll 14 and feed roll 15 described above may be used to obtain positive feeding of the document. For example, a driven vacuum roll may be used.

The document encounters further angled rollers 4*a*—*d*, cooperating with balls 7*a*—*d*, as it is moved along the feed path. The rollers 4 impart a sideways component to the feeding of the document until one side edge of the document is pushed into contact with the aligning surface of the slot 11. Thereafter, the rollers slip on the document so that it again moves only in the direction of the arrow 10. The leading edge of the aligned document is picked up by a further roller 12, cooperating with a ball 13, to feed the document on to a data sensing device, for example. The axis of the roller 12 is perpendicular to the direction of the arrow 10.

The embodiment described above uses a series of rollers arranged adjacent to one edge of the document. It will be appreciated that the rollers would normally be arranged along the center line of the document if alignment was not required, and that two, or more, rollers, each cooperating with a ball, may be positioned at spaced intervals across the width of the document.

I claim:

1. Apparatus for feeding documents including a rotatable feeding roller, a ball, a guide for said ball to allow contact between said ball and the periphery of said roller and to allow movement of the ball freely in a direction perpendicular to the periphery of said roller at the point of contact and means for applying fluid under pressure to urge said ball towards said roller.

2. Apparatus according to claim 1 including an alignment surface aligned in the direction of feed of documents and in which the rotatable feeding roller has an axis extending at an angle to the alignment surface such that the rotatable feeding roller imparts to the document movement having a component in the direction of feeding and a component directed toward the alignment surface.

3. Apparatus according to claim 1 in which the guide includes a tube of circular cross section, the axis of which is aligned with a radius of the rotatable feeding roller and the ball is freely movable in the tube.

4. Apparatus according to claim 1 including a plurality of rotatable feeding rollers, a base plate having a plurality of cylindrical holes therethrough aligned one with each rotatable feeding roller respectively, a ball in each hole in contact with the periphery of the associated rotatable feeding roller and freely movable in a direction perpendicular to the periphery of the said roller, a cover for the base plate having an inlet for fluid under pressure, said cover coacting with said base plate to form a common fluid chamber communicating with the end of each of the cylindrical holes remote from the rollers so as to permit the application of fluid under pressure to the balls to urge each of said balls towards the periphery of the roller associated therewith.

5. Apparatus according to claim 2 including means for conveying and supporting documents in a plane extending through the point of contact of the ball and the periphery of the associated rotatable feeding roller and tangentially to the surface of said roller.

6. Apparatus according to claim 5 in which the means for conveying and supporting documents includes feed means positioned ahead of the rotatable feeding roller by a distance less than the length of a document to be fed so that the trailing edge of a document is positively fed until the leading edge of said document has passed the point of contact of the ball and the periphery of the rotatable feeding roller.

7. Apparatus according to claim 1 including an alignment surface aligned in the direction of feed of documents, a plurality of rotatable feeding rollers, each said roller having an axis extending at an acute angle to the alignment surface and being effective to impart to the document movement having a component in the direction of feeding and a component directed toward the alignment surface, a base plate having a plurality of cylindrical holes therethrough aligned one with each rotatable feeding roller respectively, a ball in each hole in contact with the periphery of the associated rotatable feeding roller and freely movable in a direction perpendicular to the periphery of the said roller, a cover for the base plate having an inlet for fluid under pressure, said cover coacting with said base plate to form a common fluid chamber communicating with the end of each of the cylindrical holes remote from the rollers so as to permit the application of fluid under pressure to the balls to urge each of said balls towards the periphery of the roller associated therewith.