Sept. 10, 1957 A. L. STUCHBERY 2,805,856

METAL SHEET FEEDING DEVICES

Filed June 25, 1954 3 Sheets-Sheet 1

FIG. 1.

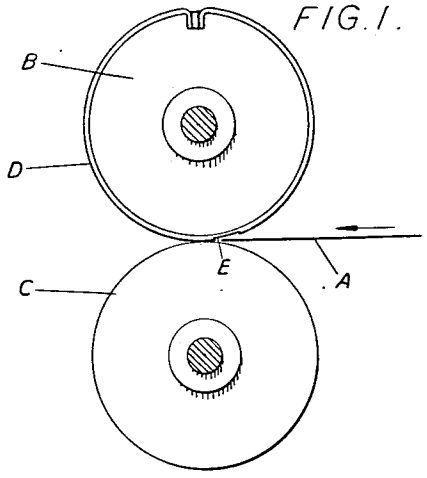
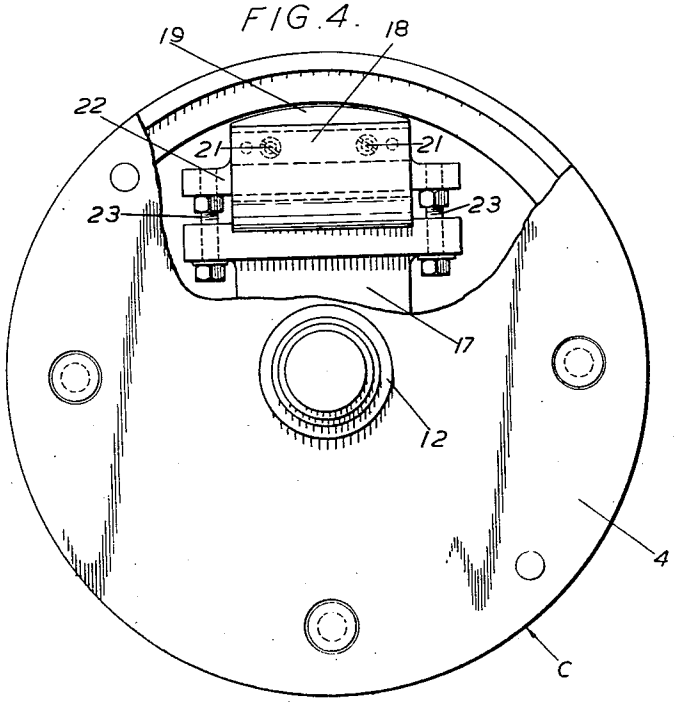


FIG. 4.



Inventor
Arthur Leslie Stuchbery.

By
Mann, Porter, Diller & Stewart
Attorneys

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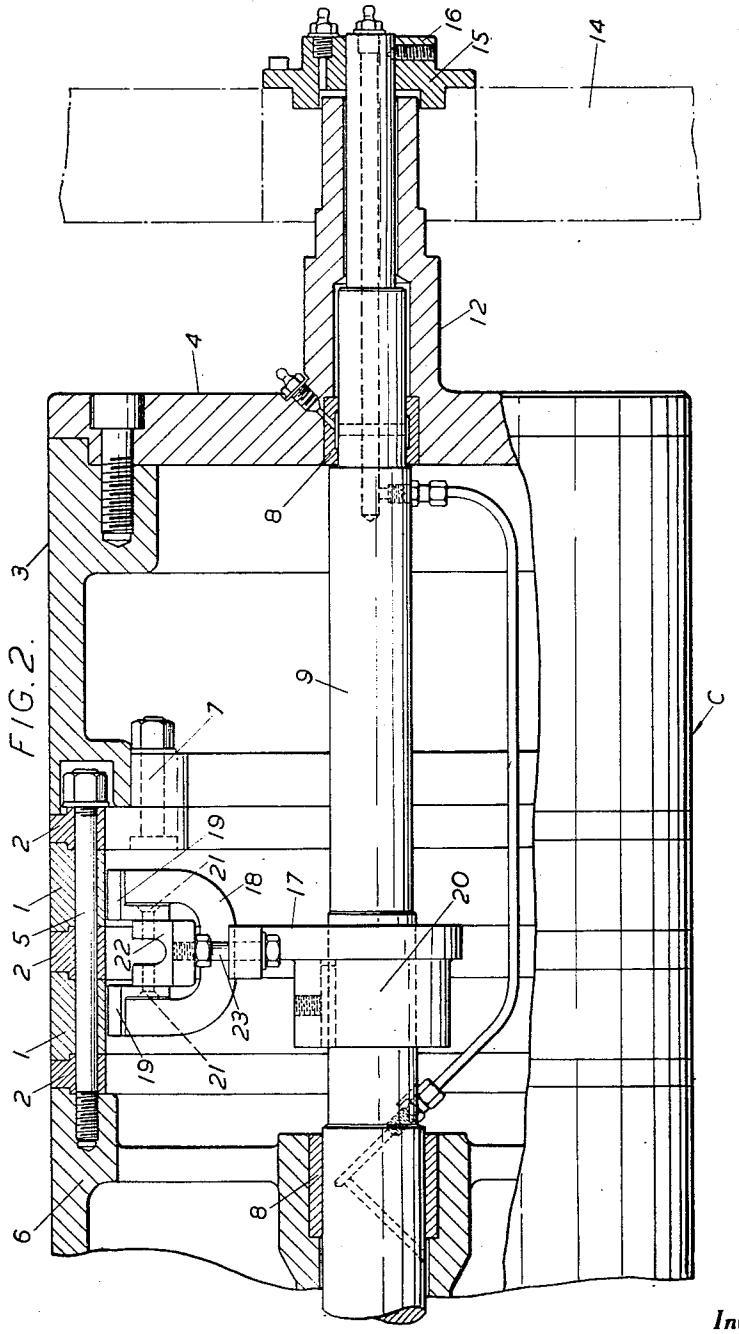


FIG. 2.

Inventor
Arthur Leslie Stuchbery.

By
Mann, Porter, Diller & Stewart
Attorneys

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Filed June 25, 1954 3 Sheets-Sheet 3

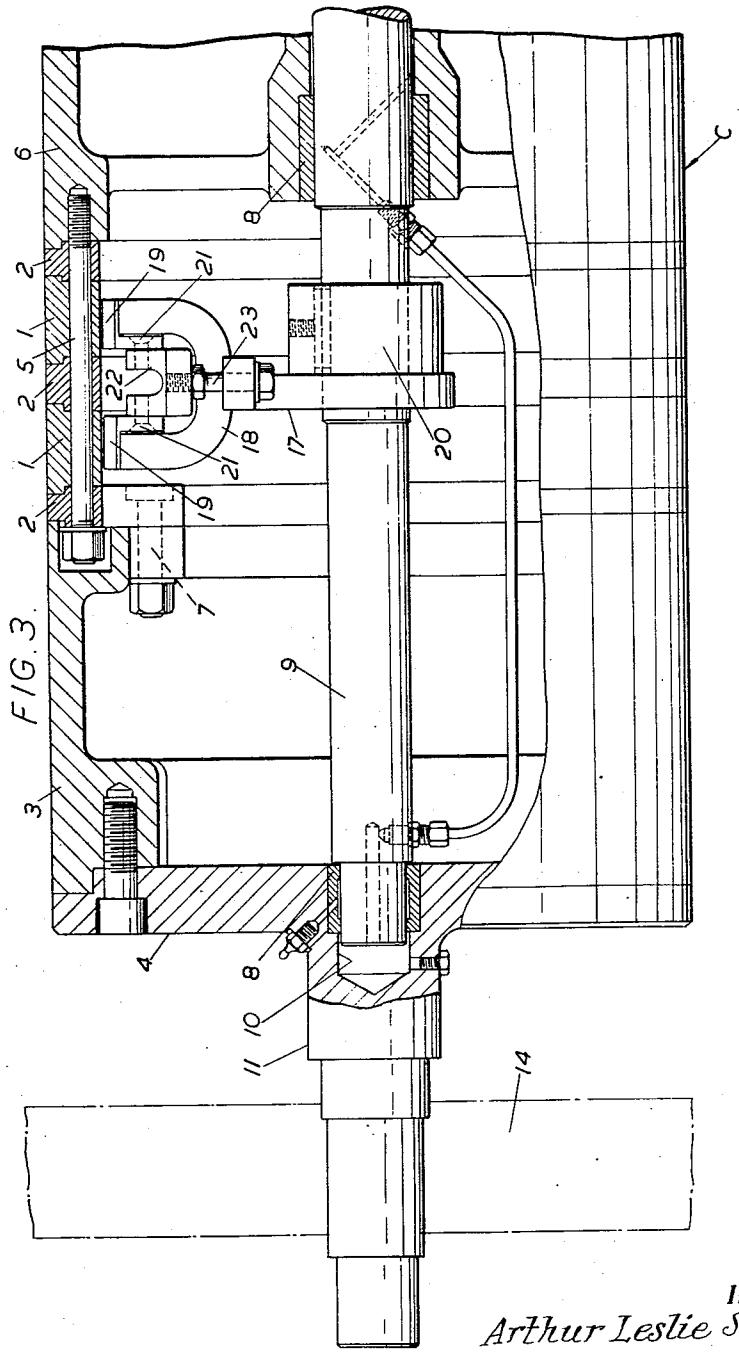


FIG. 3.

Inventor
Arthur Leslie Stuchbery

By
Mason, Porter, Dillon & Stewart
Attorneys

United States Patent Office 2,805,856 Patented Sept. 10, 1957

2,805,856

METAL SHEET FEEDING DEVICES

Arthur Leslie Stuchbery, Enfield, England, assignor to The Metal Box Company Limited, London, England, a British company

Application June 25, 1954, Serial No. 439,305

Claims priority, application Great Britain June 26, 1953

10 Claims. (Cl. 271—51)

This invention relates to roller assemblies for feeding thin metal sheets and has more particular reference to the feeding of thin ferrous metal sheets in a machine in which they are subjected to one or more manufacturing processes such as the application of a coating of lacquer or like liquid to the surfaces of the sheet.

In machines of the kind referred to above the ferrous metal sheet has to be gripped by and fed through one or more pairs of co-operating rollers, one of which, the impression roller or blanket roller, has a raised pattern on its surface to which is applied the liquid material with which the sheet is to be coated. The other of the pairs of rollers, the pressure roller, is adjusted so that the space between the impression roller and the pressure roller ensures the desired pressure on the metal sheet fed therebetween to effect gripping of the leading edge of said sheet and feeding of the sheet as the two rollers revolve in opposite directions. When, as is frequently the case, the same pattern is to be repeated at intervals lengthwise of the sheet, a gap extending across the full width of the roller has to be left between the beginning and end of the raised pattern. Similarly if a rubber or other blanket is used as the impression surface a gap has necessarily to be left between the clamped ends of the blanket. The effect of such constructions is that, when the sheet passes between the two rollers there is no contact between the impression roller and the adjacent side of the sheet. As a result the sheet is not gripped at this point, or is imperfectly gripped, and interrupted and/or inaccurate feeding of the sheet results.

A main object of the invention is to provide means, for use in machines of the kind above referred to, for ensuring positive and continuous feeding of ferrous metal sheets through pairs of co-operating rollers one of which bears a raised impression surface which is interrupted at one or more regions extending axially of the roller for the full width thereof.

According to the invention a roller for use as one of a pair of co-operating rollers between the juxtaposed surfaces of which ferrous metal sheets are fed by the pair of rollers, has incorporated therewith one or more permanent magnets or electro-magnets disposed so that the magnetic field therefrom will effect adhesion to said roller of a ferrous metal sheet passing between the pair of rollers and maintain continuity of feed of the ferrous sheet whether or not the co-operating roller of the pair is in driving contact with said sheet.

The invention also extends to an apparatus for feeding metal sheets which includes in an assembly of feed rollers a roller constructed in accordance with the invention.

It is preferred, according to the invention, to arrange the magnets in a fixed position and to rotate the roller about the magnets with annular portions of the roller in contiguity with the magnets. Alternatively, the annular portions may be wholly magnetised.

Where, as is commonly the case, the rollers are made of ferrous metal or alloy, the magnetic portions thereof are spaced from each other and/or from the remaining material of the roller by rings of non-magnetic material.

The said roller is conveniently made hollow and has mounted therein permanent magnets secured on a fixed shaft on which the roller is journalled so that the position of the magnetic field of the magnets and therefore the position, at any given instant, of the portion of the iron rings in which magnetism is induced remains constant despite the rotation of the roller. Alternatively the magnetism may be induced by one or more electromagnets arranged within the roller and energized by a suitably connected source of electric current. As a further alternative, the rings may be permanent magnets.

In order that the invention may be better understood one preferred embodiment thereof will now be described by way of example with reference to the accompanying drawings in which:

Fig. 1 shows diagrammatically the passage of a ferrous metal sheet between a pair of rollers one of which has an interrupted surface,

Figs. 2 and 3 are part sectional elevations of the right and left hand ends respectively of a roller according to the invention, and

Fig. 4 is an end view of the right hand end of the roller partly broken away to show the arrangement of the magnets therein.

The roller according to the invention is adapted in particular to form one of a pair of rollers in a sheet metal printing or lacquering machine. In such a machine, the leading edge of a sheet A is gripped between two co-operating rotating rollers B and C, as shown diagrammatically in Fig. 1, through which it is then fed. The upper roller B is the impression or blanket roller and carries a raised impression surface or blanket D which is shaped in accordance with the pattern in which the lacquer is to be applied to the sheet. As the design or pattern is to be repeated several times lengthwise of the sheet, the impression surface has one or more cut away portions E extending axially of the roller B for the full width thereof, such cut away portion having a width of say, 2 inches or more, depending on the interval desired between succeeding zones on the sheet A which are to be coated with lacquer.

When the impression roller B is in the position shown in Fig. 1 the cut away portion E of the blanket D does not make contact with the upper surface of the sheet A and means must therefore be provided to ensure positive and regularly continuous feed of the sheet A when there is no gripping contact between the sheet A and the rollers B and C. The present invention meets this requirement in the following manner:

The lower roller or pressure roller C of the pair of rollers, as shown in Figs. 2 and 3 has at each end two axially spaced iron ring members 1 separated from each other and from the other portions of the roller by contiguous brass or other non-magnetic rings 2. For this purpose the roller is made as a number of hollow cylindrical members bolted together in the following order: the end portion 3 of the roller is a cylindrical member closed at its outer end by an end plate 4 and has secured to the inner end thereof a brass ring 2, an iron ring 1, a second brass ring 2, a second iron ring 1, and a third brass ring 2. These ring members are all secured by axial bolts 5 to one end of a central cylindrical portion 6 of the roller B and the ring 2 nearest the end portion 3 of the roller is secured by axial bolts 7 to the said end portion 3. To the other end of the central portion 6 is similarly secured a similar assembly of 3 brass and 2 iron rings and the other end portion of the roller, as shown in Fig. 3.

The end and middle portions 3, 6 of the roller B are journalled on bearings 8 on a coaxially disposed central shaft 9 which extends beyond each end portion 3 of the

roller, one end of said shaft **9**—the left hand end as shown in the Fig. 3 of the drawings—terminating within a bore **10** in an axle **11** formed integral with the left hand end plate **4** and the other end of said shaft **9** extending through a hollow axle **12** (Fig. 2) formed integral with a similar end plate **4** closing the right hand end portion **3** of said roller. The said axles **11, 12** are journalled in suitable frame parts of the machine indicated at **14** and the roller C is adapted to be driven by suitable gearing (not shown). The end of the said shaft **9** extending through the hollow axle **12** is secured against rotation in the frame **14** of the apparatus, as by means of a flange plate **15** secured to the frame and a grub screw **16**.

Secured to the fixed central shaft **9** at suitable positions therealong in accordance with the location of each of the assemblies of brass and iron rings are two brackets **17** on each of which is secured a permanent horseshoe magnet **18**, each of the latter being arranged so that its two ends extend towards and in radial alignment with one of the two pairs of iron rings **1**. Each magnet has secured thereto iron shoes **19** which have an arcuate curvature corresponding to that of the inner surface of the iron rings **1** and arranged so that the said inner surface of the respective iron rings **1** is nearly in contact with the said shoes **19**.

The brackets **17** are each secured to a hub **20** which is keyed to the shaft **9**, and the said shoes **19** are secured by screws **21** to a holder **22** which is secured by bolts **23** to the bracket **17**, said holder **22** clamping the magnet **18** to its bracket **17**.

By means of the arrangement described above a part of each pair of iron rings **1** will lie within the strongest part of the magnetic field of its respective magnet **18** and is thereby magnetised, each one of the pair of rings **1** having a different polarity corresponding to the North and South polarities of the ends of its magnet **18**. By means of the shoes **19** the magnetic field is concentrated in those parts of the rings directly opposed to the shoes of the magnets and it will be seen that, as the roller C is rotated, the central shaft **9** and the magnets **18** being held stationary, the iron rings **1** will have an induced magnetic field in a position which is fixed despite the rotation of the rings **1** with the roller C. The brass rings **2** arranged to each side of each iron ring **1** confine the magnetic field to the iron rings **1**, so that the magnetism is not dissipated throughout the roller.

When used in a machine of the kind referred to, the magnets **18** will be arranged so that their magnetic fields are concentrated in the region of the opposed surfaces of the coating roller B and the pressure roller C. Thus, as a ferrous metal sheet A passes between the two rollers it will come within the influence of the magnetic fields induced in the two pairs of iron rings **1** on the pressure roller C so that, even if there is no positive driving contact between one side of the sheet A and a part E of the coating roller B, the sheet A will adhere to the pressure roller C by magnetic attraction and the feeding of the sheet through the rollers will not be momentarily interrupted. Furthermore, the magnetic attraction of the magnetised rings **1** restrains the sheet A from any tendency to adhere to the coating roller after passing between the rollers B and C.

Whilst the embodiment of the invention described above is that preferred it will be understood that it is also possible in accordance with the invention to provide in the roller rings which are permanently magnetised, in which case the provision of magnets within the roller would be unnecessary. With this latter form of the invention the magentic field would not be confined to one part of a peripheral region of the roller but would extend completely around such region.

The permanent magnets described may also be replaced, as will readily be understood, by electro-magnets, connected for energisation to a suitable source of electric current.

The location of the magnetic rings near each end of the roller also assists in maintaining the longitudinal alignment of the sheet as it passes through the rollers.

We claim:

1. In apparatus for feeding ferrous metal sheets the combination of an impression roller having a pattern thereon presenting at least one surface void, and a pressure roller rotatable about an axis disposed in a common plane with the axis of the impression roller and so spaced with relation thereto that said rollers engage opposite faces of sheets passing therebetween except at the positions of pattern voids on the impression roller, and means within the pressure roller providing for magnetic attraction of the sheets to the pressure roller to assure positive feeding of the sheets even at intervals when a pattern void on the impression roller is passing over an opposing surface on the pressure roller.

2. In apparatus for feeding ferrous metal sheets the combination of an impression roller having a pattern thereon presenting at least one surface void, and a pressure roller rotatable about an axis disposed in a common plane with the axis of the impression roller and so spaced with relation thereto that said rollers engage opposite faces of sheets passing therebetween except at the positions of pattern voids on the impression roller, and means providing for magnetic attraction of the sheets to the pressure roller to assure positive feeding of the sheets even at intervals when a pattern void on the impression roller is passing over an opposing surface on the pressure roller, said last named means including at least one iron ring on the pressure roller and magnet means held in fixed position within the pressure roller and in close proximity to the ring so as to be effective to induce a magnetic field in said ring.

3. In apparatus for feeding ferrous metal sheets the combination of an impression roller having a pattern thereon presenting at least one surface void, and a pressure roller rotatable about an axis disposed in a common plane with the axis of the impression roller and so spaced with relation thereto that said rollers engage opposite faces of sheets passing therebetween except at the positions of pattern voids on the impression roller, and means providing for magnetic attraction of the sheets to the pressure roller to assure positive feeding of the sheets even at intervals when a pattern void on the impression roller is passing over an opposing surface on the pressure roller, said last named means including at least one iron ring on the pressure roller adjacent each end thereof and magnet means held in fixed position within the pressure roller and in close proximity to each ring so as to be effective to induce a magnetic field in each said ring.

4. In apparatus for feeding ferrous metal sheets the combination of an impression roller having a pattern thereon presenting at least one surface void, and a pressure roller rotatable about an axis disposed in a common plane with the axis of the impression roller and so spaced with relation thereto that said rollers engage opposite faces of sheets passing therebetween except at the positions of pattern voids on the impression roller, and means providing for magnetic attraction of the sheets to the pressure roller to assure positive feeding of the sheets even at intervals when a pattern void on the impression roller is passing over an opposing surface on the pressure roller, said last named means including at least one magnetic annulus on the pressure roller, magnet means held in fixed position within the pressure roller and in close proximity to the annulus so as to be effective to induce a magnetic field therein and non-magnetic annuli disposed at opposite sides and endwise of the annulus on said pressure roller and effective to limit the area of the magnetic field induced in said annulus.

5. In apparatus for feeding ferrous metal sheets the combination of an impression roller having a pattern thereon presenting at least one surface void, and a pressure roller rotatable about an axis disposed in a common plane with the axis of the impression roller and so spaced

with relation thereto that said rollers engage opposite faces of sheets passing therebetween except at the positions of pattern voids on the impression roller, and means providing for magnetic attraction of the sheets to the pressure roller to assure positive feeding of the sheets even at intervals when a pattern void on the impression roller is passing over an opposing surface on the pressure roller, said last named means including at least one magnetic annulus on the pressure roller adjacent each end thereof, magnet means held in fixed position within the pressure roller and in close proximity to each annulus so as to be effective to induce a magnetic field therein and non-magnetic annuli disposed at opposite sides and endwise of each annulus on the pressure roller and in close proximity thereto so as to be effective to limit the area of the magnet field induced in each said annulus.

6. In apparatus of the character described a magnetic sheet feeding roller means comprising a fixed shaft, a roller rotatable about said shaft, said roller including as a part of its sheet feeding peripheral surface three longitudinally spaced non-magnetic annuli and two magnetic annuli disposed intermediately of the non-magnetic annuli and spaced apart by the centrally disposed non-magnetic annulus, said annuli being in end abutting contact so as to present a continuous sheet engaging surface, a bracket on said shaft, and a horseshoe magnet carried by the bracket with its poles disposed in alignment with and adjacent the two magnetic annuli.

7. In apparatus of the character described a magnetic sheet feeding roller means comprising a fixed shaft, a roller rotatable about said shaft, said roller including as a part of its sheet feeding peripheral surface adjacent each end thereof three longitudinally spaced non-magnetic annuli and two magnetic annuli disposed intermediately of the non-magnetic annuli and spaced apart by the centrally disposed non-magnetic annulus, said annuli being in end abutting contact so as to present a continuous sheet engaging surface, a bracket on said shaft adjacent each end thereof, and a horseshoe magnet carried by each bracket with its poles disposed in alignment with and adjacent the two magnetic annuli at the particular end of the roller.

8. In apparatus of the character described, a magnetic sheet feeding roller means comprising a fixed shaft, a roller rotatable about said shaft, said roller including as a part of its sheet feeding peripheral surface three longitudinally spaced non-magnetic annuli and two magnetic annuli disposed intermediately of the non-magnetic annuli and spaced apart by the centrally disposed non-magnetic annulus, said annuli being in end abutting contact so as to present a continuous sheet engaging surface, a bracket on said shaft, a horseshoe magnet carried by the bracket with its poles disposed in alignment with and adjacent the two magnetic annuli, and a magnetic shoe supported on each pole of the magnet and having an arcuate outer face conforming in shape to the interior surface of one of the magnetic annuli and lying closely adjacent the same.

9. In apparatus of the character described a magnetic sheet feeding roller means comprising a fixed shaft, a roller rotatable about said shaft, said roller including as a part of its sheet feeding peripheral surface adjacent each end thereof three longitudinally spaced non-magnetic annuli and two magnetic annuli disposed intermediately of the non-magnetic annuli and spaced apart by the centrally disposed non-magnetic annulus, said annuli being in end abutting contact so as to present a continuous sheet engaging surface, a bracket on said shaft adjacent each end thereof, a horseshoe magnet carried by each bracket with its poles disposed in alignment with and adjacent the two magnetic annuli at the particular end of the roller, and a magnetic shoe supported on each pole of each magnet and having an arcuate outer face conforming in shape to the interior surface of one of the magnetic annuli at the particular end of the roller and lying closely adjacent the same.

10. In a roller assembly including an impression roller and a pressure roller adapted to receive and convey therebetween a ferrous metal sheet by cooperative gripping rotary movement on either side of said sheet, the improvement which comprises providing magnetic means adjacent each end of said pressure roller for applying attractive force to said sheet to assure linear movement of the same by engagement with said pressure roller on one side of said sheet in the absence of cooperative gripping engagement by the impression roller on the obverse side of the sheet, said magnetic means including a magnetic annulus disposed interjacent a pair of non-magnetic annuli for limiting the area of magnetic force to which the sheet is subjected.

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