March 10, 1970 W. W. MOJDEN ETAL 3,499,199

PERMANENT MAGNET ROLL

Original Filed Oct. 22, 1965 2 Sheets-Sheet 1

Fig. 1.

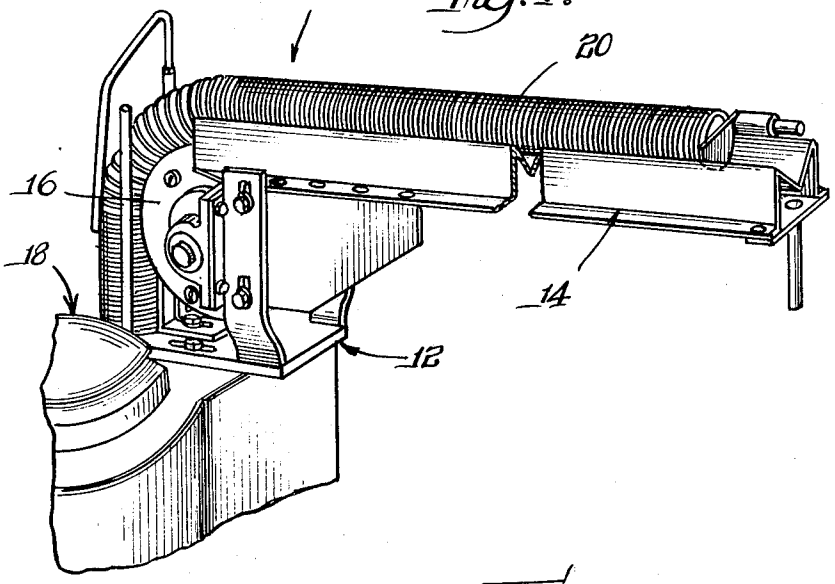
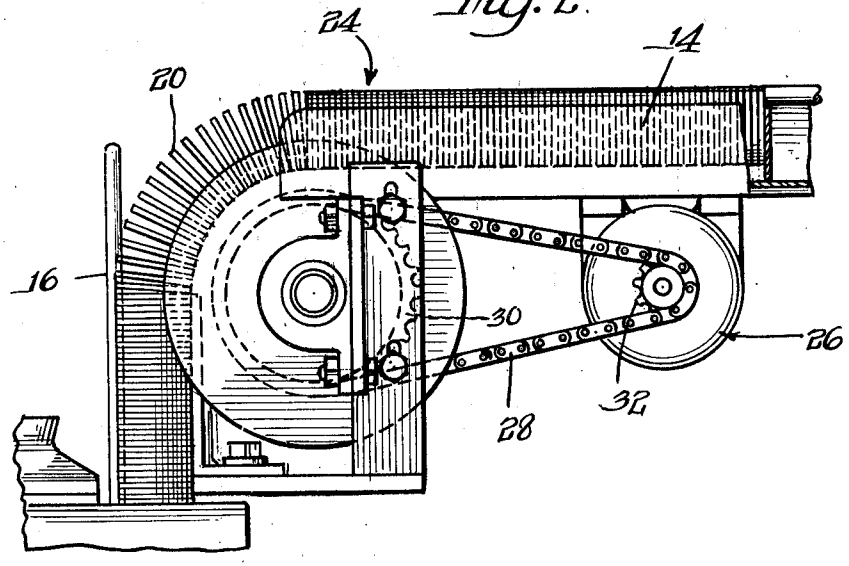


Fig. 2.



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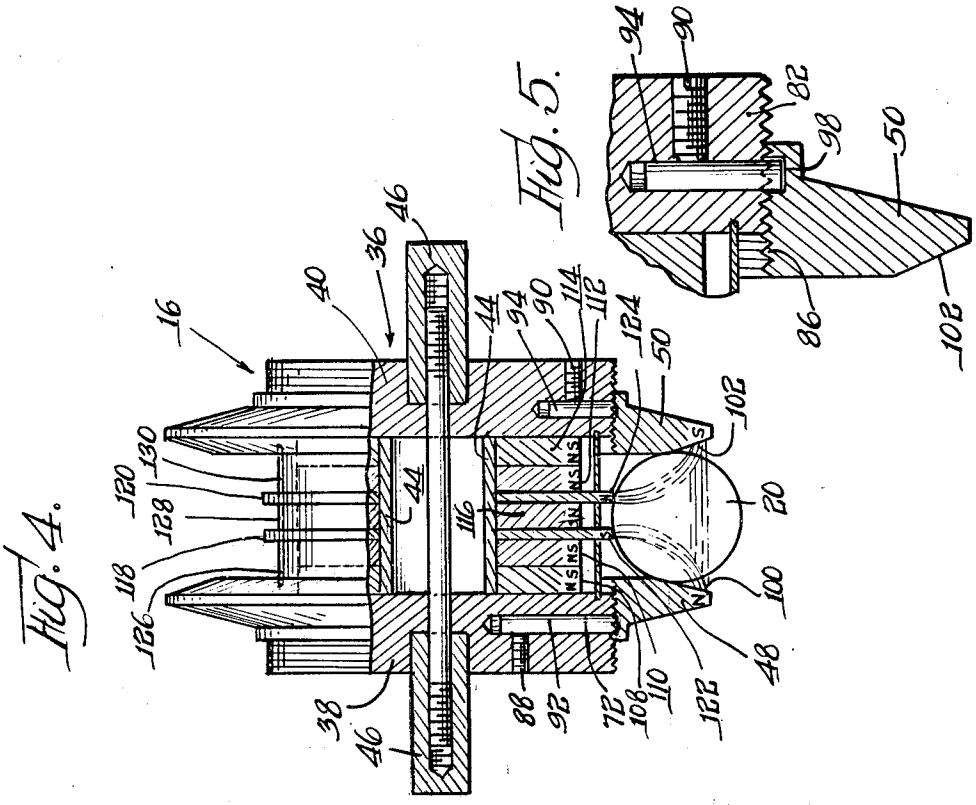


Fig. 4.

Fig. 5.

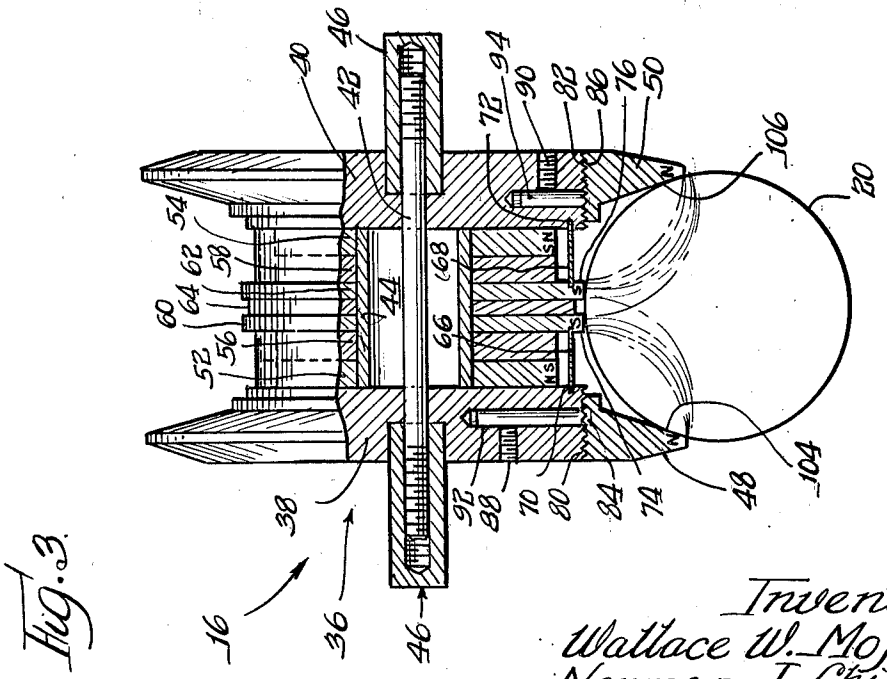


Fig. 3.

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PERMANENT MAGNET ROLL

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Continuation of application Ser. No. 501,927, Oct. 22, 1965. This application June 12, 1968, Ser. No. 739,901
Int. Cl. B21b 27/02
U.S. Cl. 29—121 8 Claims

ABSTRACT OF THE DISCLOSURE

A permanent magnet roll for a conveyer including a first pair of flange members of magnetizable material mounted on a rotatable shaft and axially spaced from each other thereon. Permanent magnets located intermediate the first flange members serve to magnetize the last-mentioned flange members as well as a second pair of flange members of magnetizable material, also located intermediate the first pair of flange members. Magnetic shields are located between a flange member of the first and second pairs respectively, so as to concentrate the magnetic field emanating from the permanent magnets. The first pair of flange members, while being longitudinally adjustable on the shaft, are also selectively adjustable so as to position first predeterminedly shaped surfaces thereof inwardly toward each other to convey therebetween articles of a first size and to position second predeterminedly shaped surfaces thereof inwardly toward each other to convey therebetween articles of a second size.

This application is a continuation of Ser. No. 501,927 and now abandoned.

This invention relates to a conveyer mechanism and more particularly to a conveyer system utilizing a permanent magnet roll.

In conveyer systems which handle metal objects, a magnetic roll may be utilized to convey the metal objects. As disclosed in my previously obtained Patent No. 3,165,210, a magnetic roll may be advantageously utilized in a conveyer system for conveying can ends from one location to another. It is also a common practice to utilize a magnetic roll when conveying pipe and other metal objects.

Prior art magnetic rolls are not well suited to conveying a variety of different objects having both large and small cross-sectional areas. The flanges of a magnetic roll, utilized for conveying an object having a large cross-sectional area, will not provide the required support and magnetic flux distribution for an object having a relatively small cross-section. Conversely, the flanges of prior art magnetic rolls which are designed to convey objects of a relatively small cross-sectional area will not provide the necessary support and magnetic flux distribution for an object having a relatively large cross-sectional area. Thus, prior art magnetic rolls must often be removed from the conveyer, and replaced with a different roll, when objects of smaller or larger cross-sectional area are to be conveyed.

It is often desirable to have a different distribution of magnets, and consequently of magnetic flux when conveying objects of different cross-sectional areas. The optimum magnetic flux field for conveying objects of different cross-sectional areas will vary with the size of the objects being conveyed. Consequently, the magnetic flux field should be variable to suit the characteristics of the particular object to be conveyed. In prior art devices, the location and number of magnets is fixed by the design of the particular magnetic roll. Thus, the magnetic field of prior art rolls could not be varied as the size and weight of the object conveyed varies.

The efficiency of prior art rolls is also reduced through the loss or short circuiting of the magnetic flux. Part of the magnetic flux, in prior art rolls, is transmitted between the poles of the magnetic roll through media other than the object conveyed. This flux is wasted, since it does not retain the object conveyed in operative contact with the magnetic roll.

A general object of this invention is to provide a magnetic roll which can be adjusted to hold objects of either a large or small cross-sectional area.

Another object of this invention is to provide a magnetic roll in which the number and location of the permanent magnets may be varied to alter the distribution of magnetic flux.

Another object of this invention is to provide a magnetic roll in which the flux losses are maintained at a minimum.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description, taken in connection with the accompanying drawings, wherein:

FIG. 1 is a fragmentary perspective view of the magnetic roll as utilized in a conveyer mechanism for conveying can ends;

FIG. 2 is a fragmentary elevational view of a modified form of the conveyer apparatus of FIG. 1;

FIG. 3 is a fragmentary cross-sectional view of the permanent magnet roll;

FIG. 4 is a fragmentary cross-sectional view of a modified form of the magnetic roll shown in FIG. 3; and

FIG. 5 is a fragmentary detailed cross-sectional view of the locking mechanism utilized in the conveyer rolls of FIGS. 3 and 4.

Referring now to the drawings, there is shown one preferred embodiment of the present invention. In FIG. 1 conveyer apparatus, generally designated **10**, is shown utilizing the magnetic roll of this invention. Such a conveyer may be utilized either as an "upstacker" for conveying can ends from a machine, such as **18**, for applying the coating material to the can ends, or as a "downstacker," for conveying the ends through a double seaming machine, as at **18**. The conveyer apparatus **10** includes a frame **12** having mounted thereon a chute or trough **14** and a magnetic roll or wheel **16**, the entire apparatus **10** being shown secured to an associated operating machine **18** which may be a coater or a liner machine, for a can seamer or closer mechanism. A plurality of can ends **20** are shown arranged in the trough **14** extending over the magnetic wheel **16** onto the operating station **18**.

When the conveyer apparatus functions as an upstacker, the can ends **20** are discharged from the coater machine at the operating station **18**, and are thrust upward below the wheel **16**. As each additional can end, with a newly applied sealing compound thereon, is inserted under the next preceding can end **20**, a vertical stack of can ends increases in height until the topmost ends **20** engage the flanges of the magnetic wheel **16**. The wheel **16** is caused to rotate by the growth of the stack of ends **20** and conveys the magnetically gripped ends **20** which extend radially from the wheel **16** one-quarter turn upwardly into the receiving end of the trough **14**.

There is shown in FIG. 2 a second form of conveyer apparatus generally designated by the numeral **24**. The conveyer apparatus **24** is a motorized upstacker that includes numerous parts similar to those previously described. A speed controlled electric motor **26** is secured to the trough **14**. A sprocket **30** is secured to a shaft of the magnetic roll. It engages the continuous drive chain **28** which extends over a sprocket **32** mounted on the motor **26**. By motorizing the upstacker **10** to rotate the

magnetic wheel **16**, the downward load due to the weight of the can ends **20** on the coater mechanism is substantially reduced. For a more complete disclosure of the conveyer mechanism reference should be had to my Patent No. 3,165,210, which issued on Jan. 12, 1965.

Two embodiments of the magnetic roll **16** are shown in FIGS. 3 and 4. Many of the same elements are used in both FIGS. 3 and 4, and like elements will be designated by like numerals in both figures. The magnetic roll of FIG. 3 is particularly well adapted for use with a larger can end **20**, while the magnetic roll of FIG. 4 is particularly well adapted for use with smaller can ends. It should be noted that the same general body structure **36** is utilized by both magnetic rolls in FIGS. 3 and 4.

Considering the magnetic roll of FIG. 3 in greater detail, the body member **36** includes two steel disks **38** and **40** which are located on the shaft **42**. The steel disks **38** and **40** are of a magnetic steel, while the shaft **42** is of a non-magnetic material such as brass or non-magnetic stainless steel. The spacer **44** is made of brass or other non-magnetic material and positions the two steel disks, **38** and **40**, relative to each other on the shaft **42**. The two end thimbles **46** are also made of a non-magnetic material and retain the steel disks **38** and **40** in abutting engagement with the brass spacer **44**. The two steel disks of the body member **36** have two flanges **48** and **50** held in threaded engagement with the steel disks. The flange members **48** and **50** are made of a material which can be easily magnetized.

Directly adjacent to the two steel disks **38** and **40** are the magnets **52** and **54**. These magnets are of a generally ring shape having an aperture in the center which is of a diameter to receive the brass spacer **44**. Directly adjacent to the two magnets **52** and **54** are the steel rings **56** and **58** which serve as spacer members between the magnets **52** and **54** and the steel pole rings **60** and **62**. The ring **64** which is located between the two steel pole rings **60** and **62** is made of a non-magnetic material such as aluminum or a non-magnetic stainless steel. The aluminum spacer ring **64** separates the two steel pole rings **60** and **62**. The two steel body disks **38** and **40** have two steel bands **66** and **68** inserted in the slots **70** and **72** in the steel disks **38** and **40**. The two steel bands **66** and **68** are made of a non-magnetic material such as a non-magnetic stainless steel and act as magnetic shields, as will be explained more fully later. The two steel pole rings **60** and **62** extend radially outward of the steel bands **66** and **68**, and have two inner flange members **74** and **76** which are separated by the non-magnetic ring **64**.

As is indicated in FIG. 3, the two magnets **52** and **54** are placed with their north poles adjacent to the two steel disks **38** and **40**. Thus, the steel disks **38** and **40** will become magnetized and the flanges **48** and **50** will assume a north magnetic polarity. The south poles of the magnets **52** and **54** are positioned adjacent the steel spacer rings **56** and **58** which contact the steel pole rings **60** and **62**. The two pole rings **60** and **62** will assume a south magnetic polarity. The two steel spacer rings **56** and **58** effectively space the two south poles of the magnets **52** and **54** from the magnetic pole flanges **74** and **76** the same distance that the flange members are from the north poles of the two magnets **52** and **54**. Thus, the north magnetic poles of the flange members **48** and **50** will be of approximately the same magnetic strength as the south magnetic poles of the flanges **74** and **76**. The substantially equal magnetic poles will all attract the can end **20** with about the same magnetic force and result in the can end **20** being evenly gripped between the flange members **48** and **50**. While the magnets **52** and **54** have been shown with their north poles adjacent the steel disks **38** and **40**, it is contemplated that they could be positioned with their south poles against the steel disks **38** and **40** with a corresponding change in the polarity of the flange members **48**, **50** and **74**, **76**.

This arrangement of magnets and flange members, which act as effective magnetic poles, results in a flux distribution through the can end **20** which is substantially as shown by the dotted lines in FIG. 3. The flange members **48** and **50** extend radially outward from the body **36** for a distance which is sufficient to enclose a relatively large segment of a can end **20** between the two flanges **48** and **50**. Thus, the magnetic flux field will extend over slightly less than one-half of the area of the can end **20**. The two flanges **74** and **76**, since they are separated by the non-magnetic ring **64**, cause the magnetic flux field to be distributed in a more uniform manner over the surface of the can end **20**.

The non-magnetic bands **66** and **68** act as magnetic shields and prevent the flux field from short-circuiting. The flux field will flow from the outer flange members **48** and **50** to the inner flange members **74** and **76** through the can end **20**. The flux, due to the shielding action of the two bands **66** and **68**, cannot flow directly from the north pole of the magnets **52** and **54** to the south pole of the magnets without flowing through the can end **20**. Thus, the strength of the magnetic field which holds the can ends **20** is enhanced by the magnetic shields **66** and **68** and by the fact that the flange members **50** enclose a large sector of the can end within the inner surfaces of the two flange members.

The two flange members **48** and **50** may be adjusted longitudinally relative to each other by rotating them relative to the steel disks **38** and **40**. The steel disks **38** and **40** have threads **80** and **82** which engage the threads **84** and **86** on the flange members **48** and **50**. If a can member of a slightly smaller diameter than the one presently being handled by the magnetic roll **16** of FIG. 3 were to be conveyed, the gap between the two flange members **48** and **50** would be reduced. The inner surfaces **104** and **106** of the two flange members **48** and **50** would then contact the outer edge of the can end. The slope of the inner surface of the flanges **48** and **50** will cause the flanges, when moved toward each other, to engage the circumferential edge of the can end tangentially. In order to adjust the gap between the two flange members **48** and **50**, it is merely necessary to loosen the two set screws **88** and **90**, and their corresponding locking pins **92** and **94**, and rotate the flange members **48** and **50** to form a gap of the desired size.

As is seen in FIG. 5, the two locking pins **90** and **94** engage recesses **98** which are spaced at predetermined locations on the inner surface of the flange members **48** and **50**. The gap setting, for objects which are frequently conveyed, may be easily set by positioning the recesses **98** in the flange members at positions which correspond to the desired gap. When the flange member **50** is positioned at the desired longitudinal location relative to the body member **36**, the locking pin **94** will engage the recess **98**. In a similar manner, the locking pin **92** will engage the recess **98** in the flange member **48** at the desired location. A plurality of recesses may be positioned at any number of desired locations on the surface of the flange members **48** and **50**. Once the locking pins **92** and **94** have engaged their respective recesses, the set screws **88** and **90** may be tightened to hold the locking pins in position.

From the foregoing description it will be apparent that the magnetic roll of FIG. 3 provides a relatively strong magnetic field which will engage the surface of any object which is brought into contact with the magnetic roll **16**. Flux field losses are prevented by the magnetic shields **66** and **68**, so that the flux from the two magnets **52** and **54** will be forced to flow through the can end **20**. Also, the flange members **48** and **50** of the magnetic roll are adjustable longitudinally with respect to each other, so that can ends of different diameters may be tangentially gripped by the inner surface of the flange members. Since there are no open gaps in the outer surface of the magnetic roll, it will be apparent that foreign matter, such

as dust, dirt, and material clinging to the objects conveyed, will not become entrapped in the surface of the magnetic roll **16** and thereby reduce the effectiveness of the two magnets. In addition, the magnetic roll **16** will be relatively easy to clean of any particles which should become attached to the roll.

In FIG. 4, a modified embodiment of the magnetic roll of FIG. 3 is shown. The embodiment of FIG. 4 is particularly efficient for the conveying of relatively small can ends. It should be noted that the two flanges **48** and **50** have been rotated 180 degrees relative to the position in which they were shown in FIG. 3. In the position of FIG. 4 the flange members **48** and **50** provide a relatively small gap for the enclosing of an article to be conveyed. The two flange members **48** and **50** of FIG. 4 may be adjusted longitudinally to predetermined positions as explained in connection with the embodiment of FIG. 3.

The sloping inner surfaces **100** and **102** on the flange members **48** and **50** as positioned in FIG. 4 will slidably engage objects of various diameters. It is apparent that the sloping surfaces **104** and **106** which are utilized to hold large objects and the relatively sharply sloping surfaces **100** and **102** make the flanges **48** and **50** adaptable for the conveying of objects of a relatively small diameter. Thus, the flanges may be adjusted longitudinally relative to the axis of the magnetic roll, so that the flanges will grip objects of various sizes. The flanges may also be rotated so that either the surfaces **100** and **102** or the surfaces **104** and **106** will be in tangential contact with the object conveyed.

In the magnetic roll shown in FIG. 4, the same steel disks **38** and **40**, as are shown in FIG. 3, are utilized to hold the flange members **48** and **50**. The brass spacer **44** also is the same as was used in the embodiment of FIG. 3. The embodiment of FIG. 4 differs from that of FIG. 3 in the use of five magnets **108**, **110**, **112**, **114** and **116** instead of the two magnets **52** and **54** of FIG. 3. As will be explained more fully, this embodiment is particularly well suited for handling objects of a relatively small diameter.

The magnets **108** and **114** are placed adjacent to the steel disks **38** and **40**. It should be noted that the north pole of the magnet **108** is adjacent to the steel disk **38**, while the south pole of the magnet **114** is adjacent to the steel disk **40**. The magnet **110** is placed with its north pole adjacent to the south pole of the magnet **108**, and similarly the magnet **112** is placed with its south pole adjacent the north pole of the magnet **114**. The steel pole rings **118** and **120** are placed adjacent to the magnets **110** and **112**. The steel pole ring **118** will, since it is adjacent to the south pole of the magnet **110**, assume a south magnetic polarity while the steel pole ring **120**, since it is adjacent to the north pole of the magnet **112**, will assume a north magnetic polarity. The central magnet **116** is placed with its south pole adjacent to the south pole of the steel pole ring **118** and its north pole adjacent to the steel pole ring **120**.

It is apparent from FIG. 4 that the two flange members **48** and **50** will assume opposite magnetic polarities, that is, the flange member **48** will assume a north magnetic polarity, while the flange member **50** will assume a south magnetic polarity. The flux field will, as shown in FIG. 4, flow between the outer two flange members **48** and **50**. The flux will also flow between the two inner flange members **122** and **124**, of the pole rings **118** and **120**, and the two outer flange members **48** and **50**. In addition, there will also be a flux path between the two inner flanges **122** and **124**. Thus, almost the entire surface area of the relatively small can end **20** will be closed by the magnetic field from the magnetic poles **48**, **50**, **122** and **124**.

There non-magnetic stainless steel bands **126**, **128**, **130** are utilized as magnetic shields for the magnets **108** to **116**. The magnetic shield member **126** is inserted into the slot **72** in the inner surface of the steel disk **38**. The steel band **126** engages a similar slot in the steel pole ring **118**. The steel bands **128** and **130** are mounted in the same manner in slots in the steel disk **40** and the steel pole rings **118** and **120** (see FIG. 4).

As is apparent from the foregoing description of the magnetic roll shown in FIG. 4, a relatively strong and compact magnetic flux field is obtained by the arrangement of magnets and pole pieces. This flux field is particularly well adapted for gripping and holding a relatively small member. Thus, by the addition of a few components, the magnetic roll of FIG. 3 may be converted into the magnetic roll shown in FIG. 4.

It is contemplated that a different arrangement from that shown in either FIGS. 3 or 4 could be utilized with the body member **36** of the magnetic roll shown in FIGS. 3 and 4. For example, the spacers **56** and **58** of FIG. 3 could be replaced by magnets, or the central magnet **116** of FIG. 4 could be replaced by a non-magnetic spacer. Various other changes in structure, will, no doubt, occur to those skilled in the art; and such changes are to be understood to be forming the invention insofar as they fall within the spirit and scope of the appended claims.

We claim:

1. A permanent magnet roll for a conveyor, said roll comprising rotatable shaft means; a pair of magnetizable members mounted in spaced apart relation on said shaft means; a non-magnetizable member mounted on said shaft means between said magnetizable members; flange means including first and second disc-shaped flange members of a magnetizable material, each one of said disc shaped members being concentrically mounted on a respective one of said magnetizable members, said disc-shaped flange members extending radially outwardly from said magnetizable members a predetermined distance, and said flange members being selectively adjustable to position first predeterminedly shaped surfaces inwardly toward each other to convey therebetween articles of a first size and to position second predeterminedly shaped surfaces inwardly toward each other to convey therebetween articles of a second, smaller size; a pair of magnetizable pole rings mounted concentrically on said non-magnetizable member in spaced apart relation, each said pole ring being axially spaced a like distance from one of said magnetizable members, said pole rings extending radially outwardly from said non-magnetizable member, a distance substantially less than that of said flange members; permanent magnet means located between each said pole ring and an adjacent corresponding magnetizable member for magnetizing said pole rings and said flange members mounted on said magnetizable members with a predetermined magnetic polarity; and non-magnetic shielding means extending axially between each said pole ring and said adjacent magnetizable member for concentrating the magnetic field produced by said permanent magnet means.

2. A permanent magnet roll as claimed in claim **1** wherein the outer perimeter of each said magnetizable member is threaded and wherein the inner perimeter of each said flange member is threaded, whereby said flange members are screwed onto respective magnetizable members and thereby adjusted axially therealong, and wherein said flange members are reversibly mountable on said magnetizable members to selectively position said first or second predeterminedly shaped surfaces inwardly toward one another.

3. A permanent magnet roll as claimed in claim **1** wherein one of said pole rings is provided with a polarity opposite from that of the other of said pole rings and wherein one of said flange members is provided with a polarity opposite from that of the other of said flange members, and also opposite from that of the corresponding one of said pole rings.

4. A permanent magnet roll as claimed in claim **1** wherein said permanent magnet means provides said

pole rings with a magnetic polarity opposite from that of said flange members.

5. A permanent magnet roll as claimed in claim 1 wherein said permanent magnet means includes disc-shaped permanent magnets located between each said pole ring and an adjacent flange member, and wherein said disc-like magnets are mounted concentrically on said non-magnetic member.

6. A permanent magnet roll as claimed in claim 5 wherein said permanent magnet means further includes a disc-shaped permanent magnet located between said pole rings for aiding in providing said pole rings with opposite polarities.

7. A permanent magnet roll as claimed in claim 1 further including between said pole rings a non-magnetic ring member mounted concentrically on said non-magnetic member.

8. A magnetic roll for a conveyor, said magnetic roll comprising: first and second annular, axially spaced-apart members of a magnetizable material; first magnet means mounted adjacent to said first member for magnetizing said first member with a first magnetic polarity; second magnetic means mounted adjacent to said second member for magnetizing said second member with a second magnetic polarity; third and fourth annular, axially spaced-apart members of a magnetizable material mounted intermediate said first and second members and said first and second magnet means, said third and fourth members having their outer peripheries spaced radially inward of the outer peripheries of said first and second members whereby a channel for reception of metallic articles is provided and a magnetic field extending between said first and second members may be achieved to attract said metallic articles to be conveyed; and a third magnet means mounted intermediate said third and fourth members, said third member being magnetized with the second magnetic polarity by said first and third magnet means to provide a magnetic field extending between said first and third members, said fourth member being magnetized with the first magnetic polarity by said second and third magnet means to provide a magnetic field extending between said second and fourth members.

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U.S. Cl. X.R.

214—7, 8.5; 335—236, 301, 302