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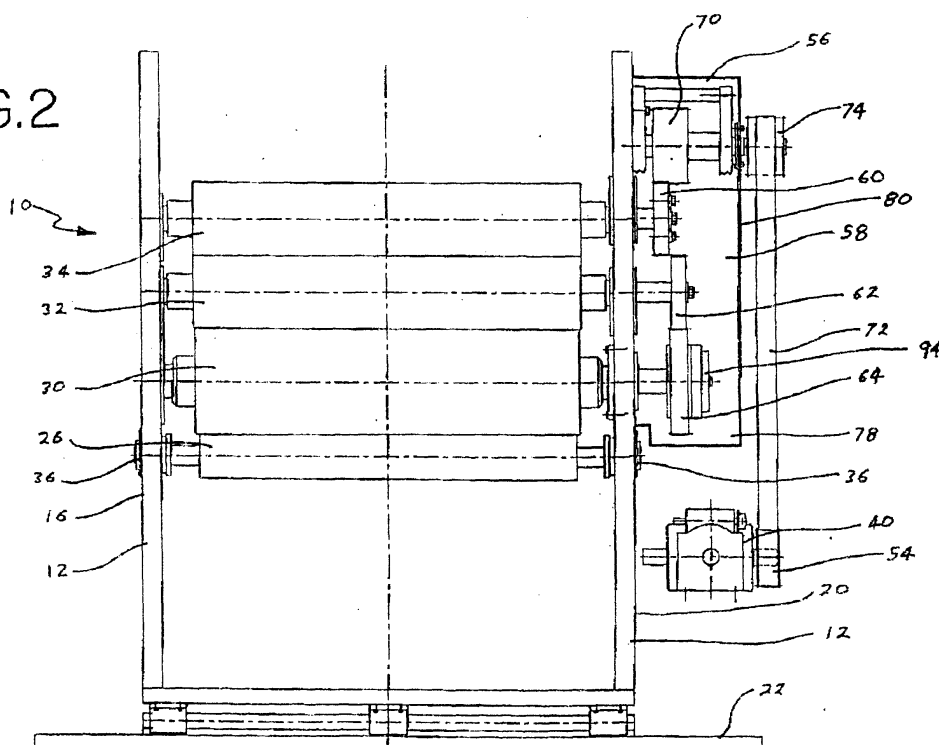
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(54) Gear driven remoist pattern gluer

(57) A gear driven rotary apparatus for processing a continuous flow of web-product comprising a lower cylinder (32) positioned beneath said web-product and an upper cylinder (34) positioned above said web-product. Both the lower and upper cylinders are supported by eccentric cylinder mounts (38) that permit the cylinders to be moved between an engaged position against

surface of the web-product and a disengaged position spaced away from the web-product. A cylinder drive assembly having one or more gears (60, 62, 64, 66, 68) connects each of the cylinders to a common drive pinion gear (70) in such a manner that the cylinders remain connected to the drive pinion when the cylinders are moved between the engaged and the disengaged positions.

FIG.2



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Description

[0001] This invention relates generally to the field of high-speed rotary machinery commonly used by the graphic arts and converting industries for the continuous processing of web-products and, in particular, to a remoist pattern gluer.

[0002] Remoist pattern gluers are used to apply glue or a coating to a continuous web-product such as paper, thin foil, thin plastic, or combined layers of these or similar materials. The glue or coating may be applied so as to cover the entire surface of the web-product, or only a portion thereof. In the later application, the gluer is typically configured to apply the glue or coating to the web-product in a predetermined pattern that is repeated along the length of the web-product. The types of materials that can be applied by the gluer include UV or aqueous coatings, metallic or fluorescent inks, micro-encapsulated fragrances, scratch-offs, remoistenables, and various types of glues.

[0003] A remoist pattern gluer is typically located after the print units and before the dryer in the web-product processing line. For example, a web-product processing line for making pre-printed mailing envelopes would typically include a rotary printer, followed by the remoist pattern gluer, followed by a dryer unit, and finally by a rotary cutter. In this example, the remoist pattern gluer would be used to add remoistenable glue to the portion of the web-product that will eventually become the flap of the envelope.

[0004] A conventional remoist pattern gluer comprises a series of rotating cylinders that transfer and/or apply the glue or coating to the web-product. For example, a typical gluer comprises an impression cylinder, a plate cylinder, a transfer cylinder, and a pan roller. The pan roller sits in a pan filled with the glue or coating that is to be applied to the web-product. As the pan is then transferred to the transfer cylinder. The surface of the transfer cylinder may be engraved to improve the retention of the glue on the surface. The quantity of glue transferred to the transfer cylinder can typically be adjusted by altering the distance between the pan roller and the transfer cylinder. The transfer cylinder may also have a doctor blade to insure a uniform coating of the glue on the surface of the transfer cylinder. The glue is then transferred to a glue pad or a cyrel plate affixed to the plate cylinder. As the plate cylinder rotates, the glue pad comes into contact with a side of the web-product. The impression cylinder, which is positioned on the other side of the web-product, presses the web-product against the glue pad, thereby transferring the glue from the pad to the surface of the web-product.

[0005] In a conventional remoist pattern gluer, each of the cylinders are connected to a drive unit by a continuous or serpentine twin tooth timing belt. The pulleys which connect the cylinders to the timing belt are sized so that the surface of each of the cylinders rotate at the same speed. The drive unit is likewise connected to a

common drive shaft, which in turn drives all of the rotary machines or units in the web-product processing line (e. g., rotary printers, rotary gluers, rotary embossers, and rotary cutters). A common drive shaft is used so that the speed of each of the rotary units can be synchronized with each other and the movement of the web-product. Synchronization is critical to insure accurate processing of the web-product by each of the rotary units. Because the rotary units come into direct contact with the web-product, synchronization is also necessary to prevent the web-product from being damaged by the rotary units (i.e., as the result of shearing forces generated by speed differentials).

[0006] As explained above, the remoist pattern gluer is typically located in the middle of the processing line, usually after the print units and before the dryer. However, the remoist pattern gluer is not always required for the processing of the web-product. Conventional gluers are therefore designed so that they can be taken "off line" (i.e., disengaged) without disconnecting the rotating cylinders from the drive unit. To accomplish this, the impression cylinder and the plate cylinder are typically mounted on eccentric supports. Rotation of these eccentric supports causes the impression cylinder and the plate cylinder to separate from each other and move away from the web-product. This allows the web-product to pass through the gluer without contacting any of the cylinders. Because the cylinders remain connected to the drive unit, the cylinders continue to rotate in sync with the speed of the web-product. Consequently, the gluer can be engaged or disengaged without shutting down the web-product processing line.

[0007] Conventional remoist pattern gluers have a number of shortcomings and disadvantages. For example, the continuous or serpentine timing belt that connects the rotating cylinders to the drive unit is subject to wear. As the timing belt wears, the cylinders may no longer rotate in sync with the speed of the web-product. This may result in a misapplication of the glue or coating to the web-product. To maintain the proper operation of the gluer, continual monitoring of the condition of the timing belt is required. Moreover, it is often necessary to replace the timing belt at the first sign of wear. Replacement of the timing belt is both expensive and time consuming.

[0008] The operation of the gluer is also compromised by the arrangement used to engage and disengage the impression and plate cylinders. As these cylinders are moved together or apart, the length of the timing belt is altered. To accommodate this change in length, the timing belt is engaged by an air operated tensioner pulley. Movement of the tensioner pulley changes the geometry of the timing belt pathway to maintain a constant belt tension. The tensioner pulley, however, is difficult to control. The tensioner pulley may apply too much force to the timing belt, causing the belt to stretch and prematurely wear. The tensioner pulley may also apply too little force to the timing belt, allowing the belt to jump or shear

teeth.

[0009] Accordingly, it would be desirable to provide a remoist pattern gluer that overcomes the disadvantages and limitations described above.

[0010] The present invention provides a unique, gear driven remoist pattern gluer that overcomes the above disadvantages and limitations. The gear driven remoist pattern gluer of the preferred embodiment comprises a pair of frame members positioned on each side of the gluer and between which the flow of web-product passes. A plate cylinder for transferring material to the lower surface of the web-product is positioned beneath the web-product and has an axis of rotation that is generally perpendicular to the flow of web-product. Each end of the plate cylinder is supported by an eccentric cylinder mount positioned on one of the frame members. The eccentric cylinder mounts each have a center of rotation that is offset from the axis of rotation of said plate cylinder. The plate cylinder can be moved between an engaged position against the lower surface of the web-product and a disengaged position spaced away from the web-product by rotating the eccentric cylinder mounts. A gear affixed to one end of the plate cylinder provides rotation to the plate cylinder.

[0011] The gluer also comprises an impression cylinder for supporting the upper side of the web-product against the plate cylinder. The impression cylinder is positioned above the web-product and has an axis of rotation that is generally perpendicular to the flow of web-product. Each end of the impression cylinder is also supported by an eccentric cylinder mount positioned on one of the frame members. The impression cylinder can likewise be moved between an engaged position against the upper surface of the web-product and a disengaged position spaced away from the web-product by rotating the eccentric cylinder mounts. A gear affixed to one end of the impression cylinder provides rotation to the impression cylinder.

[0012] The gluer further comprises a transfer cylinder for transferring the material to be applied to the web-product from a pan roller to the plate cylinder. The transfer cylinder has an axis of rotation that is generally parallel to the axis of rotation of the plate cylinder and comprises a transfer cylinder gear through which said transfer cylinder is rotated.

[0013] The gluer further comprises a cylinder drive assembly for rotating the plate cylinder, the impression cylinder, and the transfer cylinder. The cylinder drive assembly includes an upper idler gear connecting a drive pinion gear to the impression cylinder gear. The cylinder drive assembly also includes a lower idler gear connecting the drive pinion gear to the transfer cylinder gear. The plate cylinder gear is connected to the transfer cylinder gear. The cylinder drive assembly is configured so that the impression cylinder gear remains connected to the upper idler gear when the impression cylinder is being moved between the engaged and disengaged position. The cylinder drive assembly is also configured such

that the plate cylinder gear remains connected to the transfer cylinder gear when the plate cylinder is being moved between the engaged and disengaged position.

[0014] The preferred embodiment of the invention includes features in addition to those listed above. Moreover, the advantages over the current art discussed above are directly applicable to the preferred embodiment, but are not exclusive. The other features and advantages of the present invention will be further understood and appreciated when considered in relation to the detailed description of the preferred embodiment.

[0015] In the accompanying drawings:

[0016] Fig. 1 is a front view of the preferred embodiment of the gear driven remoist pattern gluer of the present invention.

[0017] Fig. 2 is a front view of a partial assembly of the gear driven remoist pattern gluer of Fig. 1 depicting the impression and plate cylinders in the engaged position.

[0018] Fig. 3 is an exterior right side view of the gear driven remoist pattern gluer of Fig. 1 showing the drive side of the gluer and depicting the impression and plate cylinders in the engaged position.

[0019] Fig. 4 is an exterior left side view of the gear driven remoist pattern gluer of Fig. 1 showing the operator's side of the gluer and depicting the impression and plate cylinders in the engaged position.

[0020] Fig. 5 is an exterior right side view of a partial assembly of the gear driven remoist pattern gluer of Fig. 1 showing the gear drive assembly and depicting the impression and plate cylinders in the disengaged position.

[0021] Fig. 6 is an interior sectional view of the operator's side of the gear driven remoist pattern gluer taken along section line 6-6 of Fig. 1 and depicting the impression and plate cylinders in the engaged position.

[0022] Fig. 7 is an interior sectional view of the gear driven remoist pattern gluer taken along section line 7-7 of Fig. 1 and depicting the impression and plate cylinders in the disengaged position.

[0023] Fig. 8 is a sectional view of the cylinder throw-off assembly of the gear driven remoist pattern gluer of Fig. 1. The components of the cylinder throw-off assembly have been rotated into the plane of the section for clarification purposes.

[0024] While the present invention will find application in all types of high-speed rotary machinery for processing web-product, the preferred embodiment of the invention is described in conjunction with the gear driven remoist pattern gluer 10 of Fig. 1. The gluer 10 comprises a plurality of cylinders supported between a frame 12 on each side of the gluer 10. Guards 14 located on the front of the gluer 10 shield several of the cylinders so as to protect the operator from moving components. The left-hand side frame 12 (as viewed in Fig. 1) is generally referred to as the operator's side 16. As best seen in Fig. 4, many of the controls and equipment used to operate the gluer 10 are located on the operator's side 16.

As will be explained in greater detail below in connection with the cylinder throw-off assembly, the air cylinders 18 that engage (or disengage) the gluer cylinders with the web-product are also located on the operator's side 16. The right-hand side frame 12 (as viewed in Fig. 1) is generally referred to as the drive side 20. As best seen in Fig. 3, most of the machinery used to drive or rotate the gluer cylinders is located on the drive side 20. A base 22 supports both frames 12 as well as machinery that operates or drives the various components of the gear driven gluer 10.

[0025] As best seen in Figs. 2 and 7, the gear driven gluer 10 comprises four rotating cylinders that extend horizontally between the drive side 20 and the operator's side 16. The axis of rotation for each of these cylinders is generally parallel to each other and perpendicular to the path of the web-product 24. The lower most cylinder is a pan roller 26 that is partially immersed in a glue pan 28 holding the glue or coating material that is to be applied to the web-product 24. As the pan roller 26 rotates, the glue is collected onto the surface of the pan roller 26 where it is then transferred to a transfer cylinder 30. The transfer cylinder 30 is located directly above the pan roller 26 and rotates in a direction opposite that of the pan roller 26. Thus, the surfaces of these two rotating cylinders are moving in the same direction. The quantity of glue transferred to the transfer cylinder 30 can be adjusted by altering the distance between the pan roller 26 and the transfer cylinder 30. In the preferred embodiment, the surface of the transfer cylinder 30 is engraved to improve the retention of the glue on the surface. A doctor blade (not shown) is positioned adjacent to the surface of the transfer cylinder 30 to remove excess glue from the transfer cylinder 30, thereby insuring an even distribution of glue on the surface of the transfer cylinder 30.

[0026] The glue is then transferred from the transfer cylinder 30 to a glue pad or a cyrel plate (not shown) affixed to the plate cylinder 32. The plate cylinder 32 is located above and forward of the transfer cylinder 30 and immediately below the path of the web-product 24. The plate cylinder 32 rotates in a direction opposite that of the transfer cylinder 30. Thus, the surfaces of these two rotating cylinders are moving in the same direction. As the plate cylinder 32 rotates, the glue pad comes into contact with the surface of the transfer cylinder 30. The glue is transferred to the glue pad as the glue pad rolls across the surface of the transfer cylinder 30. As the plate cylinder 32 continues to rotate, the glue pad comes into contact with the lower surface of the web-product 24. An impression cylinder 34 is positioned directly above the plate cylinder 32 and on the other side of the path of the web-product 24. The impression cylinder 34 presses the web-product 24 against the glue pad, thereby causing the glue to be transferred from the glue pad to the surface of the web-product 24. The design and operation of each of the cylinders are well known to those skilled in the art. The design and operation of glue

pads and cyrel plates are also well known to those skilled in the art.

[0027] The impression cylinder 34 and the plate cylinder 32 are designed to rotate with a cylinder surface speed that matches the speed and direction of the web-product 24 passing through the gluer 10. This allows the glue (or coating material) to be transferred to the web-product 24 without smearing the material or damaging the web-product 24. It should also be appreciated that the pattern of glue (or coating material) will be repeated along the length of the web-product 24 one time for each revolution of the plate cylinder 32. The distance between the pattern repeats will necessarily equal the circumference of the plate cylinder 32.

[0028] In the preferred embodiment shown, the impression cylinder 34 is positioned above the web-product 24, and the plate cylinder 32, the transfer cylinder 30, and the pan roller 26 are all positioned below the web-product 24. However, it should be appreciated that the position or arrangement of these cylinders relative to the web-product could be reversed. For example, the impression cylinder could be positioned beneath the web-product. The plate cylinder, the transfer cylinder, and the pan roller would accordingly be positioned above the web-product. With this configuration, the glue (or coating material) would be applied to the upper surface of the web-product. The configuration of the gluer cylinders will, in large part, be dictated by the lay out of the web-product processing line.

[0029] As best seen in Figs. 6 and 7, each of the gluer cylinders is supported by a pair of bearings 36, one bearing 36 in each of the frames 12 (i.e., one on the drive side 20 and one on the operator's side 16). The bearings 36 that support the impression cylinder 34 and the plate cylinder 32 are each supported by an eccentric cylinder mount 38. Each eccentric cylinder mount 38 is circular in shape and rotatably held in the gluer frame 12. The bearing 36 is positioned within the perimeter of the eccentric cylinder mount 38, but is offset from the center of eccentric cylinder mount 38. This configuration offsets the axis of rotation of the cylinder from the center of the eccentric cylinder mount 38. Accordingly, rotation of the eccentric cylinder mounts 38 permits the impression cylinder 34 and the plate cylinder 32 to be translated or moved. As will be described in greater detail below in connection with the cylinder throw-off assembly, the eccentric cylinder mounts 38 are designed to allow the impression cylinder 34 and the plate cylinder 32 to be moved apart from each other and away from the web-product 24.

[0030] As best seen in Figs. 1 and 3, the drive side 20 generally supports the drive machinery used to rotate the gluer cylinders. The drive machinery includes a drive gearbox 40 supported by a frame 42 mounted on the base 22. As best seen in Fig. 1, the drive gearbox 40 is connected to the common drive axle 44. The common drive axle 44, which is not part of the gluer 10, supplies a rotational turning force to the drive gearbox 40. In typ-

ical web-product processing lines, the common drive axle 44 supplies power to each of the rotary machines in the processing line. In addition to the rotary gluer 10 of the preferred embodiment, such machines may include rotary printers, rotary embossers, and rotary cutters. A common drive axle 44 allows each of these machines to operate at the same speed and in sync with the movement of the web-product 24 through the processing line.

[0031] The rotational turning force of the common drive axle 44 is transmitted to the drive gearbox 40 through a belt 46 that passes around a pulley 48 on the common drive axle 44, an input pulley 50 on the drive gearbox 40, and an idler pulley 52. The idler pulley 52 is used to adjust the tension of the belt 46 through lateral movement that alters the geometry of the belt pathway. The drive gearbox 40 includes a right-angle gear train that connects the input pulley 50 with an output pulley 54. The output pulley 54 is located on the exterior face of the drive gearbox 40 and has an axis of rotation that is generally parallel with the axis of rotation of the gluer cylinders. The right-angle gear train changes the angle of the axis of rotation between the input pulley 50 and the output pulley 54 by 90 degrees. The drive gearbox 40 also includes a phase unit (registration) for correcting or adjusting the speed of rotation of the output pulley 54 relative to the input pulley 50. Such adjustments are often needed to synchronize the gluer 10 with the other rotary machinery in the web-product processing line. An air clutch is also mounted on the drive gearbox 40. The air clutch allows the output pulley 54 to be disengaged from the input pulley 50, thereby permitting the operation of the gluer 10 to be shut down without disconnecting the gluer 10 from the common drive axle 44. In the preferred embodiment shown, each of the pulleys comprise a sprocket design wherein the teeth of the pulley engage similarly spaced teeth on the interior surface of the belt. A toothed belt is used to prevent slippage between the pulleys. The design and operation of the various gears and pulleys of the drive gearbox 40 are well known to those skilled in the art.

[0032] The rotational turning force of the drive gearbox 40 is next transmitted to the cylinder drive assembly 56. The cylinder drive assembly 56 is located on the outside of the frame 12 on the drive side 20 of the gluer 10. As best seen in Figs. 3 and 5, the cylinder drive assembly 56 comprises a splash housing 58 that encloses a series of helical gears connected or affixed to the axis of several of the gluer cylinders. An impression cylinder gear 60 is connected to the axis of the impression cylinder 34. A plate cylinder gear 62 is similarly connected to the axis or journal end of the plate cylinder 32. The impression cylinder gear 60 is located inwardly from the plate cylinder gear 62 so that these two gears do not interfere with each other (see Fig. 1). A transfer cylinder gear 64 is connected to the axis of the transfer cylinder 30 and is configured so as to mesh with the plate cylinder gear 62. The transfer cylinder gear 64 and the impression cylinder gear 60 are each connected by idler

gears 66, 68 to a drive pinion gear 70.

[0033] Although not readily apparent from Fig. 1, it should be appreciated that the idler gears 66, 68 are located in different planes. The idler gear 66 connecting the impression cylinder gear 60 to the drive pinion gear 70 is located in the same plane as the impression cylinder gear 60. The idler gear 68 connecting the transfer cylinder gear 64 to the drive pinion gear 70, on the other hand, is located in the same plane as the transfer cylinder gear 64 (as well as the plane of the plate cylinder gear 62). Consequently, it should be understood that the geared portion of the drive pinion gear 70 has a sufficient width to engage both of the idler gears 66, 68. In other words, the geared portion of the drive pinion gear 70 has a thickness that is at least twice that of each idler gear 66, 68. (See Fig. 2 wherein the pinion gear 70 has been rotated into the plane of this view for clarification purposes.)

[0034] The drive pinion gear 70 is connected to the drive gearbox 40 by a drive belt 72 that wraps around the output pulley 54 of the drive gearbox 40. As best seen in Fig. 2, the axle of the drive pinion gear 70 extends outwardly through the exterior face of the splash housing 58 and terminates in a pulley 74 that is aligned with the output pulley 54 of the drive gearbox 40. An idler pulley 76 also engages the drive belt 72 and provides a means for adjusting or maintaining the tension of the drive belt 72 (see Fig. 3). In the preferred embodiment shown, each of the pulleys comprise a sprocket design wherein the teeth of the pulleys engage similarly spaced teeth on the interior side of the drive belt. The design and operation of the pulleys and the drive belt is well known to those skilled in the art.

[0035] As the drive pinion gear 70 is rotated, each of the other gears of the cylinder drive assembly are in turn rotated. For example, and as shown by the directional arrows in Fig. 5, the drive pinion gear 70 is typically rotated in a clockwise direction. Both of the idler gears 66, 68 are consequently rotated in a counterclockwise direction (the surfaces of the meshing gears move in the same direction). The impression cylinder gear 60, which is connected to the upper idler gear 66, is rotated in a clockwise direction. The transfer cylinder gear 64, which is connected to the lower idler gear 68, is likewise rotated in a clockwise direction. The plate cylinder gear 62, which is connected to the transfer cylinder gear 64, is rotated in a counterclockwise direction.

[0036] In the preferred embodiment shown, the pitch diameters of the impression cylinder gear 60, the plate cylinder gear 62, and the transfer cylinder gear 64 are each equal to the diameters of their respective cylinders. The rotational surface speed of the cylinders will therefore match the rotational surface speed of the gears. This arrangement insures that the rotational surface speed of each of these three cylinders will be the same (although it should be apparent that the larger diameter transfer cylinder 30 must necessarily rotate at a lower rpm). In the preferred embodiment shown, the upper

and lower idler gears 66, 68 have the same diameter. In addition, helical gears are used for each of the gears of the cylinder drive assembly. Helical gears are quieter and less prone to wear or damage from the shearing forces. The design and manufacture of helical gears and their arrangement in mechanical apparatus are well known by those skilled in the art.

[0037] In the preferred embodiment shown, the helical gears of the cylinder drive assembly 56 are enclosed in a sealed splash housing 58. A pan 78 is located at the bottom of the splash housing 58 and holds a liquid lubricant such as oil. As best seen in Fig. 3, the transfer cylinder gear 64 extends down into the pan 78 and is partially submerged in the lubricant. As the transfer cylinder gear 64 is rotated, the teeth along the circumference of the gear throw the lubricant upwardly and throughout the interior of the splash housing 58. The rotation of the other gears further splash the lubricant throughout the splash housing 58. In the preferred embodiment shown, the exterior face of the splash housing comprises a transparent acrylic panel 80 to allow inspection and monitoring of the cylinder drive assembly 56. The splash housing 58 also comprises seals around each of the axles joining the spiral gears to their respective cylinders to contain the lubricant inside the housing 58. A seal is also provided on the exterior face of the splash housing to seal the axle of the drive pinion gear 70 where it extends outwardly for the connection to the drive belt 72.

[0038] In the preferred embodiment shown, the gluer 10 comprises a secondary drive source, called a Sunday drive 82, to rotate the transfer cylinder 30 and the pan roller 26. As best seen in Fig. 4, the Sunday drive 82 is located on the operator's side 16 of the gluer 10. The Sunday drive 82 comprises an electrically powered motor 84 that can be operated independently of the cylinder drive assembly 56. The motor 84 is of conventional design and includes drive pulley 86 affixed to the shaft of the motor 84. The drive pulley 86 is connected by a belt 88 to pulleys 90, 92 on the axles of the pan roller 26 and the transfer cylinder 30, respectively. In the preferred embodiment shown, the pan roller 26 is rotatably driven by the Sunday Drive 82. Independent operation of the pan roller 26 permits better control of the amount of glue transferred to the transfer cylinder 30. It should also be noted that it is typically not necessary, or even desirable, to synchronize the rotation of the pan roller 26 with that of the transfer cylinder 30. Of course, the pan roller 26 could alternatively be driven by the cylinder drive assembly 56 through the incorporation of the appropriate gears.

[0039] As set forth above in connection with the description of the cylinder drive assembly 56, the transfer cylinder 30 is ordinarily driven by the cylinder drive assembly 56. There may be times, however, when it is desirable to disengage the transfer cylinder 30 from the cylinder drive assembly 56. For example, it is often necessary to stop the rotation of the plate and impression

cylinders 32, 34 to perform routine maintenance or to change the glue pad. The transfer cylinder 30, however, must be continuously rotated to prevent the glue from drying on the cylinder surface. The Sunday drive 82 is utilized for this purpose. Each end of the transfer cylinder 30 includes a clutch 94. These clutches 94 allow the transfer cylinder 30 to be driven by either the Sunday drive 82 or the cylinder drive assembly 56. Ordinarily, the clutch 94 on the drive side 20 of the transfer cylinder 30 is engaged and the clutch 94 on the operator's side 16 is disengaged. This allows the transfer cylinder 30 to be driven by the cylinder drive assembly 56 and to rotate independently of the Sunday drive 82. To engage the Sunday drive 82, the clutch 94 on the drive side 20 of the transfer cylinder 30 is disengaged and the clutch 94 on the operator's side 16 is engaged.

[0040] The impression cylinder 34 and the plate cylinder 32 are engaged (or disengaged) with the web-product 24 by the cylinder throw-off assembly. As discussed above, the axis of the impression cylinder 34 and the plate cylinder 32 are each supported in eccentric cylinder mounts 38. As best seen in Figs. 6-8, the center of cylinder axis is offset from the center of the eccentric cylinder mount 38. Accordingly, rotation of the eccentric cylinder mount 38 causes the center of the cylinder axis to translate. Fig. 6, for example, shows the location of the eccentric cylinder mounts 38 when the impression and plate cylinders 34, 32 are engaged with the web-product 24 (the location of the cylinders is shown by the broken circles). Fig. 7, on the other hand, shows the location of the eccentric cylinder mounts 38 when the impression and plate cylinders 34, 32 are disengaged from the web-product 24 (in this view, the location of the eccentric cylinder mounts 38 are shown by the broken circles).

[0041] In the preferred embodiment shown, the impression cylinder 34 is disengaged by rotating the eccentric cylinder mount 38 in a clockwise direction (as viewed in Figs. 6 and 7). This causes the impression cylinder 34 to move upwardly and away from the web-product 24. As best seen in Fig. 5 the eccentric cylinder mount 38 is oriented so that the impression cylinder gear 60 will remain engaged with the idler gear 66 even when the impression cylinder 34 has been disengaged. This is accomplished by maintaining a nearly constant distance between these two gears irrespective of the rotation of the eccentric cylinder mount 38. In other words, the distance between the axis of the idler gear 66 and the axis of the impression cylinder 34 is the same for both the engaged and disengaged positions. In the preferred embodiment shown, the geometry of these components can be defined by a line which 1) intersects the axis of the idler gear 66, 2) intersects the center of the eccentric cylinder mount 38, and 3) bisects the arc defined by the axis of the impression cylinder 34 as it moves between the engaged and the disengaged position. It should be appreciated, however, that because the axis of the impression cylinder 34 moves through an

arc about the center of the eccentric cylinder mount 38, the distance between cylinder axis and the idler gear axis does vary to a small degree as the impression cylinder 34 is moved from one position to the other, and is greatest at the midpoint of the movement arc. This variance, however, is within the tolerance of the gear teeth (i.e., the gear teeth remain engaged even though slightly separated).

[0042] In the preferred embodiment shown, the plate cylinder 32 is disengaged by rotating the eccentric cylinder mount 38 in a counterclockwise direction (as viewed in Figs. 6 and 7). This causes the plate cylinder 32 to move downwardly and away from the web-product 24. As best seen in Fig. 5, the eccentric cylinder mount 38 is oriented so that the plate cylinder gear 62 will remain engaged with the transfer cylinder gear 64 even when the plate cylinder 32 has been disengaged. The orientation of the axis of the plate cylinder 32 relative to the axis of the transfer cylinder 30 is similar to that of the transfer axis and the idler axis described above. In the preferred embodiment shown, the geometry of these components can be defined by a line which 1) intersects the axis of the transfer cylinder gear 64, 2) intersects the center of the eccentric cylinder mount 38, and 3) bisects the arc defined by the axis of the plate cylinder 32 as it moves between the engaged and the disengaged position. In the preferred embodiment, the impression cylinder 34 and the plate cylinder 32 are moved apart from each other approximately $1\frac{1}{2}$ inches when in the disengaged position (i.e., approximately $\frac{3}{4}$ inches above and below the web-product 24, respectively).

[0043] The cylinder throw-off assembly further comprises a pair of air cylinders 18 located on the operator's side 16 of the gluer 10. As best seen in Figs. 4, 6 and 8, one air cylinder 18 is connected to the eccentric cylinder mounts 38 for the impression cylinder 34. The other air cylinder 18 is connected to the eccentric cylinder mounts 38 for the plate cylinder 32. Each air cylinder 18 comprises a housing 96 and a movable piston 98. The reciprocal movement of the piston 98 is controlled by air that is introduced or removed from the housing 96 by hoses connected to a pump or compressor (not shown). The design and function of the air cylinders 18 are well known to those skilled in the art. The piston 98 of each air cylinder 18 is connected to a cam arm 100. As best seen in Fig. 8, each cam arm 100 is affixed to a shaft 102 that extends between the frames 12 of the operator's side 16 and the drive side 20. Each shaft 102 is supported at its ends by bearings that allow each shaft 102 to rotate about its axis. As best seen in Fig. 6, the shafts 102 are connected to the eccentric cylinder mounts 38 by secondary cam arms 104 and throw-off linkages 106.

[0044] The operation of the cylinder throw-off assembly is essentially the same for the impression cylinder 34 and the plate cylinder 32. Consequently, only the operation of the throw-off assembly with respect to the plate cylinder 32 will be discussed in detail. Figs. 4 and

6 show the position of the throw-off assembly when the plate cylinder 32 is in the engaged position (i.e., against the web-product). As best seen in Fig. 4, the piston 98 of the air cylinder 18 is fully extended. To disengage the plate cylinder 32 (i.e., move the plate cylinder 32 away from the web-product 24), the piston 98 is retracted into the air cylinder 18. As the piston 98 is retracted, the end of the cam arm 100 is pulled downwards, thereby causing the shaft 102 to rotate counterclockwise (as viewed in Fig. 4). It should be noted that the air cylinder 18 and the piston 98 are pivotally mounted between the gluer frame 12 and the end of the cam arm 100 to provide the necessary freedom of movement to allow the cam arm 100 to swing downwards. As the shaft 102 rotates, the secondary cam arm 104 adjacent to each of the eccentric cylinder mounts 38 is likewise rotated or swung (as best seen in Figs. 6 and 7). This movement of the secondary cam arm 104 forces the eccentric cylinder mount 38, by way of the throw-off linkage 106, to rotate in the prescribed direction. When the plate cylinder 32 is in the disengaged position, the secondary cam arm 104 and the eccentric cylinder mount 38 are in the position shown in Fig. 7. To engage the plate cylinder 32, the above-describe operation is reversed (i.e., the piston 98 is extended from the air cylinder 18). Of course, it should be understood that other arrangements might be utilized to rotate the eccentric cylinder mounts 38. For example, a single air cylinder could be connected via appropriate cam arms and mechanical linkages to the eccentric cylinder mounts for both the impression and plate cylinders. In addition, hydraulic cylinders or other types of mechanical actuators could be utilized instead of air cylinders.

Claims

1. A gear driven rotary apparatus for processing a continuous flow of web-product comprising:
 - a) a pair of frame members positioned on each side of the apparatus and between which said flow of web-product passes;
 - b) a lower cylinder positioned beneath said web-product and having an axis of rotation that is generally perpendicular to the flow of web-product, said lower cylinder having two ends, each of said ends being supported by an eccentric cylinder mount positioned on one of said frame members, said eccentric cylinder mounts each having a center of rotation that is offset from the axis of rotation of said lower cylinder, wherein said lower cylinder is moved between an engaged position against a lower surface of the web-product and a disengaged position spaced away from the lower surface of the web-product, said lower cylinder being moved from

said engaged position to said disengaged position by rotation of said eccentric cylinder mounts, said lower cylinder further comprising a lower cylinder gear through which said lower cylinder is rotated;

c) a upper cylinder positioned above said web-product and having an axis of rotation that is generally perpendicular to the flow of web-product, said upper cylinder having two ends, each of said ends being supported by an eccentric cylinder mount positioned on one of said frame members, said eccentric cylinder mounts each having a center of rotation that is offset from the axis of rotation of said upper cylinder, wherein said upper cylinder is moved between an engaged position against an upper surface of the web-product and a disengaged position spaced away from the upper surface of the web-product, said upper cylinder being moved from said engaged position to said disengaged position by rotation of said eccentric cylinder mounts, said upper cylinder further comprising an upper cylinder gear through which said upper cylinder is rotated; and

d) a cylinder drive assembly for rotating the lower cylinder and the upper cylinder in opposite directions, said cylinder drive assembly comprising one or more gears connecting the lower cylinder gear and the upper cylinder gear each to a common drive pinion gear, wherein the drive pinion gear remains connected to the lower cylinder gear and the upper cylinder gear when the lower cylinder and the upper cylinder are being moved between the engaged and the disengaged positions.

2. The gear driven rotary apparatus of claim 1 wherein the lower cylinder comprises a plate cylinder for transferring material to the lower surface of the web-product and the upper cylinder comprises an impression cylinder for supporting the upper side of the web-product against the plate cylinder.
3. The gear driven rotary apparatus of claim 2 further comprising a transfer cylinder positioned adjacent to said plate cylinder for transferring said material from a pan roller to the plate cylinder, said transfer cylinder further comprising a transfer cylinder gear through which said transfer cylinder is rotated.
4. The gear driven rotary apparatus of claim 3 wherein said transfer cylinder gear is connected between said lower cylinder gear and said drive pinion gear such that said transfer cylinder and said plate cylinder rotate in opposite directions.

5. The gear driven rotary apparatus of claim 4 wherein the cylinder drive assembly further comprises an upper idler gear connected between said upper cylinder gear and said drive pinion gear, and a lower idler gear connected between said transfer cylinder gear and said drive pinion gear.

6. The gear driven rotary apparatus of claim 3 wherein said pan roller is connected to a motor for rotating said pan roller.

7. The gear driven rotary apparatus of claim 1 wherein said eccentric cylinder mounts are connected to an air cylinder comprising a housing and reciprocating piston, said eccentric cylinder mounts being rotated by the reciprocation of said piston.

8. The gear driven rotary apparatus of claim 7 wherein said reciprocating piston is reciprocated to move the lower cylinder and the upper cylinder between the engaged and the disengaged positions.

9. The gear driven rotary apparatus of claim 1 wherein the lower cylinder and the upper cylinder each comprise a cylinder surface, where said cylinder surfaces are in close proximity to each other when said lower cylinder and said upper cylinder are in the engaged position, and where said cylinder surfaces are space apart from each other when said lower cylinder and said upper cylinder are in the disengaged position.

10. The gear driven rotary apparatus of claim 9 wherein said cylinder surfaces are space apart approximately 1-2 inches when said lower cylinder and said upper cylinder are in the disengaged position

11. The gear driven rotary apparatus of claim 1 wherein said cylinder drive assembly is enclosed in a housing containing a liquid lubricant.

12. A gear driven remoist pattern gluer for processing a continuous flow of web-product comprising:

a) a pair of frame members positioned on each side of the gluer and between which said flow of web-product passes;

b) a plate cylinder for transferring material to a first surface of said web-product, said plate cylinder being positioned adjacent to the first surface of said web-product and having an axis of rotation that is generally perpendicular to the flow of web-product, said plate cylinder having two ends, each said end being supported by an eccentric cylinder mount positioned on one of said frame members, said eccentric cylinder mounts each having a center of rotation that is

offset from the axis of rotation of said plate cylinder, wherein said plate cylinder is moved between an engaged position against the first surface of the web-product and a disengaged position spaced away from the first surface of the web-product, said plate cylinder being moved from said engaged position to said disengaged position by rotation of said eccentric cylinder mounts, said plate cylinder further comprising a plate cylinder gear through which said plate cylinder is rotated;

c) an impression cylinder for supporting the web-product against the plate cylinder, said impression cylinder being positioned adjacent to a second surface of said web-product and having an axis of rotation that is generally perpendicular to the flow of web-product, said second surface being on a side of said web-product that is opposite from said first surface, said impression cylinder having two ends, each said end being supported by an eccentric cylinder mount positioned on one of said frame members, said eccentric cylinder mounts each having a center of rotation that is offset from the axis of rotation of said impression cylinder, wherein said impression cylinder is moved between an engaged position against the second surface of the web-product and a disengaged position spaced away from the second surface of the web-product, said impression cylinder being moved from said engaged position to said disengaged position by rotation of said eccentric cylinder mounts, said impression cylinder further comprising an impression cylinder gear through which said impression cylinder is rotated;

d) a pan roller partially submerged in a pan containing said material, said pan roller being rotated so as to collect said material on a surface of the pan roller;

e) a transfer cylinder for transferring said material from the surface of the pan roller to the plate cylinder, said transfer cylinder being positioned generally between the pan roller and the plate cylinder and having an axis of rotation that is generally parallel to the axis of rotation of the plate cylinder, said transfer cylinder comprising a transfer cylinder gear through which said transfer cylinder is rotated;

f) a cylinder drive assembly for rotating the plate cylinder, the impression cylinder, and the transfer cylinder, said cylinder drive assembly comprising an upper idler gear connecting a drive pinion gear to the impression cylinder

gear, and a lower idler gear connecting the drive pinion gear to the transfer cylinder gear, said transfer cylinder gear being connected to the plate cylinder gear, wherein the impression cylinder gear remains connected to the upper idler gear when the impression cylinder is being moved between the engaged and disengaged position, and further wherein the plate cylinder gear remains connected to the transfer cylinder gear when the plate cylinder is being moved between the engaged and disengaged position.

13. The gear driven remoist pattern gluer of claim 12 wherein the impression cylinder gear, the plate cylinder gear, the transfer cylinder gear, the upper idler gear, the lower idler gear, and the drive pinion gear are each enclosed within a splash housing, said splash housing containing a liquid lubricant that is dispersed throughout said splash housing by the rotation of said gears.

14. The gear driven remoist pattern gluer of claim 12 wherein the impression cylinder gear, the plate cylinder gear, the transfer cylinder gear, the upper idler gear, the lower idler gear, and the drive pinion gear each comprise helical gears.

15. The gear driven remoist pattern gluer of claim 12 wherein the flow of web-product is in a substantially horizontal plane, the first surface of the web-product comprises the lower surface of the web-product, and the plate cylinder is positioned beneath the lower surface of the web-product.

16. The gear driven remoist pattern gluer of claim 12 wherein the rotation of said pan roller is provided by a motor.

17. A gear driven remoist pattern gluer for processing a continuous flow of web-product comprising:

a) a pair of frame members positioned on each side of the gluer and between which said flow of web-product passes;

b) a plate cylinder for transferring material to a lower surface of said web-product, said plate cylinder being positioned beneath said web-product and having an axis of rotation that is generally perpendicular to the flow of web-product, said plate cylinder having two ends, each said end being supported by an eccentric cylinder mount positioned on one of said frame members, said eccentric cylinder mounts each having a center of rotation that is offset from the axis of rotation of said plate cylinder, wherein said plate cylinder is moved between an engaged position against the lower surface of the

web-product and a disengaged position spaced away from the lower surface of the web-product, said plate cylinder being moved from said engaged position to said disengaged position by rotation of said eccentric cylinder mounts, said plate cylinder further comprising a plate cylinder gear through which said plate cylinder is rotated;

c) an impression cylinder for supporting the web-product against the plate cylinder, said impression cylinder being positioned above said web-product and having an axis of rotation that is generally perpendicular to the flow of web-product, said impression cylinder having two ends, each said end being supported by an eccentric cylinder mount positioned on one of said frame members, said eccentric cylinder mounts each having a center of rotation that is offset from the axis of rotation of said impression cylinder, wherein said Impression cylinder is moved between an engaged position against the upper surface of the web-product and a disengaged position spaced away from the upper surface of the web-product, said impression cylinder being moved from said engaged position to said disengaged position by rotation of said eccentric cylinder mounts, said impression cylinder further comprising an impression cylinder gear through which said impression cylinder is rotated;

d) a pan roller partially submerged in a pan containing said material, said pan roller being rotated so as to collect said material on a surface of the pan roller;

e) a transfer cylinder for transferring said material from the surface of the pan roller to the plate cylinder, said transfer cylinder being positioned generally between the pan roller and the plate cylinder and having an axis of rotation that is generally parallel to the axis of rotation of the plate cylinder, said transfer cylinder comprising a transfer cylinder gear through which said transfer cylinder is rotated;

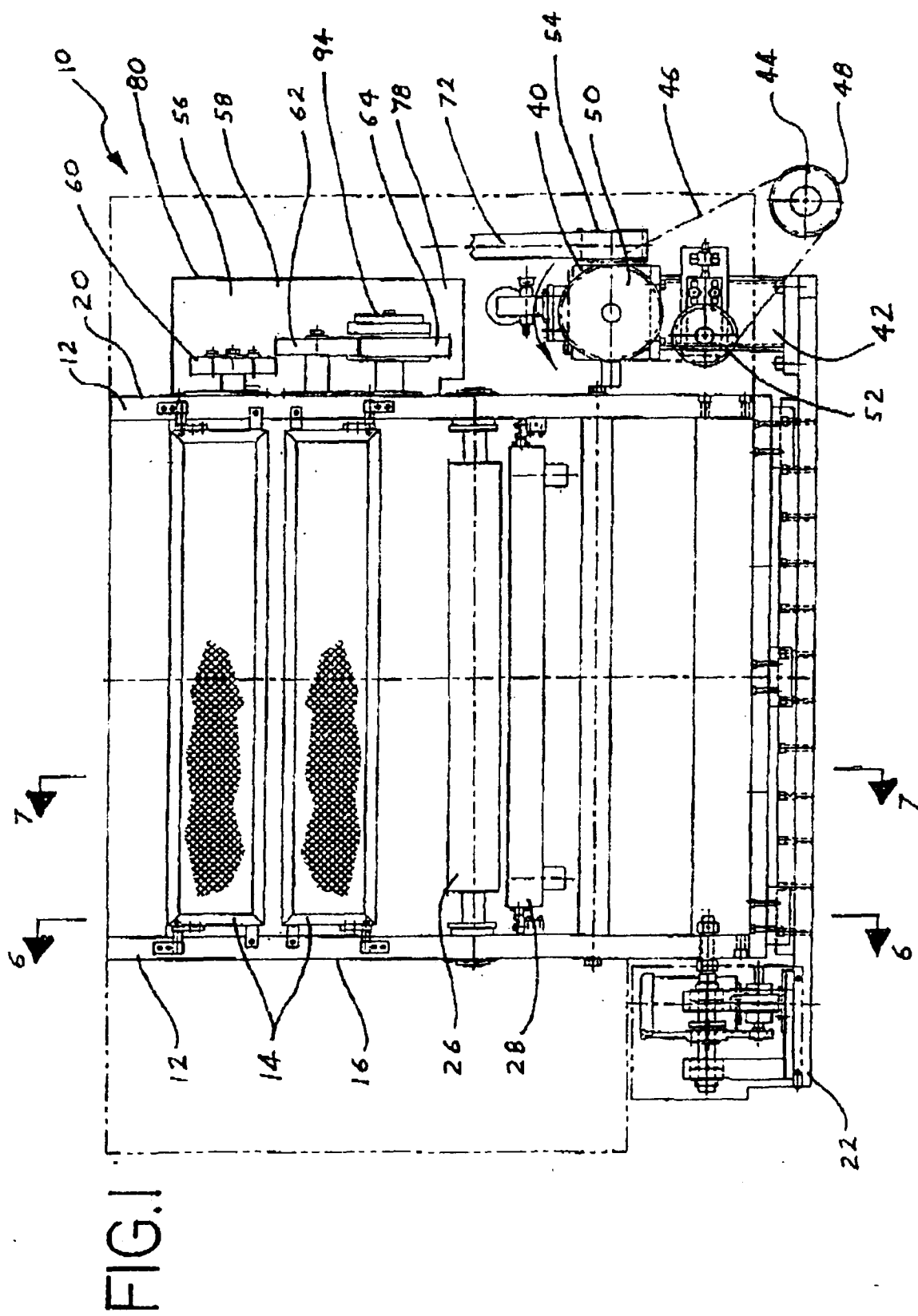
f) a cylinder drive assembly for rotating the plate cylinder, the impression cylinder, and the transfer cylinder, said cylinder drive assembly comprising an upper idler gear connecting a drive pinion gear to the impression cylinder gear, and a lower idler gear connecting the drive pinion gear to the transfer cylinder gear, said transfer cylinder gear being connected to the plate cylinder gear, wherein the impression cylinder gear remains connected to the upper idler gear when the impression cylinder is being

moved between the engaged and disengaged position, and further wherein the plate cylinder gear remains connected to the transfer cylinder gear when the plate cylinder is being moved between the engaged and disengaged position.

18. The gear driven remoist pattern gluer of claim 17 wherein the impression cylinder gear, the plate cylinder gear, the transfer cylinder gear, the upper idler gear, the lower idler gear, and the drive pinion gear are each enclosed within a splash housing, said splash housing containing a liquid lubricant that is dispersed throughout said splash housing by the rotation of said gears.

19. The gear driven remoist pattern gluer of claim 17 wherein the impression cylinder gear, the plate cylinder gear, the transfer cylinder gear, the upper idler gear, the lower idler gear, and the drive pinion gear each comprise helical gears.

20. The gear driven remoist pattern gluer of claim 17 wherein the transfer cylinder comprises a clutch for disconnecting said transfer cylinder from said cylinder drive assembly.



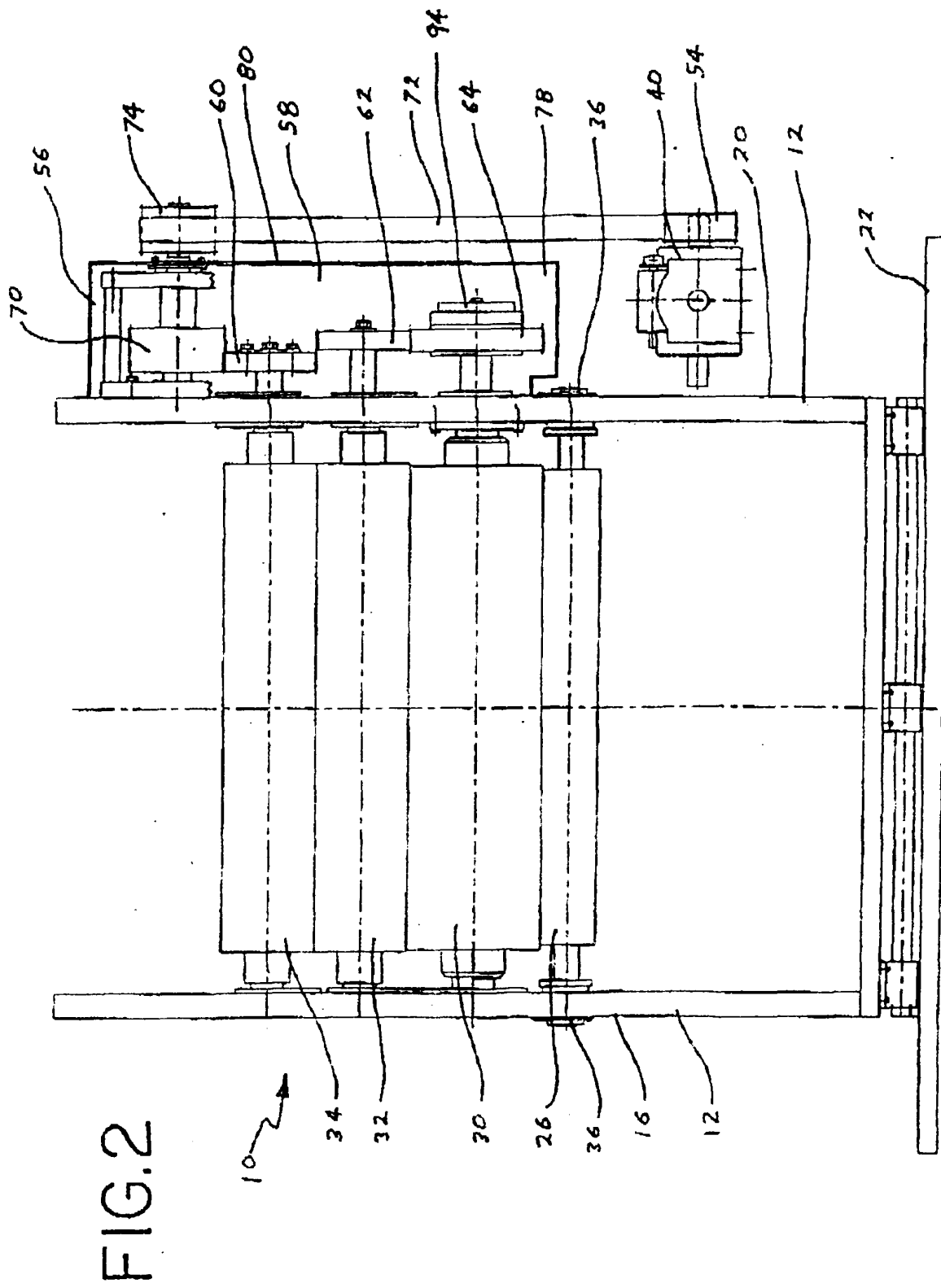


FIG.3

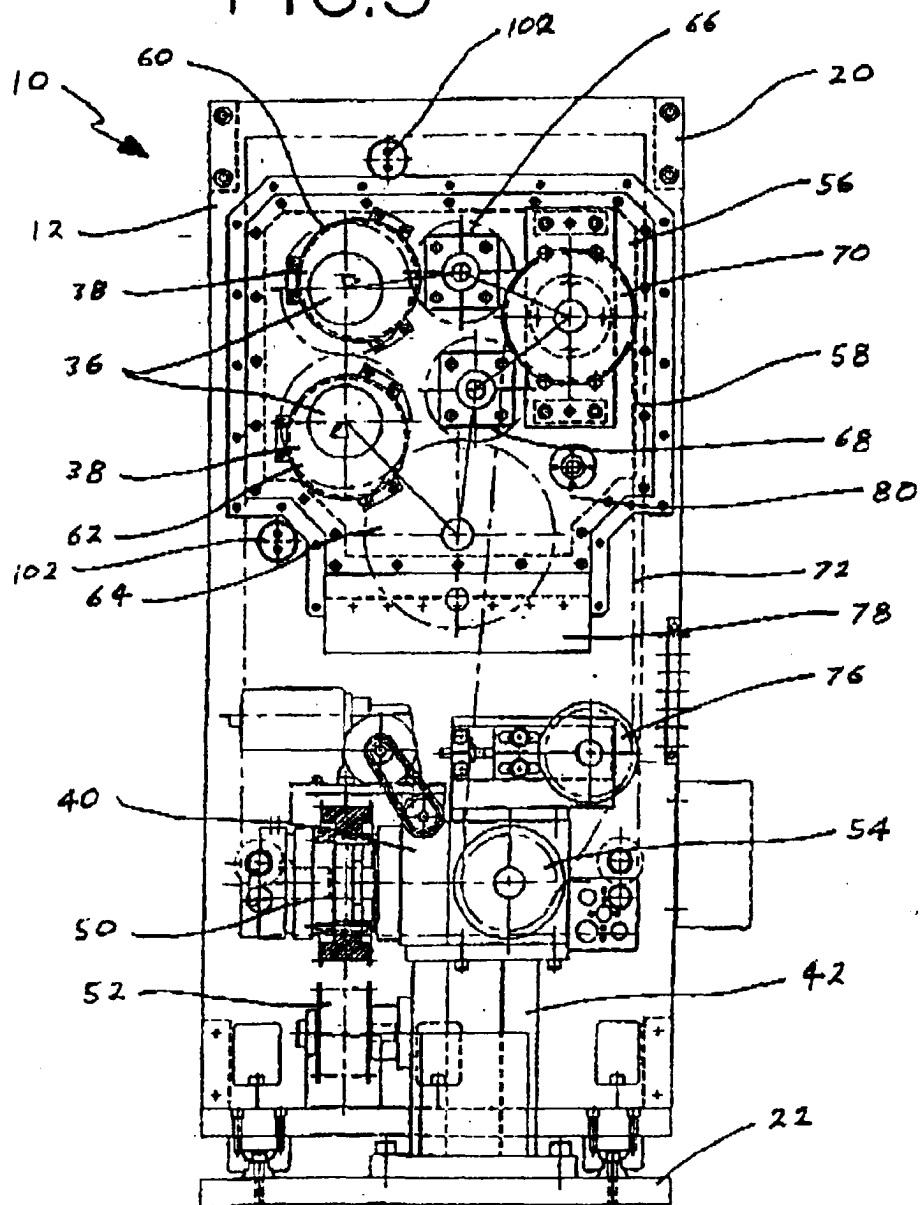


FIG.4

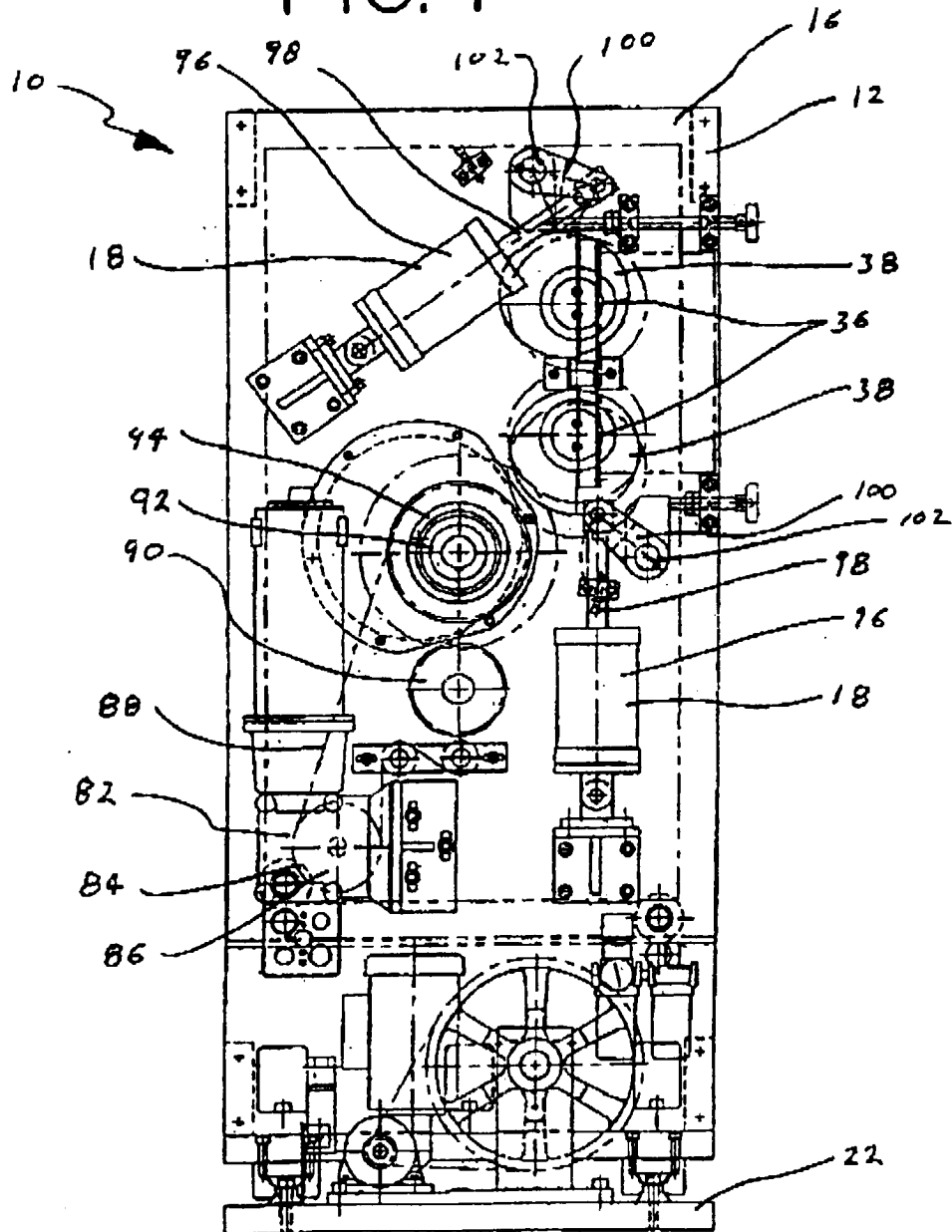


FIG.5

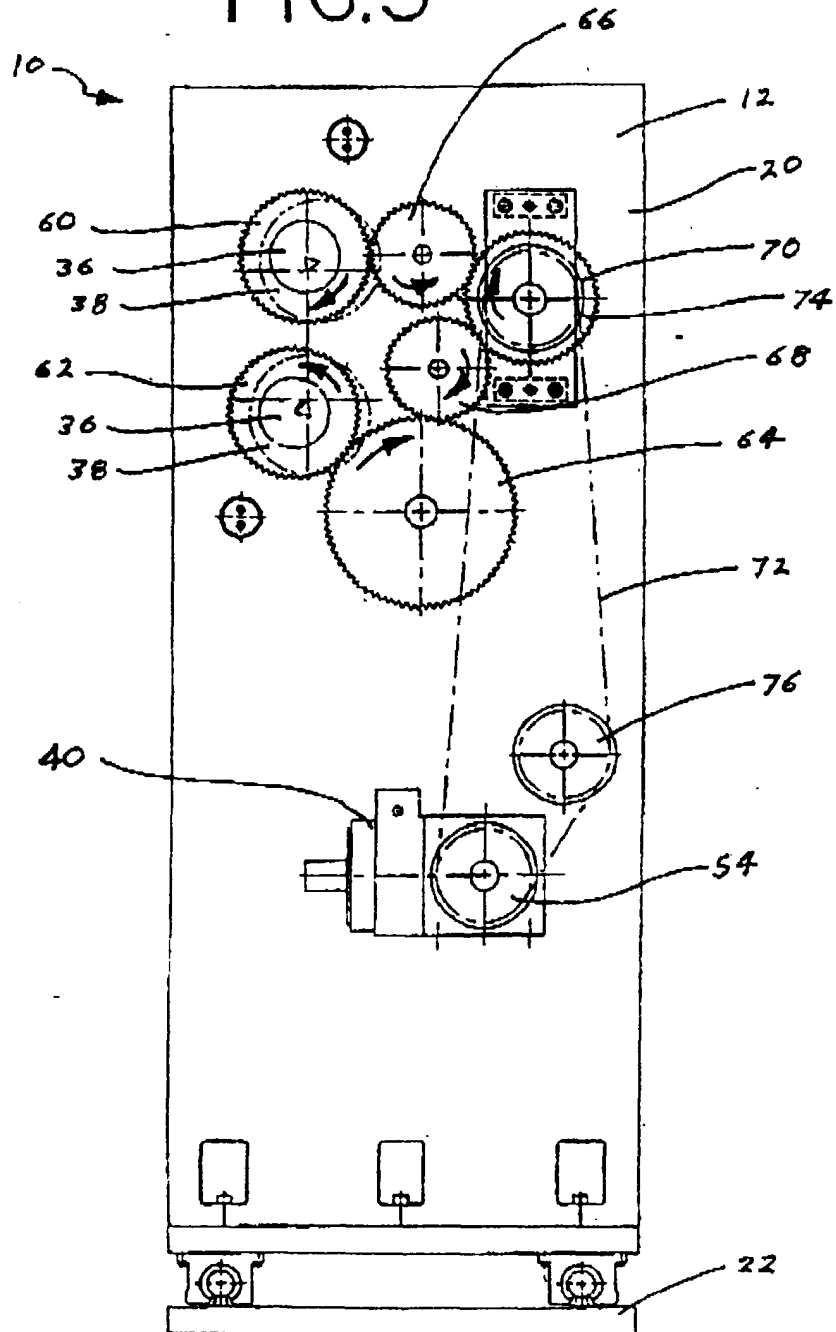


FIG.6

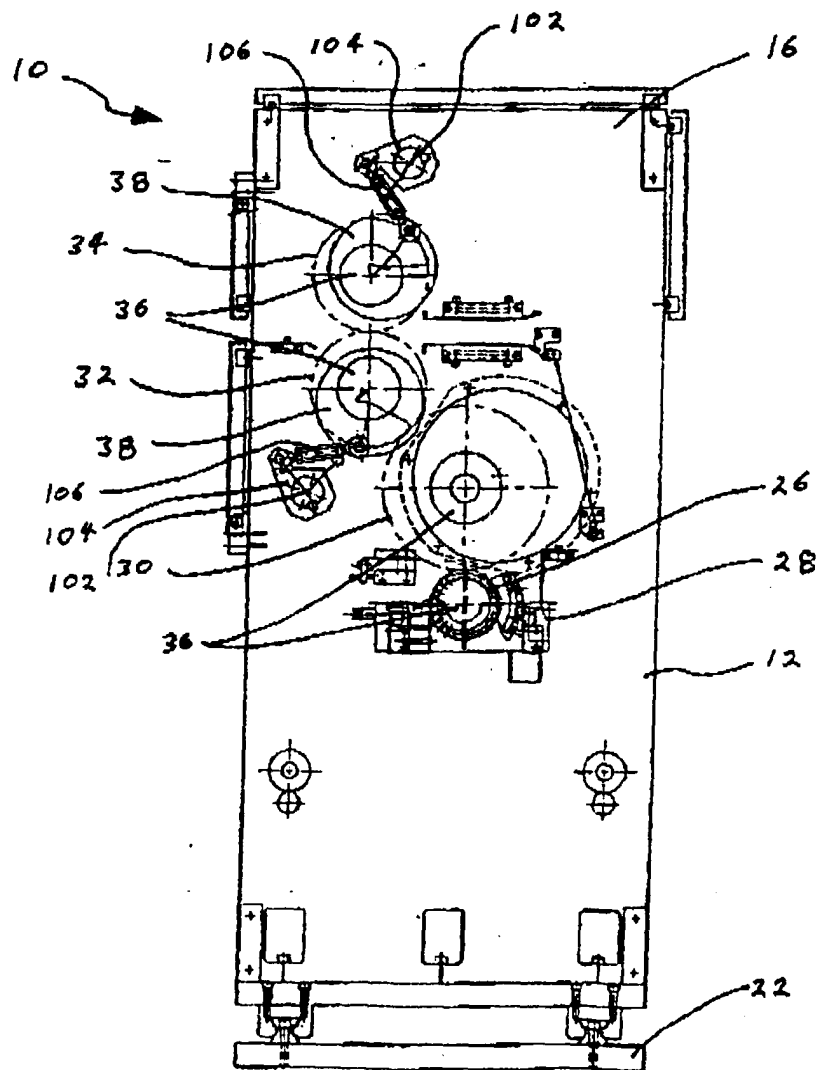
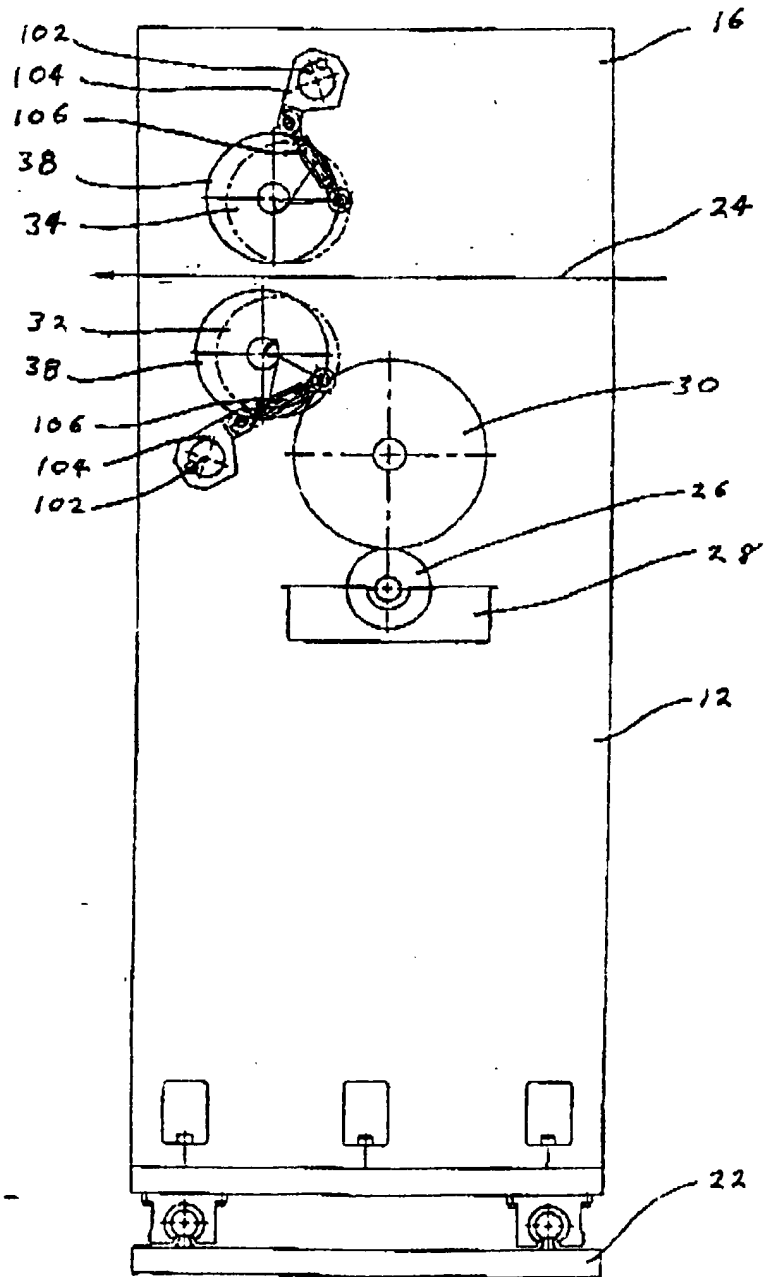


FIG.7



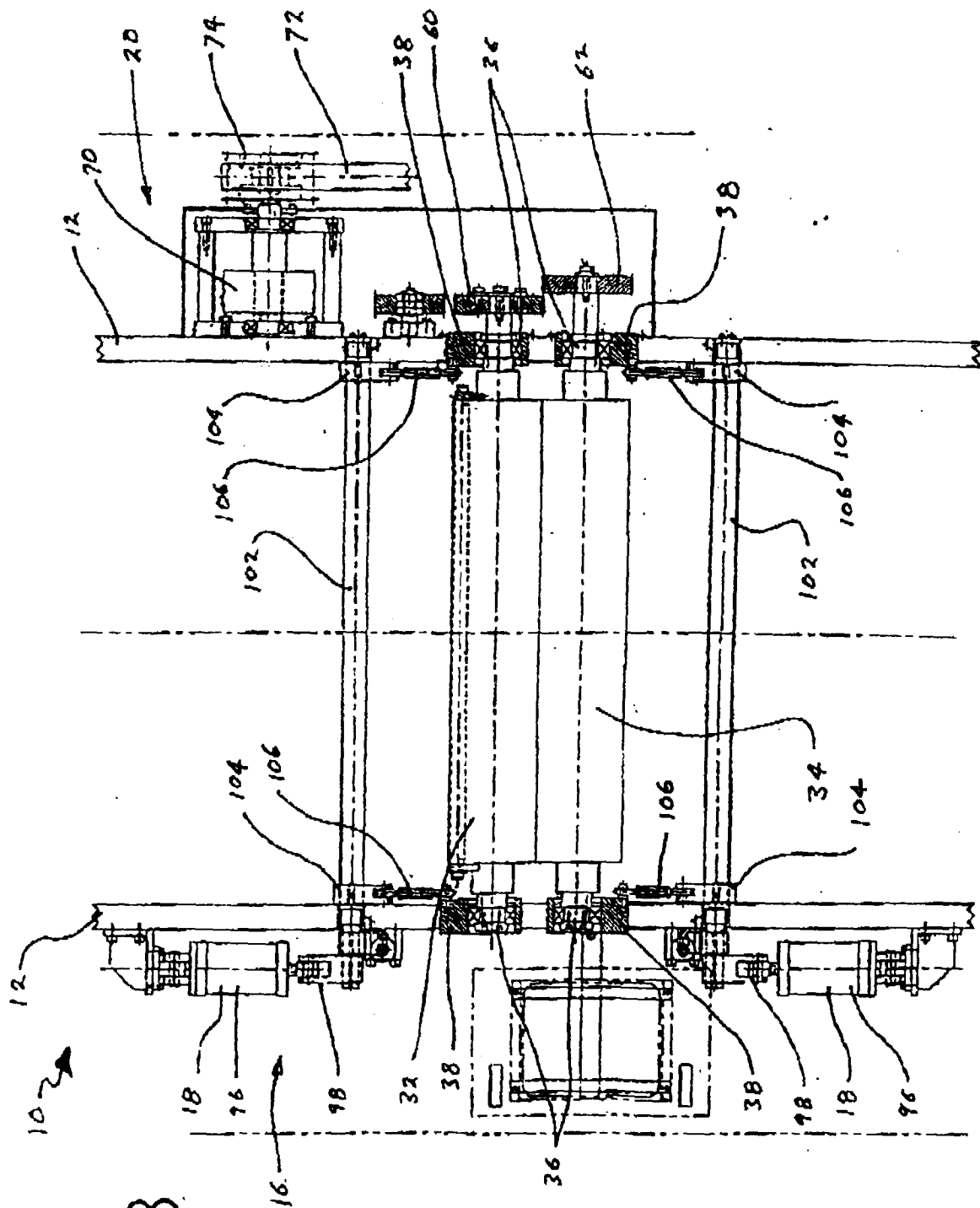


FIG. 8