

[54] **PIN BELT MECHANISM FOR
MOVEMENT OF A CONTINUOUS
STRIP**

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[58] Field of Search **226/74, 75, 52, 87**

[56] **References Cited**

UNITED STATES PATENTS

3,114,491 12/1963 Wright **226/75**

FOREIGN PATENTS OR APPLICATIONS

1,229,552 12/1966 Germany **226/74**

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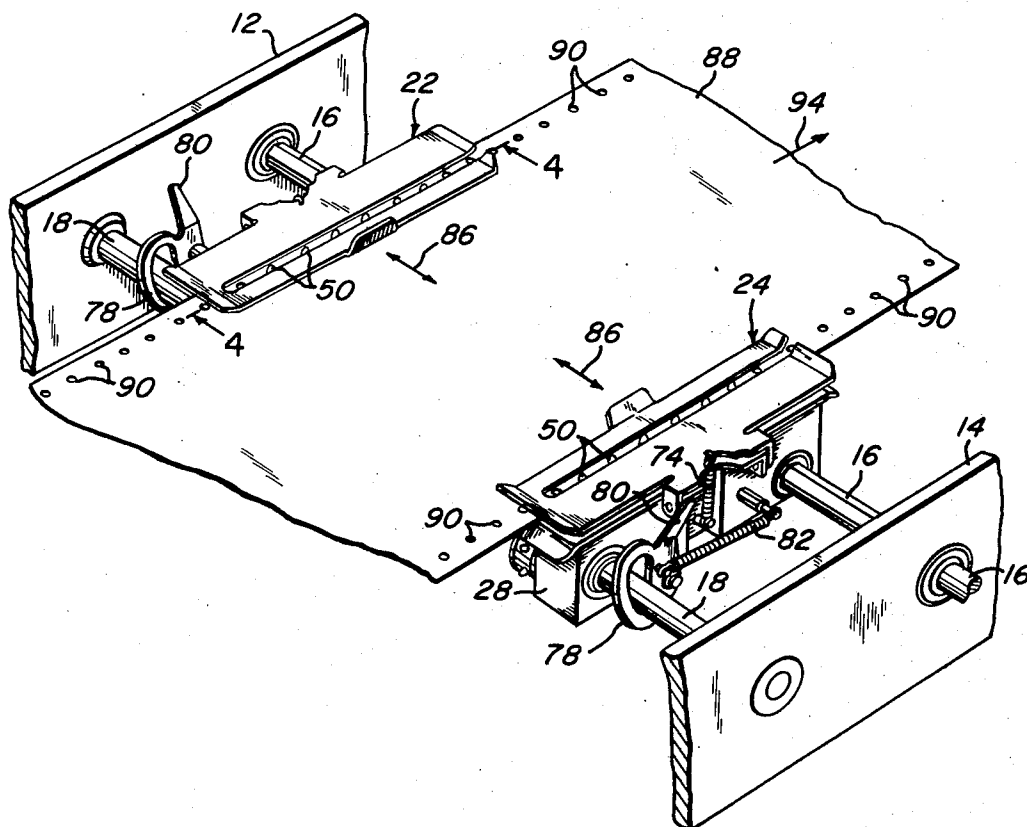
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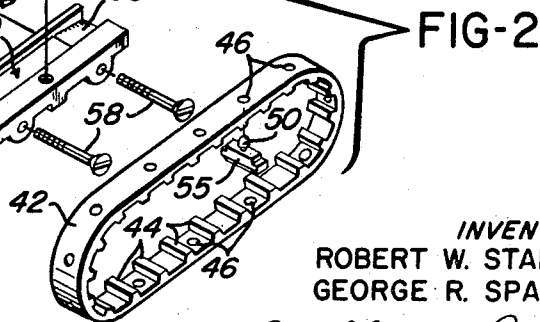
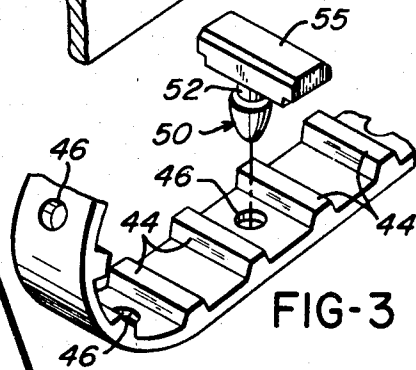
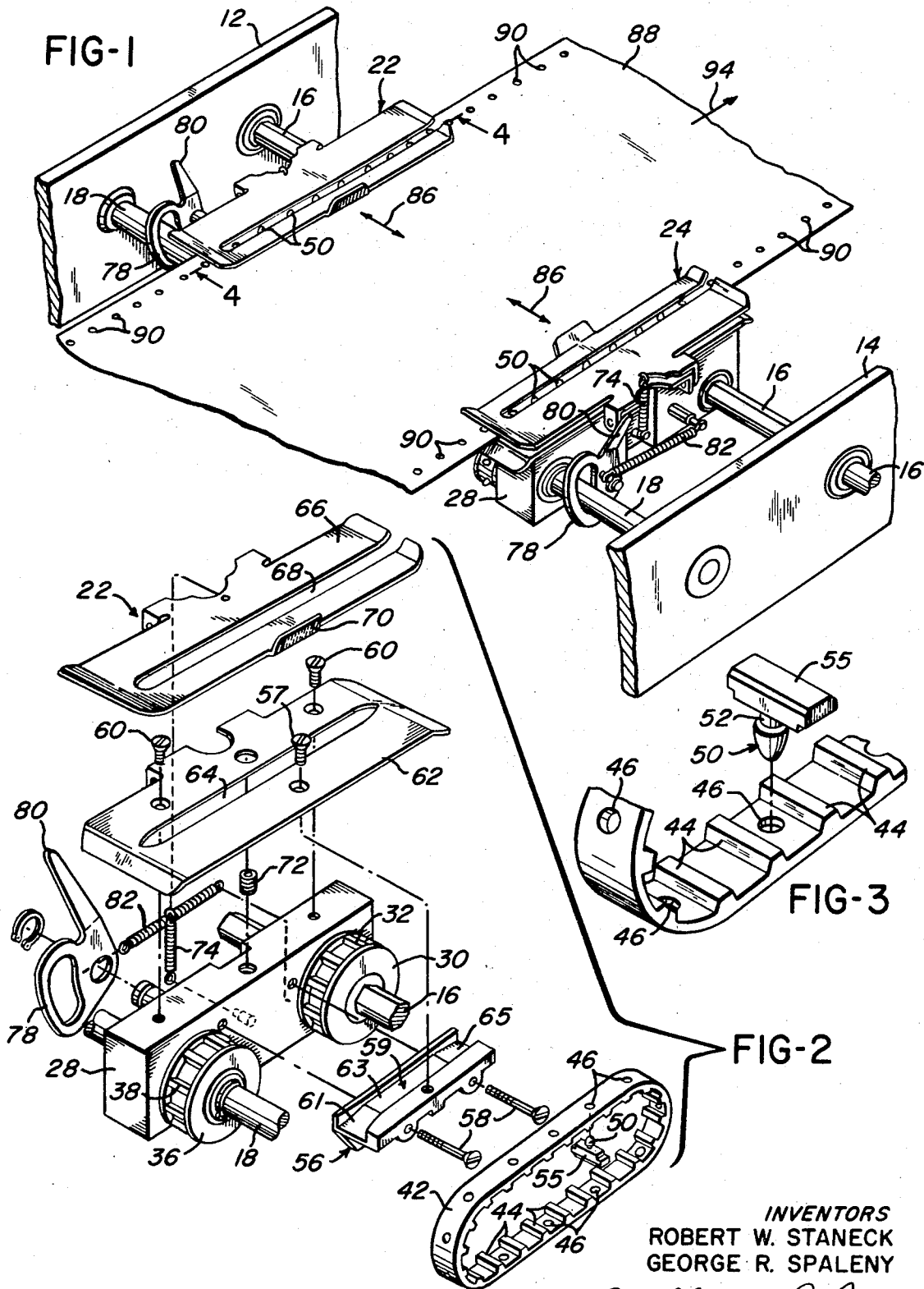
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[57] **ABSTRACT**

Pin belt mechanism for movement of a continuous strip or web which has pin feed holes. The belt is annular and the pins are attached thereto along the central portion thereof. The pins are easily and readily attached to the belt and removed therefrom. The belt during at least a portion of its movement engages a ramp which correctly directs each pin into a hole in the web for movement of the web. Each pin moves laterally in a substantially straight line as it assists in movement of the strip and is then removed from the hole.

6 Claims, 8 Drawing Figures

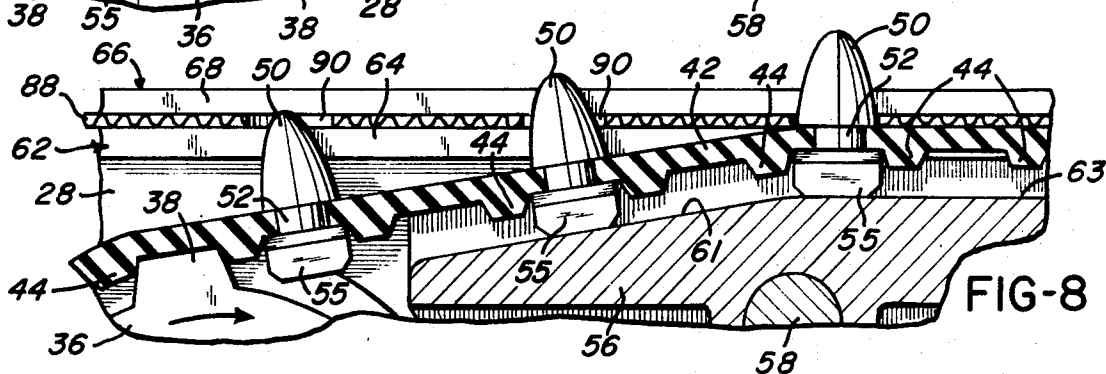
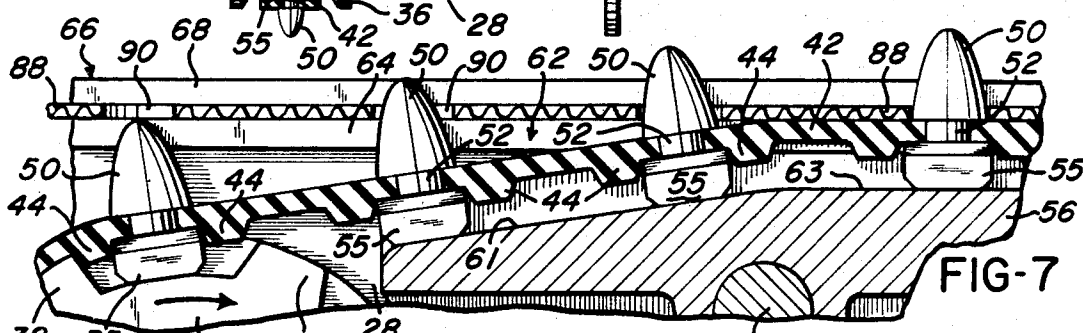
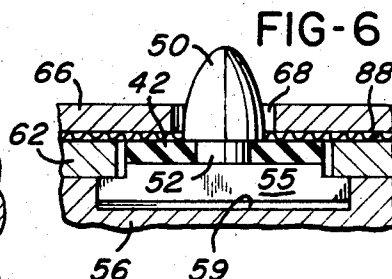
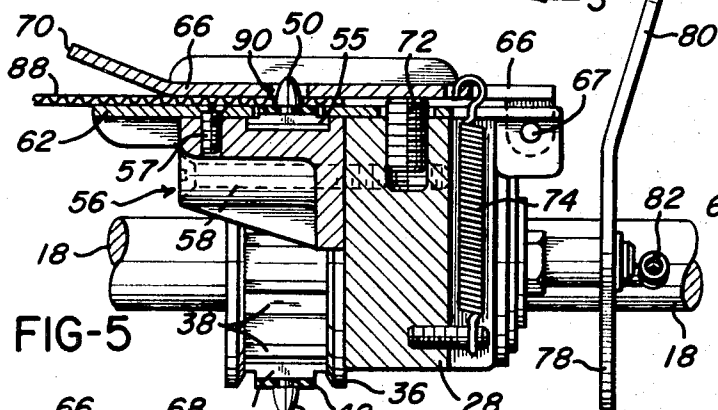
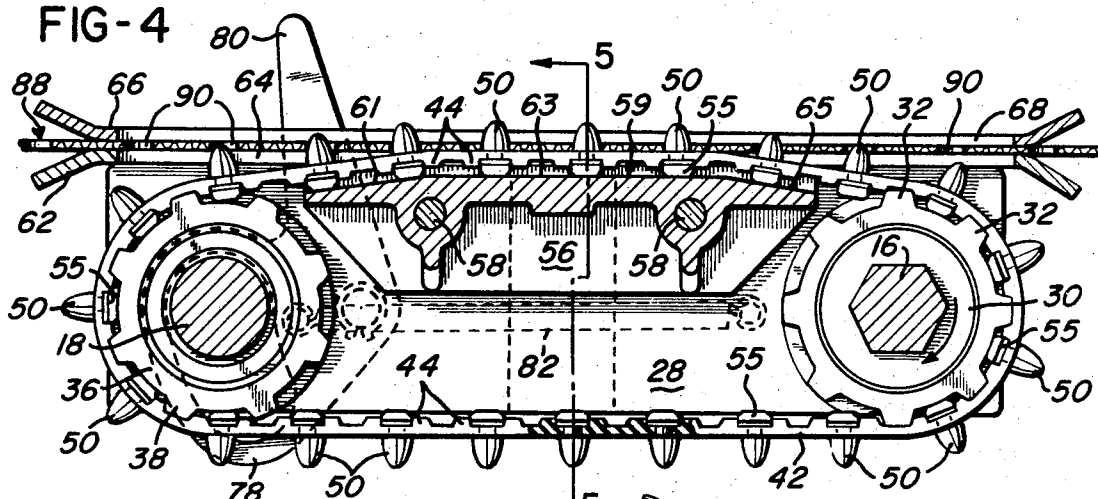




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FIG-4



PIN BELT MECHANISM FOR MOVEMENT OF A CONTINUOUS STRIP

BACKGROUND OF THE INVENTION

Annular rotatable belts or chains having pins attached thereto have been used previously for movement of a continuous strip or web. However, problems have occurred if the pins have been attached to the belt or chain between the side edges thereof. This is due to the fact that the pitch line of such a belt or chain is within its thickness. Thus, when a pair of rotatable wheels rotatably carry and move the belt, the pins carried directly by the belt do not enter the holes of the web at the pitch line of the belt. Therefore, the pins do not enter the web at a proper angle to avoid interference with the web at the edges of the holes. Thus, in the past, in regard to a pin belt feed mechanism, in order to avoid interference with the web as the pins enter the holes in the web and to position the pins at the proper pitch line, the pins have been mounted upon stems which are attached to the edge of the belt. The stems laterally position the pins from the belt, but at the pitch line of the belt. Such structure is shown, for example, in U.S. Pat. Nos. 2,171,003 and 3,507,431.

Of course, such structure in which the pins are spaced laterally from the carrier belt or chain is more expensive to produce, occupies more space, and is therefore less desirable than structure in which the pins are within the belt or a part thereof between the side edges thereof.

Therefore, it is an object of this invention to provide belt type pin feed mechanism in which the pins are attached directly to the belt and are positioned between the side edges thereof, but in which the pins properly move into and out of the holes of the strip.

It is another object of this invention to provide such pin feed mechanism in which the pins are easily and readily attachable to the carrier belt and removable therefrom.

It is another object of this invention to provide such pin feed mechanism in which each pin has a portion which cooperates with pin guide means for guiding and controlling the movement of the pin.

Another object of this invention is to provide such mechanism which can be employed with any one of various types of machines or apparatus in which a continuous strip of material is moved.

Another object of this invention is to provide such pin feed mechanism which is arranged in pairs of units and in which spacing between units is adjustable to receive a strip of a lesser width or of a greater width.

Another object of this invention is to provide such mechanism in which such a unit is automatically secured in any adjusted position.

Another object of this invention is to provide such mechanism which can be produced at relatively low costs and is long lived.

Other objects and advantages reside in the construction of the invention, combinations thereof, the method of manufacture, and the mode of operation, as will become more apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary perspective view, with parts broken away and shown in section, of mechanism of this invention.

FIG. 2 is a fragmentary exploded view, drawn on a slightly larger scale than FIG. 1, showing a portion of the mechanism thereof.

FIG. 3 is a fragmentary exploded view, drawn on a larger scale than FIG. 2, of a portion of the mechanism thereof.

FIG. 4 is an enlarged sectional view, taken substantially on line 4—4 of FIG. 1.

FIG. 5 is a sectional view, taken substantially on line 5—5 of FIG. 4.

FIG. 6 is an enlarged fragmentary sectional view of a portion of the structure of FIG. 5.

FIG. 7 is an enlarged fragmentary sectional view of a portion of the structure shown in FIG. 4.

FIG. 8 is an enlarged fragmentary sectional view, similar to FIG. 7, but showing elements of the structure in another position of operation.

DETAILED DESCRIPTION OF THE INVENTION

Strip feed mechanism of this invention may comprise an individual machine for movement of a continuous strip, or mechanism of this invention may be a part of apparatus which performs certain functions upon a continuous strip or web of material.

The mechanism is shown in FIG. 1 as being provided with a pair of spaced-apart support members 12 and 14. A drive shaft 16 is rotatably supported by the support members 12 and 14 and extends therebetween. A shaft 18 is non-rotatably supported by the support members 12 and 14 and extends therebetween, in substantially parallel spaced relationship with respect to the drive shaft 16.

Supported by the shafts 16 and 18 are a pair of drive units 22 and 24. The drive units 22 and 24 are similar one with respect to the other. The drive unit 22 is described below in detail. Corresponding reference numerals are applied to elements of the drive unit 24.

The drive unit 22 has a carriage 28 which is carried by the shafts 16 and 18, as the shafts 16 and 18 extend through the carriage 28. The drive shaft 16 is rotatably journaled in the carriage 28, and the carriage 28 is also slidably movable upon the shafts 16 and 18. Adjacent the carriage 28 and joined to the shaft 16 for rotation therewith is a drive wheel 30 which has a plurality of radially extending lugs 32. Rotatably supported upon the shaft 18 adjacent the carriage 28 is a driven wheel 36 which has a plurality of radially extending lugs 38. The wheels 30 and 36 are slidably movable along the shafts 16 and 18, respectively, with sliding movement of the carriage 28 along the shafts 16 and 18.

An annular flexible band in the form of a chain or belt 42 encompasses the wheels 30 and 36. The belt 42 has a plurality of spaced-apart lugs 44 at the inner surface thereof. The belt 42 has a plurality of holes 46 therethrough, as shown in FIG. 2. Herein there is shown a hole 46 in the belt 42 between alternate pairs of adjacent lugs 44.

A pin 50 extends through each hole 46. Each pin 50 is shown as being tapered at the portion thereof which is on the outer surface of the belt 42. Each pin 50 has an intermediate part 52 which has a transverse dimension substantially equal to that of the hole 46 through which the pin 50 extends. Thus, the intermediate part 52 snugly fits within the hole 46. The intermediate part 52 is considerably less in transverse dimension than the

tapered part of the pin 50. Each pin 50 has a base 55 which fits between two adjacent lugs 44 on the inner surface of the belt 42. Each pin 50 may be molded, or cast, or machined, or the like, and is preferably of a plastics material, such as "Delrin" or the like, having a low coefficient of friction. However, each pin 50 may be of steel or other metallic material.

The belt 42 is preferably of elastomeric material. Each pin 50 is attached to the belt 42 by forcing the tapered part of the pin 50 through an opening 46. The tapered part of the pin 50 is positioned at the outer surface of the belt 42 and the base 55 is positioned at the inner surface of the belt 42. Thus, the pins 50 are attached to the belt 42 for movement with rotative movement of the belt 42.

An elongate guide member 56 is attached to the carriage 28 in any suitable manner, such as by means of screws 58. The guide member 56 has a channel 59 along the length thereof, within which the base 55 of each pin 50 moves during rotative movement of the belt 42. As shown in FIG. 4, the floor of the channel 59 has a forward sloped or inclined portion 61, a main portion 63, and a rear sloped or inclined portion 65.

Also attached to the carriage 28 in any suitable manner, such as by means of screws 60, is a plate 62. The plate 62 is also attached to the guide member 56 by means of a screw 57. The plate 62 has an elongate slot 64 therein which extends most of the length thereof and is open at one end thereof, as shown in FIG. 2. The portion of the plate 62 which has the slot 64 therein is positioned above the channel 59 of the guide member 56. Thus, the tapered part of each pin 50 which is disposed in the channel 59 extends through the slot 64.

A plate 66 is pivotally attached, by suitable means, such as a pin 67, to the plate 62 and is normally positioned above the plate 62. The plate 66 may be pivotally moved to a position substantially at right angles to the plate 62. The plate 66 has a slot 68 therein which extends most of the length thereof, and which is aligned with the slot 64 of the plate 62 so that a part of a pin 50 may also be disposed within the slot 64. The plate 66 has a tab 70 for manual pivotal movement of the plate 66.

An abutment screw 72 is adjustably attached to the carriage 28 and is engageable by the plate 66 and spaces the plate 66 from the plate 62.

A spring 74 is attached to the carriage 28 and to the plate 66 and urges the plate 66 toward the plate 62 when the plates 62 and 66 are in substantially parallel relationship.

A clamping member 78 is pivotally attached to the carriage 28 and encompasses the shaft 18. The clamping member 78 has a handle 80 for pivotal movement thereof. A spring 82 is attached to the carriage 28 and to the clamping member 78 and urges the clamping member 78 toward clamping position upon the shaft 18.

OPERATION

The drive units 22 and 24 are adjustably movable along the length of the shafts 16 and 18. Therefore, the drive units 22 and 24 may be moved one toward the other or one from the other, as illustrated by arrows 86 in FIG. 1. Thus, the drive units 22 and 24 are positionable to receive a continuous strip or web 88 which is of any reasonable width.

The clamping member 78 has an opening therein which is smaller at one portion and larger at another portion. The spring 82, which is attached to the clamping member 78, urges pivotal movement thereof so that the smaller part of the clamping member 78 encompasses the shaft 18. Thus, the drive unit 22 or 24 is prevented from movement along the shaft 18.

When it is desired to change the spaced relationship between the drive units 22 and 24, the handle 80 of the unit which is to be moved, is manually engaged and pivotally moved. Thus, the clamping member 78 is pivotally moved so that the larger part of the clamping member 78 is adjacent the shaft 18. Then the drive unit 22 or 24 is movable along the length of the shaft 18 and is also, of course, movable along the length of the shaft 16, for changing the spaced relationship between the drive units 22 and 24.

The continuous web or strip 88 has a row of feed holes 90 adjacent each of the edges thereof, as shown in FIG. 1. Each of the edges of the strip 88 has a portion thereof between the plates 66 and 62 of the drive unit 22 or 24. In positioning an edge portion of the web 88 between the plates 62 and 66 of a drive unit 22 or 24, the plate 66 is pivotally moved to a substantially vertical position, and the edge portion of the web 88 is laid upon the plate 62, with some of the pins 50 extending through some of the holes 90 of the web 88.

Then the plate 66 is pivotally moved into substantially parallel relationship with the plate 62, as the plate 66 engages the abutment screw 72 which positions the plate 66 a slight distance from the plate 62. The abutment screw 72 is adjusted to space the plate 66 from the plate 62 a distance which is slightly greater than the thickness of the web 88. Thus, the edge portion of the web 88 can move between the plates 62 and 66. If a web or strip 88 of a greater thickness is positioned between the plates 62 and 66, the abutment screw 72 is adjusted to position the plate 66 a slightly greater distance from the plate 62.

The shaft 16 is rotated by any suitable motor means, not shown. Due to the fact that the wheel 30 of each drive unit 22 and 24 is attached to the shaft 16 for rotation therewith, the wheel 30 of each drive unit 22 and 24 rotates with rotation of the shaft 16.

A lug 32 of the wheel 30 fits between two adjacent lugs 44 of the belt 42 for rotatively driving the belt 42. As the belt 42 rotatively moves, the pins 50 thereof move into the holes 90 in the web 88 and move the web 88 as illustrated by an arrow 94 in FIG. 1. The web 88 is shown as being substantially coplanar as it travels adjacent the drive units 22 and 24.

As shown in FIGS. 2, 4, 5, and 6, the main portion 63 of the floor of the channel 59 of the guide member 56 is substantially straight and extends along the mid-portion of the channel 59. However, the forward portion 61 and the rear portion 65 are inclined. Thus, as the belt 42 rotatively moves, the pins 50 move in seriatim relationship into the channel 59. The base 55 of the pin 50 engages the inclined forward portion 61 of the channel 59 and moves thereupon. The angle of incline of the forward portion 61 causes each pin 50 to move angularly in a manner to compensate for the difference between the pitch line of the belt and the line of travel of the web 88. Thus, each pin 50 freely enters a hole 90, without coming into contact with the web 88 adjacent the hole 90. Each pin 50 after movement into a

hole 90, moves upon the main portion 63 of the channel 59 and laterally moves into engagement with the web 88 at the forward part of its respective hole 90 and urges forward movement of the web 88. After each pin 50 has moved forwardly upon the main portion 63 of the channel 59, the pin 50 moves downwardly upon the rear portion 65 of the channel 59. Thus, each pin 50 freely moves from its respective hole 90, without substantial engagement with the web 88 during withdrawal of the pin 50. Due to the fact that the elongate slot 64 of each plate 62 is open at the withdrawal end thereof, a possible constricted region is eliminated. Therefore, the possibility of jamming of paper in this region of the mechanism is greatly reduced.

As shown in FIGS. 5 and 6, when each pin 50 has its base 55 within the channel 59 of the guide member 56, a portion of the upper surface of the base 55 is below the plate 62. Thus, even when the belt 42 rotatively moves at a high rate of speed and high centrifugal forces exist, the base 55 of each pin 50 remains within the channel 59.

Thus, the web 88 is properly moved forwardly substantially linearly.

Although the preferred embodiment of the has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claims.

The invention having thus been described, the following is claimed:

1. Mechanism for movement of a continuous web provided with a longitudinal row of apertures comprising:

- a pair of spaced-apart rotatable wheels, rotatable about parallel axes,
- an annular flexible band having opposed side edges, the band encompassing the wheels and rotatable therewith,
- a guide member within the confines of the band and intermediate the wheels, the guide member being provided with a guide surface having a main portion and a first ramp portion and a second ramp portion, the main portion being substantially straight and separating the ramp portions, the guide member having a channel, the guide surface of the guide member being within the channel,
- a plurality of pin members attached to the band in aligned relationship intermediate the side edges thereof, each pin member having a base engageable with the guide surface of the guide member and movable therealong, the pin members being moved with rotative movement of the band as the pin members move in seriatim relationship along the guide surface of the guide member, each pin member moving along the first ramp portion of the surface to the main portion thereof and then along the main portion to the second ramp portion and then along the second ramp portion to the end of the guide surface of the guide member,
- the pin members being adapted to move a continuous web as a substantially coplanar portion of the web is disposed adjacent the band and is substan-

tially parallel to the main portion of the guide surface of the guide member, the coplanar portion of the web being farther from the ramp portions of the guide surface of the guide member than from the main portion of the guide surface of the guide member, each pin member thus approaching the web at an angle as the pin member moves along the first ramp portion and gradually and freely enters into an aperture of the web, without distortion of the web at the edge of the aperture, the pin member engaging an edge of the aperture after the pin member enters the aperture and is normal to the coplanar portion of the web, the pin member thus being in driving relationship to the web as the pin member engages the web at an edge portion of the aperture, the pin member then moving in a substantially straight line along the main portion of the guide surface of the guide member, the pin member then gradually moving from the aperture in the web as the pin member moves along the second ramp portion of the guide surface of the guide member, the pin member thus smoothly withdrawing from the aperture without distortion of the web at the edge of the aperture.

2. Mechanism for movement of a continuous web provided with a longitudinal row of apertures comprising:

- a pair of spaced-apart rotatable wheels, rotatable about parallel axes,
- an annular flexible band having opposed side edges, the band encompassing the wheels and rotatable therewith,
- a guide member within the confines of the band and intermediate the wheels, the guide member being provided with a guide surface having a main portion and a first ramp portion and a second ramp portion, the main portion being substantially straight and separating the ramp portions,
- a plurality of pin members attached to the band in aligned relationship intermediate the side edges thereof, each pin member having a base engageable with the guide surface of the guide member and movable therealong, the pin members being moved with rotative movement of the band as the pin members move in seriatim relationship along the guide surface of the guide member, each pin member moving along the first ramp portion of the surface to the main portion thereof and then along the main portion to the second ramp portion and then along the second ramp portion to the end of the guide surface of the guide member, the band having a plurality of holes therethrough, each pin member extending through a hole in the band, the band having a plurality of spaced-apart lugs on the inner surface thereof and each of the wheels having a plurality of spaced-apart lugs at the periphery thereof, lugs of the wheels and lugs of the band being in meshed relationship, each hole in the band being intermediate two of the lugs thereof, each pin member having a stem portion snugly disposed within a hole of the belt, with parts of the pin member at opposed sides of the belt, each stem portion having a lesser cross-sectional dimension than the parts of the pin member at the opposed sides of the belt,

the pin members being adapted to move a continuous web as a substantially coplanar portion of the web is disposed adjacent the band and is substantially parallel to the main portion of the guide surface of the guide member, the coplanar portion of the web being farther from the ramp portions of the guide surface of the guide member than from the main portion of the guide surface of the guide member, each pin member thus approaching the web at an angle as the pin member moves along the first ramp portion and gradually and freely enters into an aperture of the web, without distortion of the web at the edge of the aperture, the pin member engaging an edge of the aperture after the pin member enters the aperture and is normal to the coplanar portion of the web, the pin member thus being in driving relationship to the web as the pin member engages the web at an edge portion of the aperture, the pin member then moving in a substantially straight line along the main portion of the guide surface of the guide member, the pin member then gradually moving from the aperture in the web as the pin member moves along the second ramp portion of the guide surface of the guide member, the pin member thus smoothly withdrawing from the aperture without distortion of the web at the edge of the aperture.

3. Mechanism for movement of a continuous web provided with a longitudinal row of apertures comprising:

a pair of spaced-apart rotatable wheels, rotatable about parallel axes,

an annular flexible band having opposed side edges, the band encompassing the wheels and rotatable therewith,

a guide member within the confines of the band and intermediate the wheels, the guide member being provided with a guide surface having a main portion and a first ramp portion and a second ramp portion, the main portion being substantially straight and separating the ramp portions,

a plurality of pin members attached to the band in aligned relationship intermediate the side edges thereof,

each pin member having a base engageable with the guide surface of the guide member and movable therealong, the pin members being moved with rotative movement of the band as the pin members move in seriatim relationship along the guide surface of the guide member, each pin member moving along the first ramp portion of the surface to the main portion thereof and then along the main portion to the second ramp portion and then along the second ramp portion to the end of the guide surface of the guide member,

the pin members being adapted to move a continuous web as a substantially coplanar portion of the web is disposed adjacent the band and is substantially parallel to the main portion of the guide surface of the guide member, the coplanar portion of the web being farther from the ramp portions of the guide surface of the guide member than from the main portion of the guide surface of the guide member, each pin member thus approaching the web at an angle as the pin member moves along

the first ramp portion and gradually and freely enters into an aperture of the web, without distortion of the web at the edge of the aperture, the pin member engaging an edge of the aperture after the pin member enters the aperture and is normal to the coplanar portion of the web, the pin member thus being in driving relationship to the web as the pin member engages the web at an edge portion of the aperture, the pin member then moving in a substantially straight line along the main portion of the guide surface of the guide member, the pin member then gradually moving from the aperture in the web as the pin member moves along the second ramp portion of the guide surface of the guide member, the pin member thus smoothly withdrawing from the aperture without distortion of the web at the edge of the aperture,

a pair of substantially parallel spaced-apart shafts, one of the shafts being rotatable and the other shaft being non-rotatable, one of the wheels being rotatably attached to the non-rotatable shaft for rotation with respect thereto, the other wheel being attached to the rotatable shaft for rotation therewith, each wheel being slidably axially movable upon its respective shaft,

support means carried by the shafts adjacent the wheels and movable along the shafts, the guide member being carried by the support means,

clamping means attached to the support means and engageable with the non-rotatable shaft for securing the position of the support means with respect to the shafts.

4. Mechanism for movement of a continuous strip which is provided with a longitudinal row of apertures comprising:

an annular flexible band arranged to rotate about a pair of substantially parallel axes,

the band including a belt having a pair of side edges and a plurality of pins arranged in aligned spaced-apart relationship around the belt and disposed between the side edges thereof,

guide means within the confines of the band and engageable thereby, the guide means having an elongate main surface portion which is substantially straight and a sloped surface portion leading to the elongate main surface portion,

successive portions of the band moving along the sloped surface portion to the main surface portion as the pins gradually enter the apertures in a strip which is substantially parallel to the main surface portion, successive portions of the band then moving along the elongate main surface portion as the pins within the apertures engage the strip at the edges of the apertures and move the strip,

the belt having holes therein in which the pins are removably disposed, each pin having opposed end portions and an intermediate portion, the intermediate portion being snugly disposed within a hole in the belt,

the intermediate portion of each pin being smaller than the opposed end portions of the pin.

5. Mechanism for movement of a continuous strip which is provided with a longitudinal row of apertures comprising:

an annular flexible band arranged to rotate about a pair of substantially parallel axes,

the band including a belt having a pair of side edges and a plurality of pins arranged in aligned spaced-apart relationship around the belt and disposed between the side edges thereof,

guide means within the confines of the band and engageable thereby, the guide means having an elongate main surface portion which is substantially straight and a sloped surface portion leading to the elongate main surface portion,

successive portions of the band moving along the sloped surface portion to the main surface portion as the pins gradually enter the apertures in a strip which is substantially parallel to the main surface portion, successive portions of the band then moving along the elongate main surface portion as the pins within the apertures engage the strip at the edges of the apertures and move the strip, the guide means being provided with a channel in which the elongate main surface portion is located, the mechanism including a support member which covers the channel, the support member having a substantially coplanar surface, the strip having a portion in engagement with the coplanar surface of the support member, at least one of the pins being disposed within an aperture of the strip.

6. Mechanism for movement of a continuous web provided with a longitudinal row of apertures comprising:

a pair of spaced-apart rotatable wheels, rotatable about parallel axes,

an annular flexible band having opposed side edges, the band encompassing the wheels and rotatable therewith,

a guide member within the confines of the band and intermediate the wheels, the guide member being provided with a guide surface having a main portion and a first ramp portion and a second ramp portion, the main portion being substantially straight and separating the ramp portions,

a plurality of pin members attached to the band in aligned relationship intermediate the side edges thereof, each pin member having a base engageable with the guide surface of the guide member and movable therealong, the pin members being moved with rotative movement of the band as the

pin members move in seriatim relationship along the guide surface of the guide member, each pin member moving along the first ramp portion of the surface to the main portion thereof and then along the main portion to the second ramp portion and then along the second ramp portion to the end of the guide surface of the guide member,

the pin members being adapted to move a continuous web as a substantially coplanar portion of the web is disposed adjacent the band and is substantially parallel to the main portion of the guide surface of the guide member, the coplanar portion of the web being farther from the ramp portions of the guide surface of the guide member than from the main portion of the guide surface of the guide member, each pin member thus approaching the web at an angle as the pin member moves along the first ramp portion and gradually and freely enters into an aperture of the web, without distortion of the web at the edge of the aperture, the pin member engaging an edge of the aperture after the pin member enters the aperture and is normal to the coplanar portion of the web, the pin member thus being in driving relationship to the web as the pin member engages the web at an edge portion of the aperture, the pin member then moving in a substantially straight line along the main portion of the guide surface of the guide member, the pin member then gradually moving from the aperture in the web as the pin member moves along the second ramp portion of the guide surface of the guide member, the pin member thus smoothly withdrawing from the aperture without distortion of the web at the edge of the aperture,

web support means, the web support means having a planar part which is substantially parallel to and adjacent the main surface portion of the guide means, each pin member having a base portion movable between the web support means and the main portion of the guide surface of the guide member, the planar part of the web support means having a slot therein, a portion of each pin member being movable within the slot, the slot being open at one end thereof.

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