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Black et al.

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[54] CONVEYING APPARATUS

[75] Inventors: **Howard Black,** Briarcliff Manor, N.Y.; **Morton A. Breier,** Greenwich, Conn.

[73] Assignee: **Dorr-Oliver Incorporated,** Stamford, Conn.

[22] Filed: **Jan. 29, 1971**

[21] Appl. No.: **110,842**

[52] **U.S. Cl.**.....**198/20 R,** 198/127 R, 193/37 MD

[51] **Int. Cl.**.....**B65g 47/00,** B05g 15/00

[58] **Field of Search** 198/127, 20; 193/35, 36, 37

[56] **References Cited**

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Primary Examiner—Richard E. Aegerter

Attorney—Burtsell J. Kearns and Theodore M. Jablon

[57] **ABSTRACT**

Conveying apparatus comprising a right-angle transfer station whereby the movement of a container or the like is diverted automatically or semi-automatically from one horizontal direction into another horizontal direction perpendicular thereto.

9 Claims, 16 Drawing Figures

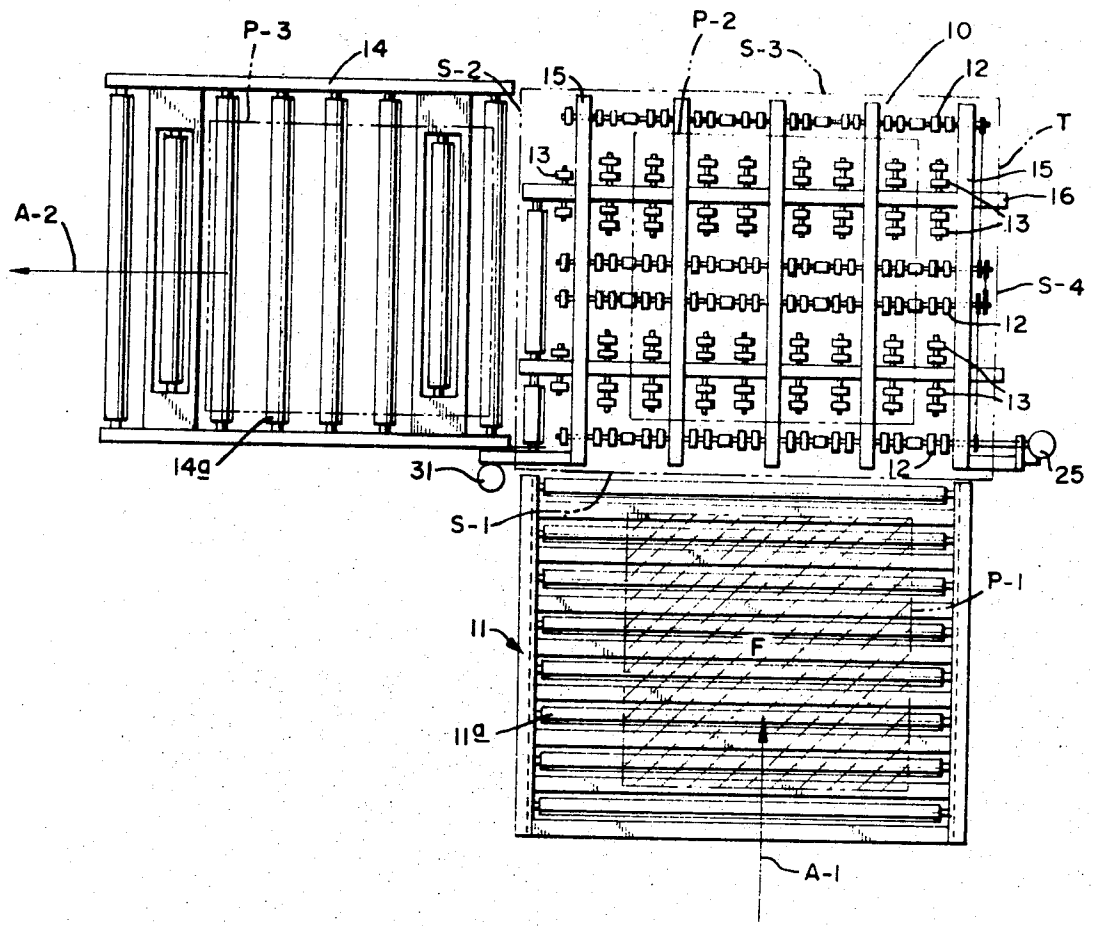


FIG. 1

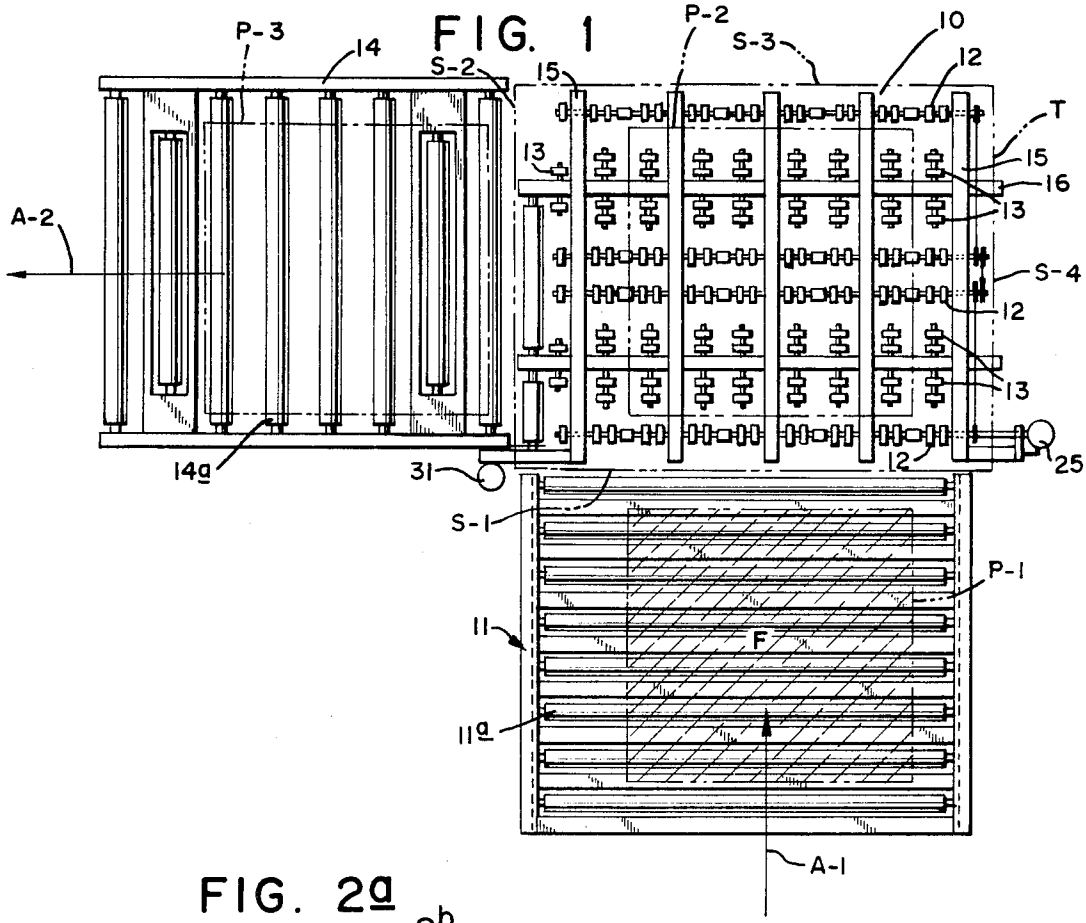


FIG. 2a

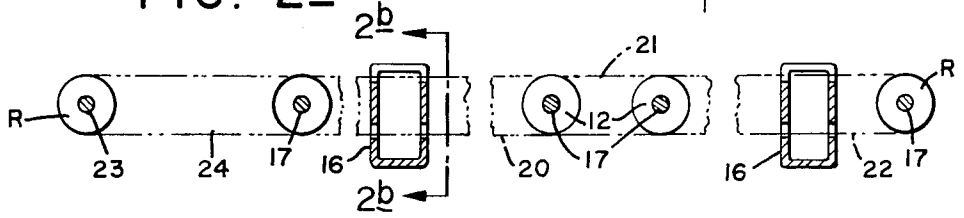


FIG. 2b

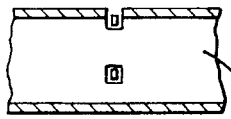


FIG. 2c

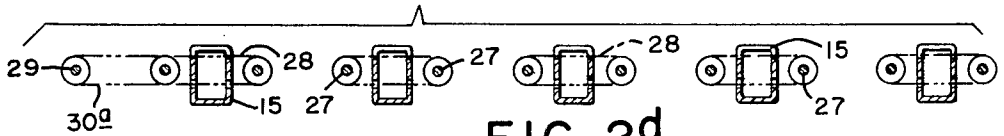
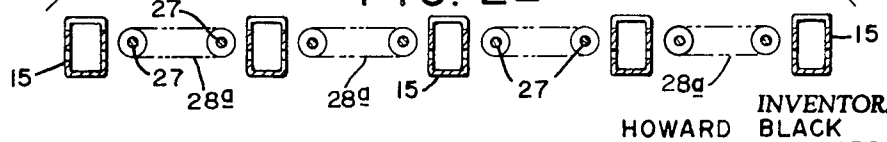


FIG. 2d



INVENTORS.
HOWARD BLACK
MORTON A. BREIER
BY Theodore N. Jablon
ATTORNEY.

FIG. 2

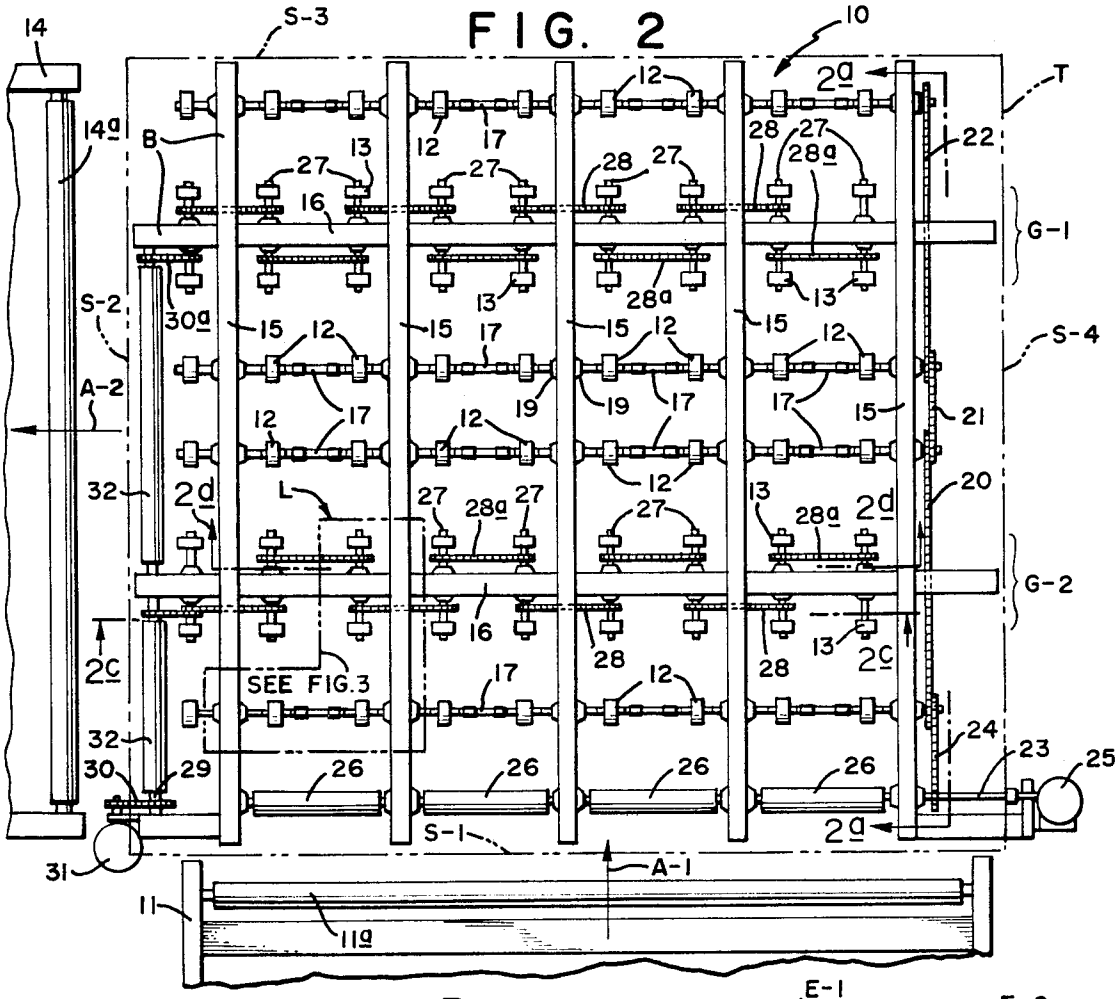


FIG. 6

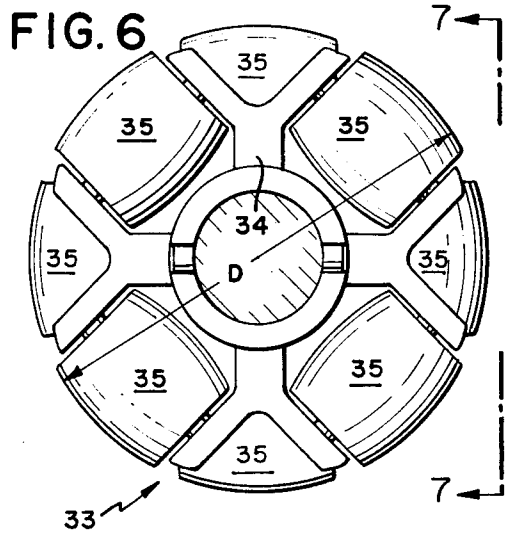
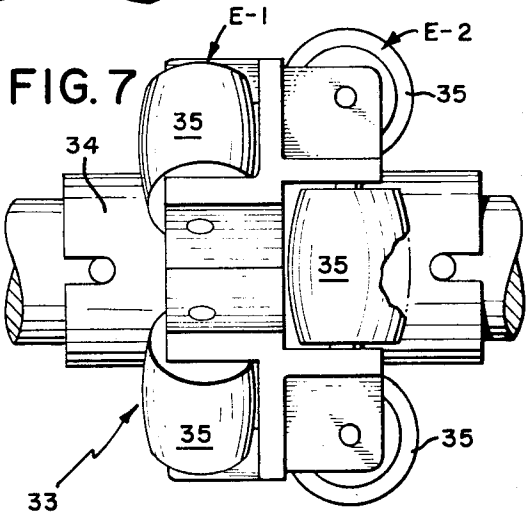


FIG. 7



INVENTORS.
HOWARD BLACK
MORTON A. BREIER

BY Theodore M. Jablon

ATTORNEY.

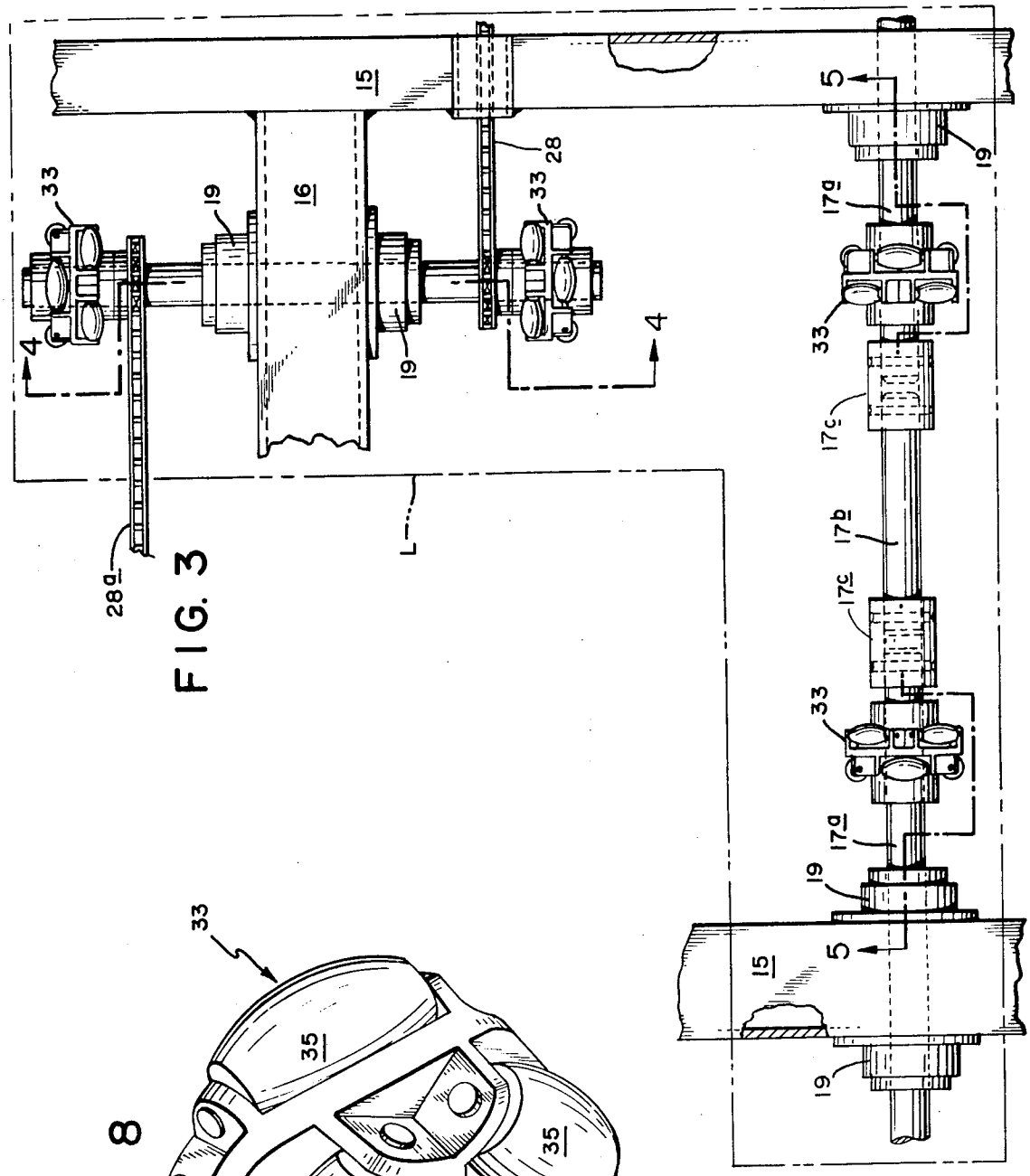


FIG. 3

FIG. 8

INVENTORS.
HOWARD BLACK
MORTON A. BREIER
BY Theodore M. Jablon
ATTORNEY.

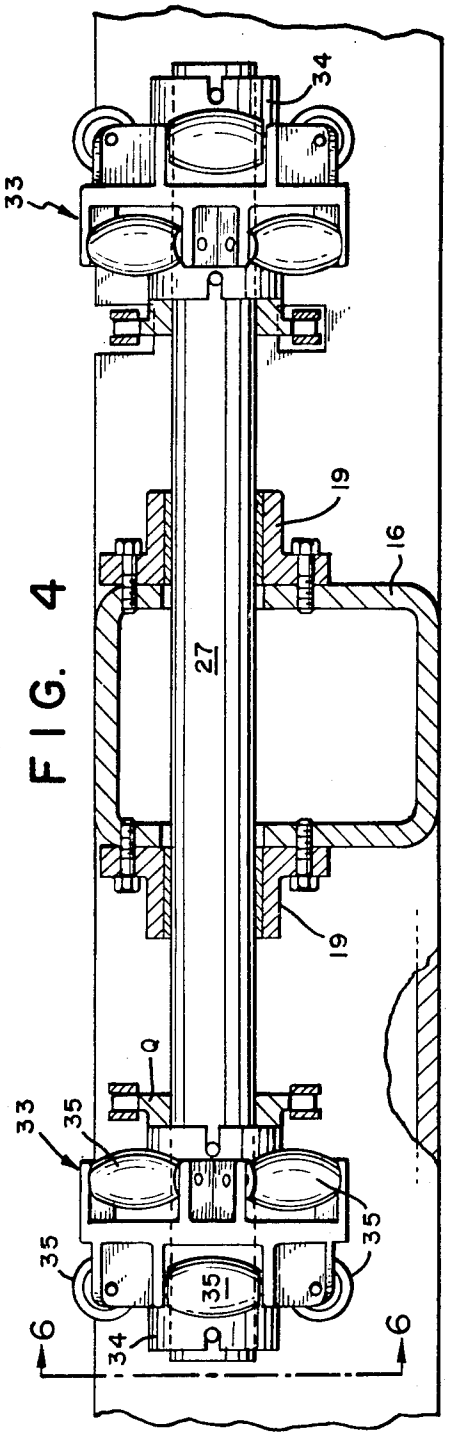


FIG. 4

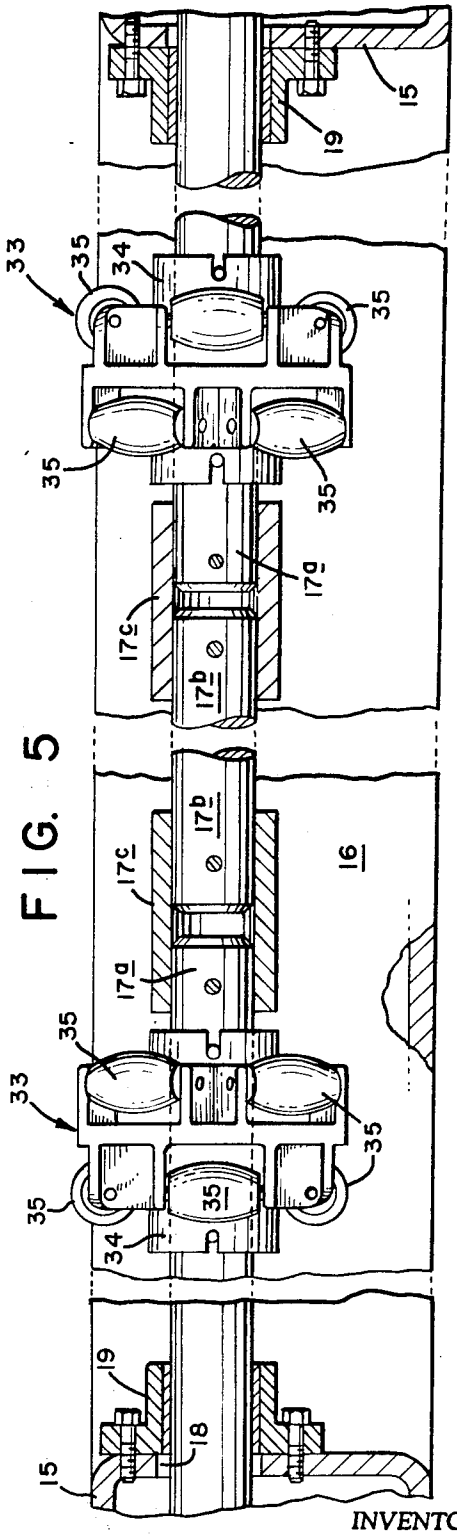
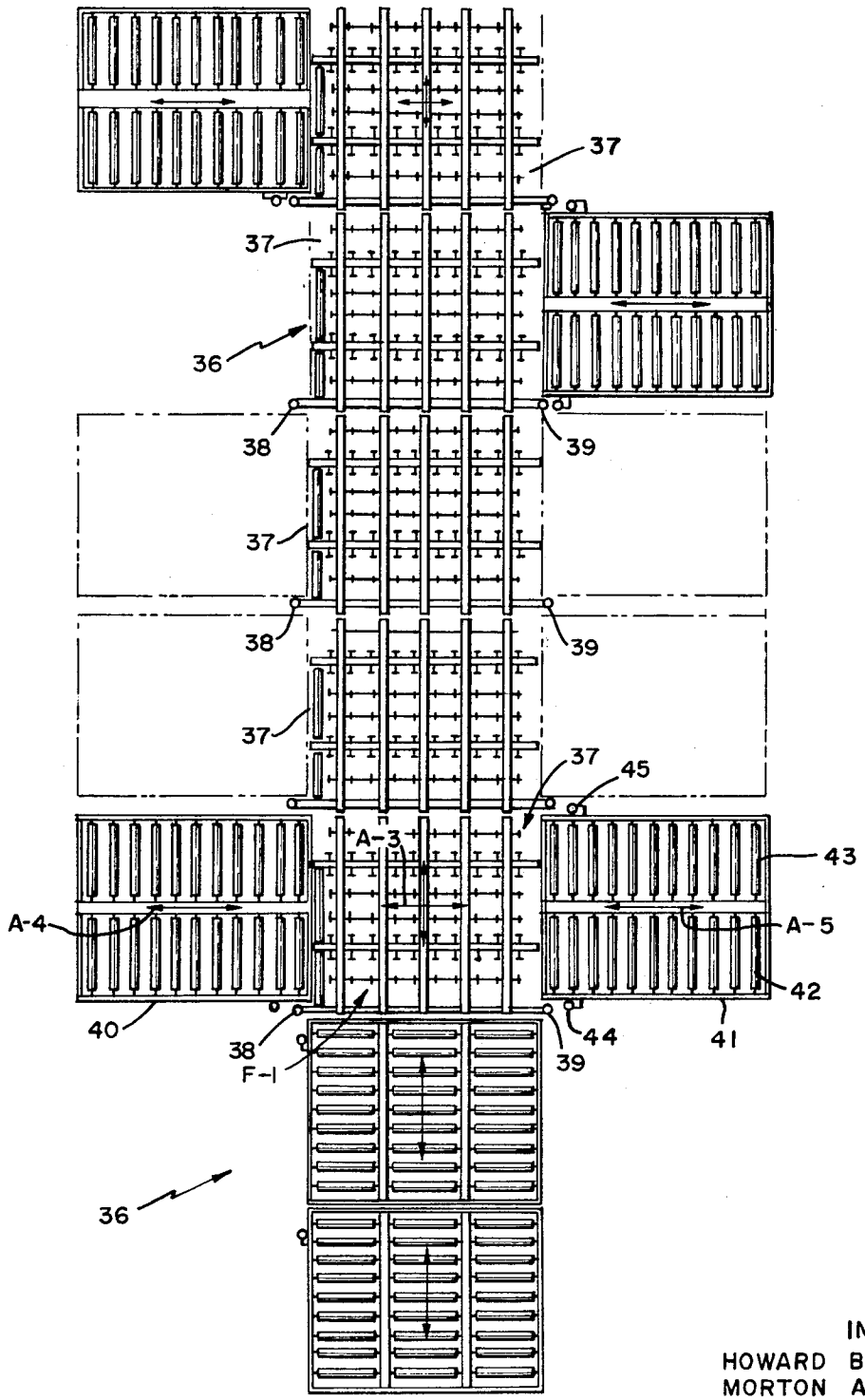


FIG. 5

INVENTORS.
HOWARD BLACK
MORTON A. BREIER
BY Theodore M. Jablon
ATTORNEY.

FIG. 9



INVENTORS.
HOWARD BLACK
MORTON A. BREIER
BY: Theodore H. Jablon
ATTORNEY.

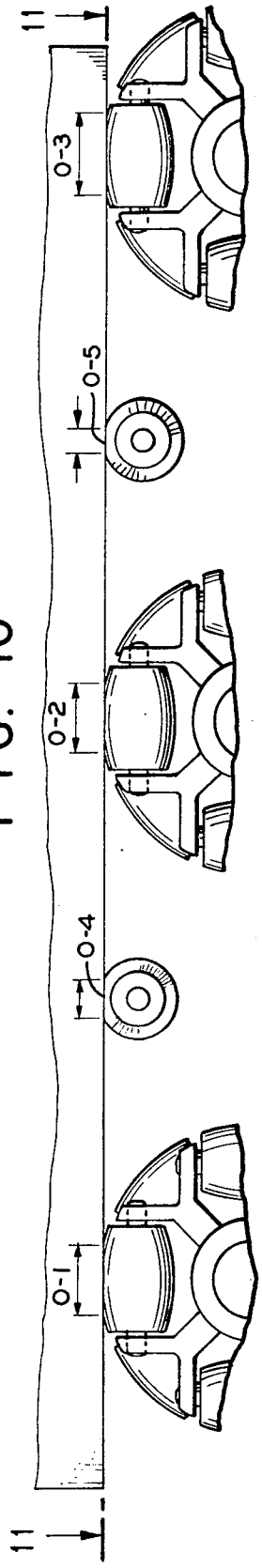


FIG. 10

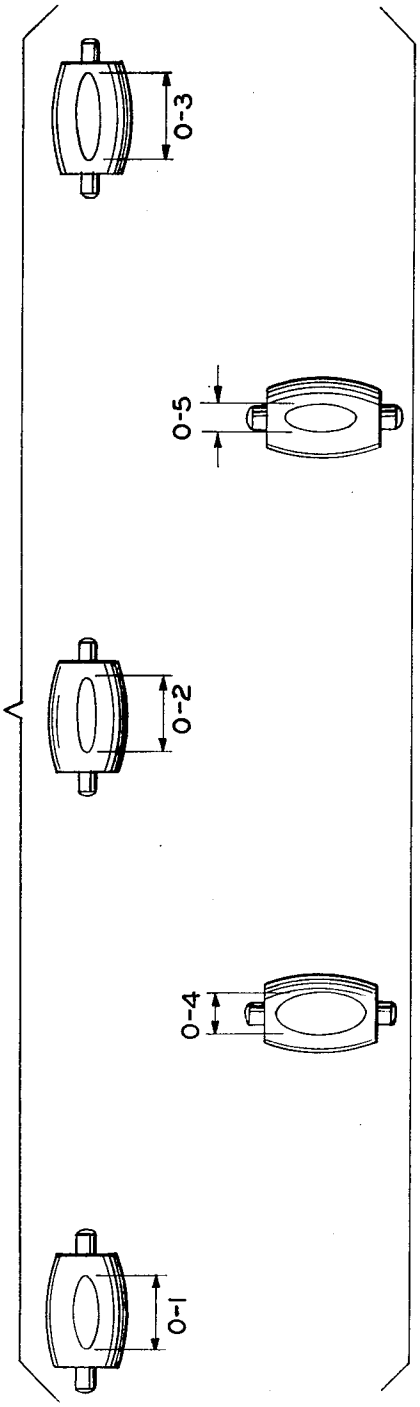


FIG. 11

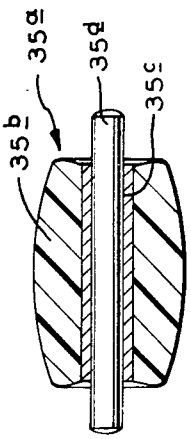


FIG. 12

INVENTORS.
HOWARD BLACK
MORTON A. BREIER

BY: Theodore M. Jablon

ATTORNEY.

CONVEYING APPARATUS

This invention relates to freight conveying apparatus for handling freight containers, pallets, or packages, and more particularly to the provision of a right-angle transfer station whereby the movement of the container is diverted from one horizontal direction into another horizontal direction perpendicular thereto.

Such a transfer station presents a horizontal transfer area of suitable rectangular configuration, receiving the container across one side, and delivering it across an adjoining side. This transfer station may be embodied in a variety conveyer apparatus or systems, for example in a plain cornering device, or in a main spur, for diverting the container onto one of a number of side spurs perpendicular to the main spur. Another embodiment is in a loading platform that may be of the stationary or of the mobile type.

The object is to provide a right-angle transfer station equipped with power-actuated means effective to move the container into position in the transfer area, and then move it off the transfer area in a direction perpendicular to the feed direction, and to provide such power-actuated means capable of positively tracking the container entering and leaving the transfer area.

Another object is to provide such a transfer station wherein the power-actuated means for moving the container are simple, compact, and accessible, and constructed so as to present minimum loading height.

To attain these objects, the invention provides in the transfer area two mutually complementary and cooperating systems of support and drive rollers mounted on a horizontal frame structure or beam construction. The one support and drive roller system is individually power driven so that the drive rollers will move the container into position in the transfer area, while the second or complementary roller system is kept at rest, although providing idle roller support for the entering movement of the container. The second roller system is individually power-driven to subsequently move the container in the perpendicular direction off the transfer area, while the first roller system in turn is kept at rest, although providing idling roller support for the outgoing movement of the container.

More in particular, the first drive roller system comprises a set of horizontally spaced shafts parallel to one side of the transfer area, while the second or complementary drive roller system comprises a set of horizontally spaced shafts extending at right angles to the first set of shafts, which shafts may be in a common plane therewith. Suitable power drive means are provided to drive each set of shafts individually, rotating these shafts simultaneously, and in the same direction.

Each of the shafts of the two roller systems carries a plurality of roller assembly units arranged so that the sum total of all roller units will provide numerous suitably spaced supporting points for the container or pallet within the transfer area. Each roller assembly unit comprises a suitable number of barrel-shaped idler rollers mounted peripherally upon a hub member which in turn is fixed to the respective shaft, namely in such a manner that the axis of rotation of each idler roller is located in a plane extending transversely at right angles to the shaft.

Thus when the shafts of the first roller system are driven with the second roller system kept at rest, the roller assembly units on the driven system, in effect acting as drive rollers, will move a container in the direction of rotation of the shafts by frictionally engaging the underside of the container. Meanwhile, the second or complementary roller system being kept at rest provides idling roller support and guidance for the incoming movement of the container. Then, after the container has reached its intended position in the transfer area, and the drive of the first roller system has been stopped, the second roller system will be actuated. Thus the roller assembly units of the second roller system in turn become in effect driving rollers moving the container off the transfer area in the perpendicular direction, with the first roller system now in turn providing roller support and guidance for the outgoing movement of the container.

Control means may be provided for automatically moving the container through the right-angle transfer station.

Such automotive timing control may comprise:

a. starting the first power drive effective to move the container into the transfer area,
b. stopping the first power drive with he container properly located in the transfer area,
c. starting the second power drive effective to move the container from the transfer area,
d. stopping the second power drive after the container has left the transfer area.

Suitable associated conveyer means may transport the container to and from the transfer station, while the two cooperating roller systems control the right-angle transfer movement through the transfer station.

Specific features are found in the manner in which the two roller systems are arranged and mounted in a supporting frame structure or beam construction, and in the arrangement of the power-actuated drive means for the respective roller systems.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiments are illustrative and not restrictive. The scope of the invention is defined by the appended claims rather than by the description preceding them, and all embodiments which fall within the meaning and range of equivalency of the claims are therefore intended to be embraced by those claims.

Still other features are concerned with the provision of a load supporting roller arrangement capable of moving the load even while guiding the same against lateral deviation.

FIG. 1 is a schematic plan view of the right-angle transfer station embodied in a cornering conveying apparatus, illustrating a single right-angle diversion movement of a container through a transfer station featuring two mutually complementary drive roller systems.

FIG. 2 is an enlarged further implemented plan view of the transfer station showing more fully the two mutually complementary drive roller systems, and the arrangement of drive means therefor.

FIG. 2*a* is a detail sectional view taken on line 2*a*—2*a* in FIG. 2, showing the chain drive means for the first roller system.

FIG. 2*b* is a sectional view taken on line 2*b*—2*b* of FIG. 2*a*.

FIG. 2*c* is a detail sectional view taken on line 2*c*—2*c* of FIG. 2, showing the chain drive means for the second roller system.

FIG. 2*d* is a similar sectional view of the second chain drive means, taken on line 2*d*—2*d* of FIG. 2.

FIG. 3 is a greatly enlarged detail plan view of the two drive roller systems, taken from FIG. 1 to illustrate their structural and functional inter-relationship.

FIG. 4 is a sectional view taken on line 4—4 in FIG. 3.

FIG. 5 is a sectional view taken on line 5—5 in FIG. 3.

FIG. 6 is a detail sectional view taken on line 6—6 in FIG. 4, showing the peripheral arrangement of a set of idler rollers of one of the individual roller assembly units.

FIG. 7 is a side view of the roller assembly unit, taken on line 7—7 of FIG. 6.

FIG. 8 is a perspective view of the roller assembly unit shown in FIGS. 6 and 7.

FIG. 9 shows another embodiment of the invention, wherein a container may be diverted from a main spur into a side spur perpendicular to the main spur.

FIG. 10 is a semi-diagrammatic vertical sectional view of the load-supporting drive roller arrangement, illustrating the operational effectiveness thereof.

FIG. 11 is a plane view taken on line 11—11 in FIG. 10.

FIG. 12 is a detail longitudinal sectional view of one of the rollers.

A right-angle transfer station emboding this invention is exemplified in a conveyer system of which a part or corner section is shown in the plan view of FIG. 1. This corner section comprises a right-angle transfer station 10 (see also FIG. 2) occupying a transfer area T (shown in dot-and-dash) of suitable rectangular or square-shaped configuration having sides S-1, S-2, S-3, and S-4. A feed conveyer 11 moves a freight container or pallet F from position P-1 in the direction of arrow A-1 towards and into the transfer area T. In this area, a set or system of drive rollers 12 moves the container to a stop in position P-2. Then, a second set or system of drive rollers 13 will move the container from the transfer area to a delivery conveyer 14 as indicated by container position P-3, that is in the direction of arrow A-2 perpendicular to directional arrow A-1.

As herein exemplified, both said drive roller systems are mounted on a horizontal frame structure or beam construction, so that both roller systems operate in a common plane, as well as substantially in the plane of the supporting frame structure. The two roller systems will be actuated sequentially or in alternation, whereby the second system will be started after the first system will have stopped.

The feed conveyer 11 has power driven tubular rollers 11a geared together in series, for moving the container F towards the transfer area T. The delivery conveyer 14 is of similar construction, comprising power driven tubular rollers 14a effective to move the container away from the transfer area T.

In the example of an embodiment illustrated in FIG. 2, the supporting frame structure B of transfer station 10 comprises a first set of parallel beams 15 extending parallel to sides S-2 and S-4 of the transfer area T. A second or transverse set of parallel beams 16 rigidly connect the beams 15 with one another, both sets of beams extending in a common plane, and in right-angle relationship to one another. The beams of box-shaped profile in cross-section are seen in detail FIGS. 4 and 5.

Mounted upon the frame structure is a first set of parallel horizontal drive shafts 17 carrying the drive roller units 12, and extending parallel to sides S-1 and S-3 of the transfer area, and substantially from end to end thereof. As herein exemplified, these shafts penetrate the beams through openings 18 (see FIG. 5), supported for rotation in bearings 19 fixed laterally to the beams. A chain drive for rotating these shafts simultaneously and in the same direction comprises drive chains 20, 21 and 22 (see also FIG. 2*a*) extending along and adjacent the side S-4 of the transfer area, and engaging respective sprockets R (see FIG. 2*a*) provided upon the ends of respective shafts. These chains and shafts in turn are driven from a countershaft 23 through chain 24 powered by a motor drive unit 25.

Referring now to detail FIG. 3 (which is the enlarged L-shaped portion L seen in FIG. 2) together with detail FIGS. 4 and 5, the shafts 17 themselves may be of a composite construction wherein short length 17*a* carry the drive rollers, supported midway in the aforementioned bearings 19 on the beams. These roller-carrying shaft sections 17*a* are connected axially to one another by intermediate lengths or shaft section 17*b* through flexible couplings or connectors 17*c*. Countershaft 23 may extend the length of shafts 17, being similarly supported for rotation on the beams, and in a common plane therewith. Drive rollers 26 may be provided on the counter shaft to aid in effecting transfer movement of the container from feed conveyer 11 into the transfer area T.

A second set of parallel horizontal drive shafts 27 carrying drive rollers extend at right angles to shafts 17, and thus parallel to side S-2 and S-4 of the transfer area. As herein exemplified, this set of transverse drive shafts comprise two identical groups G-1 and G-2 of parallel shafts mounted on respective beams 16 of the supporting frame, in a manner similar to the mounting of the shaft sections 17*a*. Each group of shafts 27 is rotated by two parallel rows of drive chains 28 and 28*a* respectively, mounted upon respective opposite ends of shafts 27. In this way, driving force is transmitted from one shaft 27 to the next, the first shaft 27 being driven from a counter shaft 29 through chain drives 30 and 30*a*, powered by a motor drive unit 31. Tubular drive rollers 32 may be provided on counter-shaft 29, aiding the transfer movement of the container from transfer area T to the delivery conveyer 14.

The drive roller units 12 and 13 carried by the respective sets of drive shafts 17 and 27 may be of identical construction. However, for purposes of this invention each such drive roller is in the form of an idling roller assembly unit 33 as shown in FIGS. 3, 4 and 5, and most clearly illustrated in the greatly enlarged detail FIGS. 6, 7 and 8. Accordingly, as herein exemplified, each of these roller assembly units 33 comprises a hub member 34 fixed to a respective shaft. Mounted side by side upon this hub member are two parallel sets E-1 and E-2 (see FIG. 7) of barrel-shaped idler rollers 35, arranged in staggered relationship relative to each other, and with the axes of the rollers located in planes extending perpendicular to the axis of the shaft. The staggered arrangement of the idler rol-

lers provides in effect a substantially continuous periphery as indicated by diameter D in FIG. 6, in effect equivalent to that of a simple driving roller. This idler roller unit need not be limited to the specific construction shown. Accordingly, each set of idler rollers in one plane may comprise either more or less than the four idler rollers shown. Also, more than two parallel sets of idler rollers may be assembled side by side instead of the two sets E-1 and E-2 shown in the example. It will furthermore be understood that the load herein referred to as a container, may comprise a pallet loaded with a plurality of containers.

According to FIG. 9, the invention is embodied in a conveyer system wherein a main spur 36 comprises a plurality of sequential or in-line right-angle transfer stations 37 each of which may be similar to the one shown in FIG. 2 described above, and containing the two individually driven sets of roller units.

In the operation of this system,a pallet or container moving along the main spur 36 may be stopped in a selected transfer station F-1 equipped with two independent motor drive units 38 and 39 corresponding to those previously described in FIG. 2. With appropriate controls, these motor units will move the pallet into a side spur or storage area 40 or 41, to the left or to the right, as indicated by double arrow A-3. Reversing the process, the pallet can be retrieved from these storage areas, as indicated by double arrow A-4 and A-5, for further handling by the main spur 36, with the subsequent in-line transfer stations then being controlled to cooperate in the manner of a straight conveyer. Each of the side spurs or storage areas is shown to have a pair of parallel conveyers 42 and 43 of the roller type, powered by respective motors 44 and 45.

As illustrated more particularly in FIGS. 10 and 11, the system of supporting rollers, constructed and arranged according to this invention provides uniform load distribution for the container, effective power driving engagement of the bottom face of the container by the rollers, as well as positive tracking guidance preventing lateral deviation or erratic movement of the container passing through the transfer area.

The foregoing qualifications of the support and drive roller system, according to this invention, are attainable due to the provision of rollers 35*a* (see FIG. 12) having a barrel-shaped body portion 35*b* of resiliently deformable material or elastomer, for example polyurethane, molded coaxially around a bushing 35*c* consisting of a suitable wear-resisting material, rotatable about a shaft 35*d*. This molded material not only has a relatively high frictional coefficient relative to the underside of the container, but at the contact point with container load the roller surfaces will somewhat flatten resiliently in the manner indicated by the oval areas 0-1, 0-2, 0-3, 0-4, 0-5 in FIGS. 10 and 11.

In addition the rollers thus constructed provide tracking guidance for the container being moved through the transfer area. Such tracking is mainly due to the guiding effect afforded by the sets of roller units that are idling, while the other set of roller units have frictional driving engagement with the container. Thus, in the operation, about half of all the roller load contact points will have frictional power drive engagement with the container, while the other half provides tracking guidance preventing lateral deviation or erratic movement of the container being moved through the transfer area. These combined functions are maintainable for example by the coordinated operation of two reversable motors alternatingly providing the driving force for the respective sets of rollers.

It will be understood that the system herein shown and described need not be limited to the details shown. For example, belt drive means may be employed instead of the chain drive means; instead of the two drive motors for the respective sets of roller units a single motor may be substituted together with suitable clutch mechanisms; driving power may be applied only partially, mainly to move the container into position in the transfer area, and then moving the container manually out of the transfer area in a direction of right-angles to the incoming positioning movement, or vice versa.

A transfer area containing the two sets of roller units, may also be employed for straight-through movement as illustrated in the system shown in FIG. 9, still with one set of roller units providing the forward driving force, and the other set of roller units providing the aforementioned tracking effect for the container.

The shafts carrying the roller assembly units, instead of penetrating the beams of the support structure, may also be mounted atop the beams or other suitable support structure.

OPERATION

Referring again to FIG. 1, it may be assumed that the feed conveyer 11 and the delivery conveyer 14 are running continuously, while the two drive roller systems involving the drive shafts 17 and 27 in the transfer station 10, need be actuated only when receiving a container, and then in alternation and in timed relationship so controlled as to divert the movement of an incoming container into a direction horizontally perpendicular thereto.

Accordingly, the timing or control of the power driven elements (see FIGS. 1 and 2) is such that, as the container enters the transfer area T, it encounters the drive roller units 33 on shafts 17 rotating in the direction of forward movement of the container. That is to say, a suitable starter switch or trip switch will have started the motor drive 25 driving these shafts, thus causing the roller units 33 to move the container into the transfer area until it encounters a limit switch stopping the motor drive 25, and arresting the container in position P-2. During this positioning movement the shafts 27 will have remained at rest, however with the roller units 33 thereon providing idling roller support of the container.

The end of this positioning movement signals the start of motor drive unit 31 causing the shafts 27 to rotate, and the roller units 33 thereon to act as drive rollers moving the container away from the transfer area and onto the delivery conveyer 14, however with the roller units 33 on shaft 17 meanwhile providing idling roller support for the container.

After the container has thus left the transfer area, the motor drive unit will be stopped to terminate the rotation of shafts 27. Thereupon the motor drive unit 25 may be started again to rotate shafts 17 in preparation for the arrival of the next container.

We claim:

1. A freight-handling right-angle transfer station which comprises

a horizontal rigid support structure representing a rectangular transfer area for a container, said support structure comprising a first set of beams extending parallel to one side of said transfer area, horizontally spaced from one another, and a second set of beams horizontally spaced from one another, and rigidly connected to said first mentioned beams in right-angle relationship therewith to constitute said rigid support structure, said two sets of beams extending in a common plane,

a first set of parallel shafts representing long shafts spaced from one another, extending across and supported by said first set of beams,

a second set of parallel shafts representing short shafts extending across and supported by said second set of beams, and in a common plane with said first long shafts,

a plurality of roller assembly units mounted on each of the drive shafts of said first and said second set of shafts, providing a system of multiple supporting points for the container throughout said transfer area, each said roller assembly unit comprising a hub member fixed on said shaft, a plurality of barrel-shaped idling rollers mounted peripherally on said hub member with the axis of each roller located in a plane extending transversely at right angles to the shaft, and with the barrel-shaped contour of said rollers constituting a substantially continuous circular periphery adapted for frictional driving contact with said container incident to rotation of said shafts,

first power-actuated drive means for said first set of shafts, operable to rotate said shafts together with their roller assembly units simultaneously in the same direction, thereby causing said roller assembly units to frictionally engage and move a container into position in said transfer area, with said second set of shafts kept at rest, but providing idling roller support for said container,

and a second power actuated drive means for said second set of shafts, operable to rotate said shafts together with their roller assembly units simultaneously at the same speed and in the same direction, thereby causing said roller assembly units to move the container from said position in the transfer area in a direction perpendicular to the direction of movement of the container towards said position, with said first set of shafts kept at rest, but providing idling roller support as well as tracking guidance for said container.

2. The right-angle transfer station according to claim 1, wherein the common horizontal plane of said long shafts and said short shafts is located intermediate the top face and the bottom face of said support structure.

3. The right-angle transfer station according to claim 1, with the addition of a series of similar right-angle transfer stations placed in line with said first transfer station, and operable as a main spur for the movement therealong of a container, side spurs cooperatively connected to respective transfer stations, said transfer stations of the main spur being selectively operable to cause a container moved along said main spur to be diverted into a respective side spur, or conversely from a side spur into a main spur,

4. In a freight handling conveyer system for moving freight containers or the like, a right angle transfer station which comprises a horizontal support structure representing a rectangular shaped horizontal transfer area, said support structure comprising a first set of beams extending parallel to one side of said transfer area, and spaced substantially evenly relative to one another as well as relative to said transfer area, and a second set of beams rigidly interconnecting the first mentioned beams so as to constitute therewith a rigid support structure, with both sets of beams extending in a common plane,

a first set of parallel shafts extending across said first set of beams substantially from end to end of said transfer area, and in horizontally spaced relationship to one another, and mounted for rotation on said shafts,

a second set of parallel shafts extending at right angles to said second set of beams and at right angles to said first set of shafts and in a common plane therewith, said second set of shafts being mounted for rotation on said second set of beams so that the end portions of said shafts are overhanging from respective supporting beams,

a plurality of freight supporting roller assembly units mounted on each of said sets of shafts, and providing a system of multiple supporting points for the container, substantially uniformly distributed over said transfer area, each said roller assembly unit comprising a hub member fixed on said shaft, a plurality of barrel-shaped idling rollers mounted peripherally on said hub member, with the axis of each said roller located in a plane extending transversely at right angles to the shaft, and with the barrel-shaped contours of said rollers constituting a substantially continuous circular periphery adapted for frictional driving contact with said container incident to rotation of said shaft,

first power-actuated drive means for said first set of shafts, operable to rotate said shafts together with their roller assembly units so as to cause said roller assembly units by frictional engagement to move a container into position in said transfer area, with said second set of shafts kept at rest, but providing idling roller support for said container being moved into said position,

and second power-actuated drive means for said second set of shafts, operable to rotate said shafts together with their roller assembly units by frictional engagement to move the container from said position in the transfer area in a direction substantially perpendicular to the direction of movement of the container towards said position, with said first set of shafts kept at rest, but providing idling roller support for said container being moved from said position.

5. The right-angle transfer station according to claim 5 wherein both said first and said second set of shafts extend in a common plane with said support structure.

6. The right angle transfer station according to claim 4, wherein said first drive means comprise a first motor drive unit, a countershaft to be driven by said motor unit, and extending parallel to said first set of shafts at one side of said transfer area, and first drive means for transmitting rotation from said counter shaft to said first set of shafts, and comprising individual motion transmitting drive means, arranged in series along the

adjacent side of the transfer area, and in such a manner that each shaft is driven by the preceding shaft,

and wherein said second drive means comprise a second motor unit, a countershaft to be driven by said motor unit, and extending along the side of said transfer area, which is opposite to said first drive means, and second motion transmitting means for transmitting rotation from said countershaft to said second set of shafts, and comprising individual drive arranged in series parallel to said first set of shafts, and in such a manner that each shaft is driven by the preceding shaft.

7. The transfer station according to claim 6, wherein said individual drive means for said second set of shafts are so arranged that one set of said drive means mounted upon one end portion of the shafts is staggered relative to a second set of said drive means mounted upon the opposite end portion of the shafts, said two sets of drive means thus being located on respective opposite sides of the supporting beam.

8. A freight handling right-angle transfer station which comprises

a horizontal support structure representing a rectangular horizontal transfer area for a container,

a first set of drive shafts parallel to one side of said transfer area, mounted on said support structure in parallel spaced relationship,

a second set of drive shafts mounted on said support structure in parallel spaced relationship to one another, and extending at right angles to said first set of shafts,

a plurality of roller assembly units which comprises a first and a second set, said sets being mounted respectively on the drive shafts of said first and said second set, providing a system of multiple supporting points for the container throughout said transfer area, each said roller assembly unit comprising a hub member fixed on said shaft, a plurality of barrel-shaped idling rollers mounted peripherally on said hub member with the axis of each said roller located in a plane extending transversely at right angles to the shaft, and with the barrel-shaped contours of said rollers constituting a substantially continuous circular periphery adapted for frictional driving contact with the underside of said container incident to rotation of said shafts, said rollers comprising a barrel-shaped body portion of elastically deformable frictionally effective material, and a bushing coaxially surrounded by said material and bonded thereto, the elastic deformability of said material being such as to allow for uniform distribution of the load to the roller units supporting said container, due to respective flattened frictional contact areas occurring between the supporting roller units and said container, by elastic deformations,

a first power-actuated drive means for said first set of shafts, operable to rotate said shafts together with their roller assembly units simultaneously in the same direction, thereby causing said roller assembly units to positively frictionally engage and move a container into an end position in said transfer area, while said second set of shafts is kept at rest, although providing idling roller support as well as positive tracking guidance for said container being moved to said end position,

a second power-actuated drive means for said second set of shafts, operable to rotate said shafts together with their roller assembly units simultaneously and at the same speed and in the same direction, thereby causing said roller assembly units to move the container from said end position in the transfer area in a direction perpendicular to the direction of movement of the container towards said position, while said first set of shafts is kept at rest, although providing idling roller support as well as positive tracking guidance for said container being moved from said position,

a feed roller section at one side of the rectangular transfer area for moving the load container into said transfer area,

means for actuating said first set of rollers to cooperate with said feed roller section in moving said container into said area,

means for stopping the operation of said first set of rollers when said container reaches a predetermined position in said area,

means for starting the operation of said second set of rollers for moving the load container out of said transfer area,

a delivery roller section cooperating with said second set of roller units in moving the load container out of said transfer area,

and means for stopping the operation of said second set of rollers.

9. The apparatus according to claim 8, with the addition of automatic control means for moving said container automatically into and out of said transfer area.

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