United States Patent [19]

Ribordy

[11] **3,858,626**

[45] **Jan. 7, 1975**

[54] **CONVEYOR SYSTEM**

[75] Inventor: **James E. Ribordy,** South Beloit, Ill.

[73] Assignee: **Rockford Automation Inc.,** Rockford, Ill.

[22] Filed: **Nov. 7, 1973**

[21] Appl. No.: **413,568**

[52] **U.S. Cl.** **104/166,** 104/252, 198/19

[51] **Int. Cl.** **B61b 13/00**

[58] **Field of Search** 104/165, 166, 249, 252, 104/99; 74/25, 190; 198/19

[56] **References Cited**

UNITED STATES PATENTS

2,619,916	12/1952	Rainier	104/249 X
3,118,393	1/1964	Ohlin	104/166
3,120,761	2/1964	Pravel	74/25
3,696,890	10/1972	Armstrong	104/249 X

FOREIGN PATENTS OR APPLICATIONS

1,025,997	4/1953	France	74/25

Primary Examiner—Lloyd L. King
Assistant Examiner—Randolph A. Reese
Attorney, Agent, or Firm—Morsbach & Pillote

[57] **ABSTRACT**

The conveyor system propels pallets by frictional contact between a rotating drive shaft and a drive wheel carried by the pallet. The drive wheel is pivotally mounted for movement between a drive position oblique to the drive shaft axis and a stop position with the wheel axis parallel to the drive shaft axis. Stops are selectively positioned to engage an arm connected to the drive wheel and move it to the stop position. The arm is provided with three vertical positions; a lower position where it passes the stop, an intermediate position where it engages the stop, and an upper position where it is released from the stop. Each pallet is provided with a rearwardly facing stop to engage the arm and prevent collision between the pallets.

20 Claims, 15 Drawing Figures

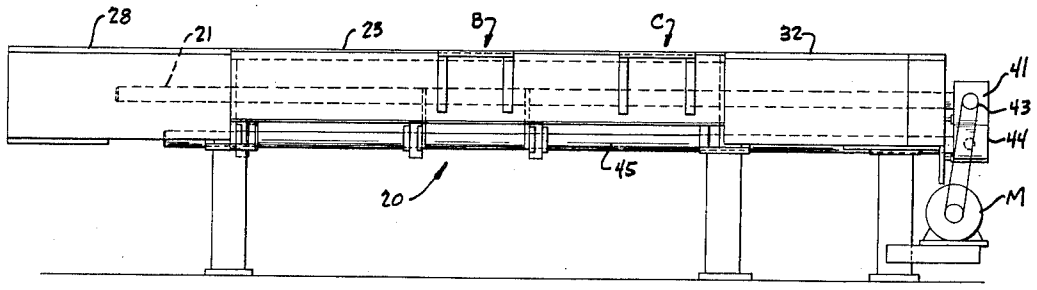


Fig. 2.

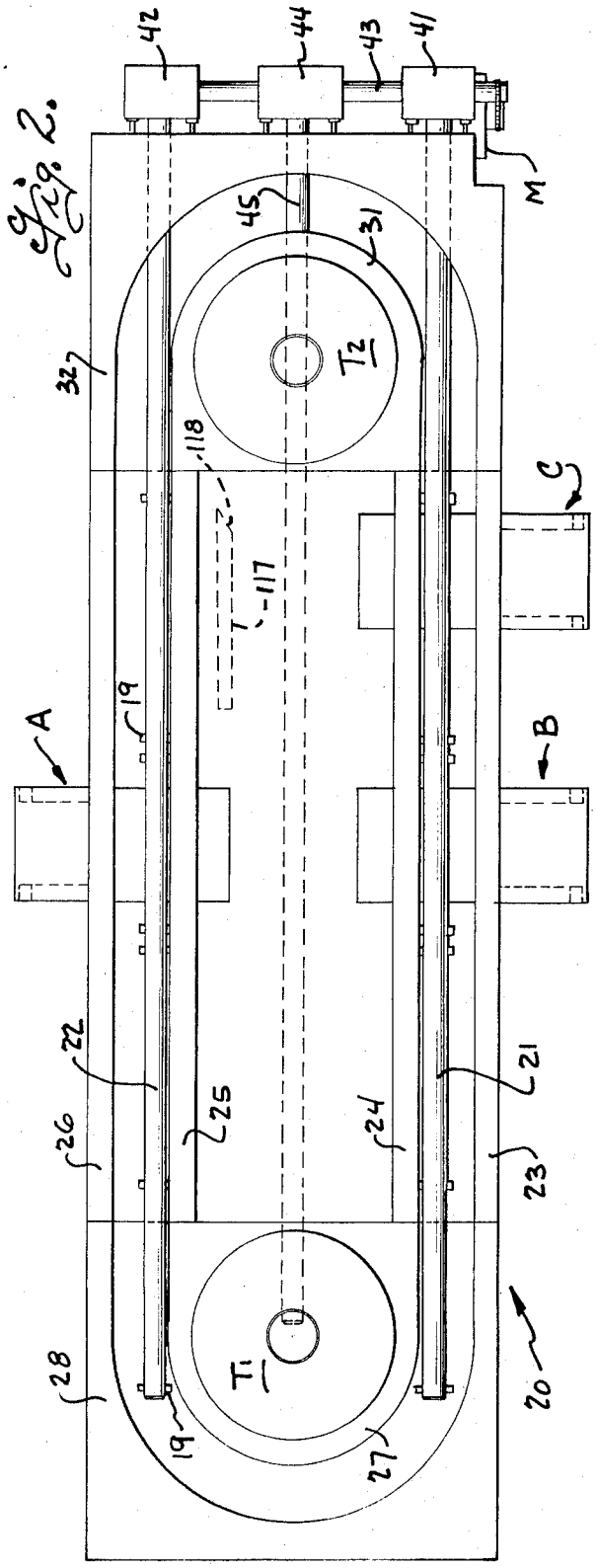

42
44
43
41
M
45
31
32
T2
118
117
C
A
19
B
22
25
26
24
21
23
28
T1
20
27

Fig. 1.

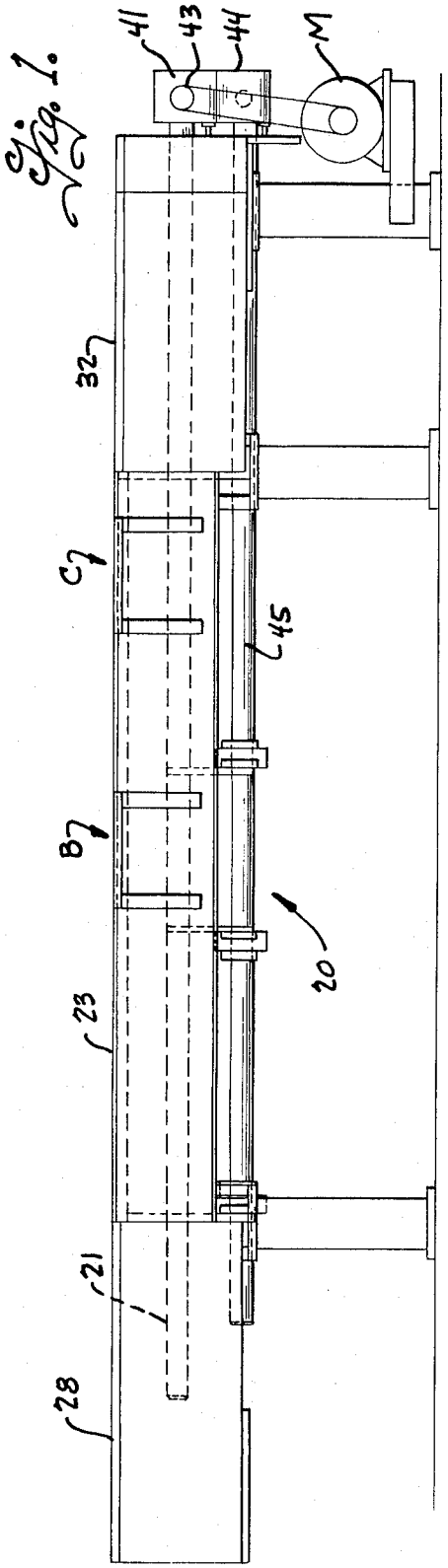

41
43
44
M
32
C
45
B
20
23
21
28

Fig. 3.

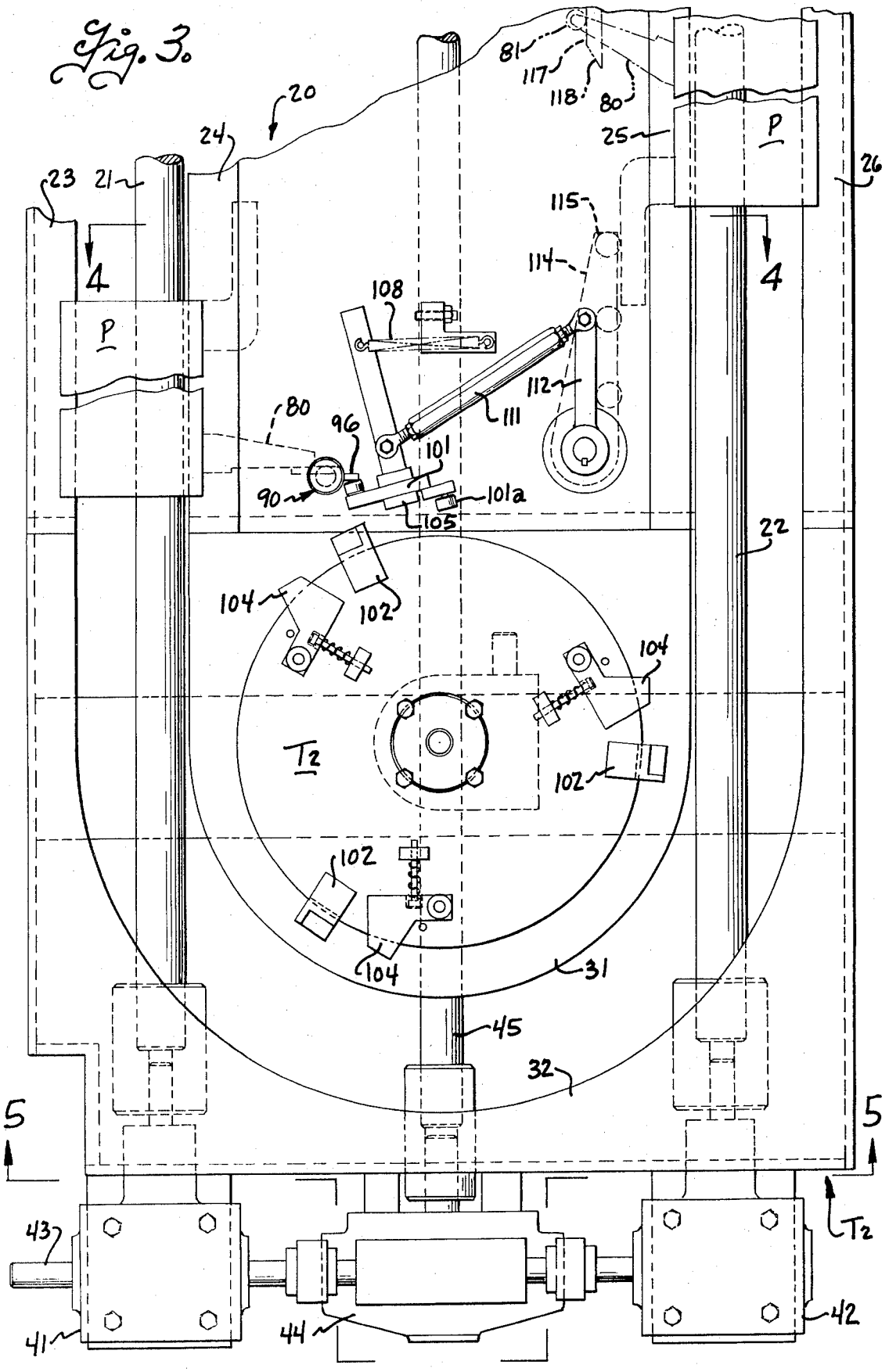

81
117
118
80
20
24
25
P
26
23
21
4
115
114
4
108
P
112
80
96
111
101
90
101a
105
22
104
102
104
T2
102
102
104
31
45
32
5
5
T2
43
41
44
42

Fig. 4.

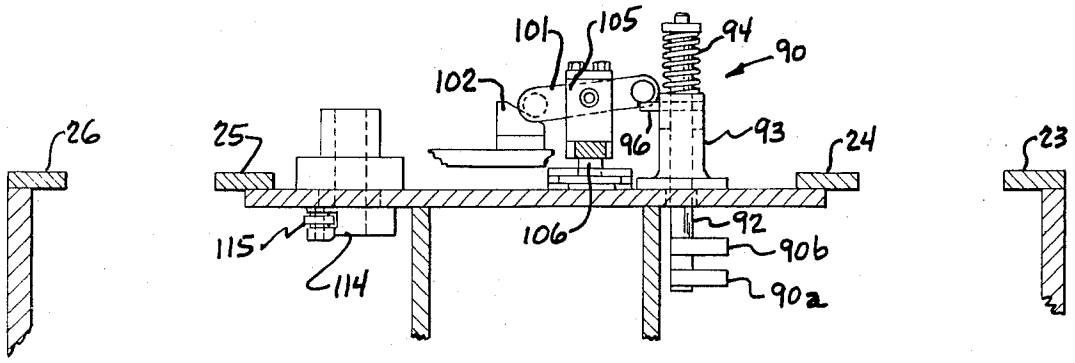
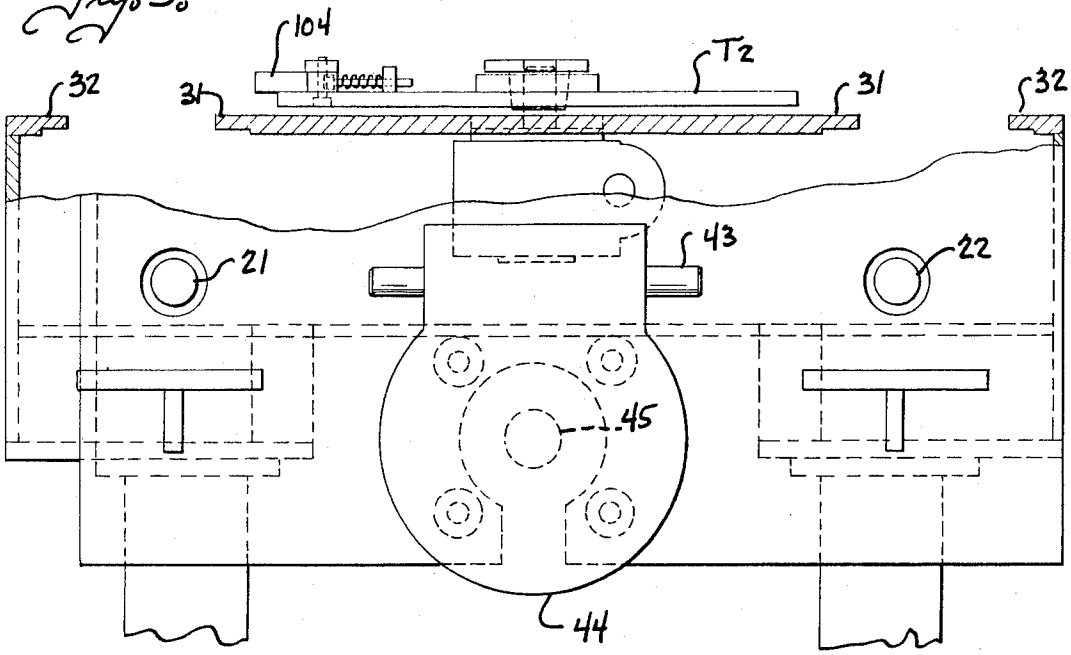

101
105
94
90
102
96
93
26
25
24
23
92
106
115
114
90b
90a

Fig. 5.


104
T2
32
31
31
32
43
21
22
45
44

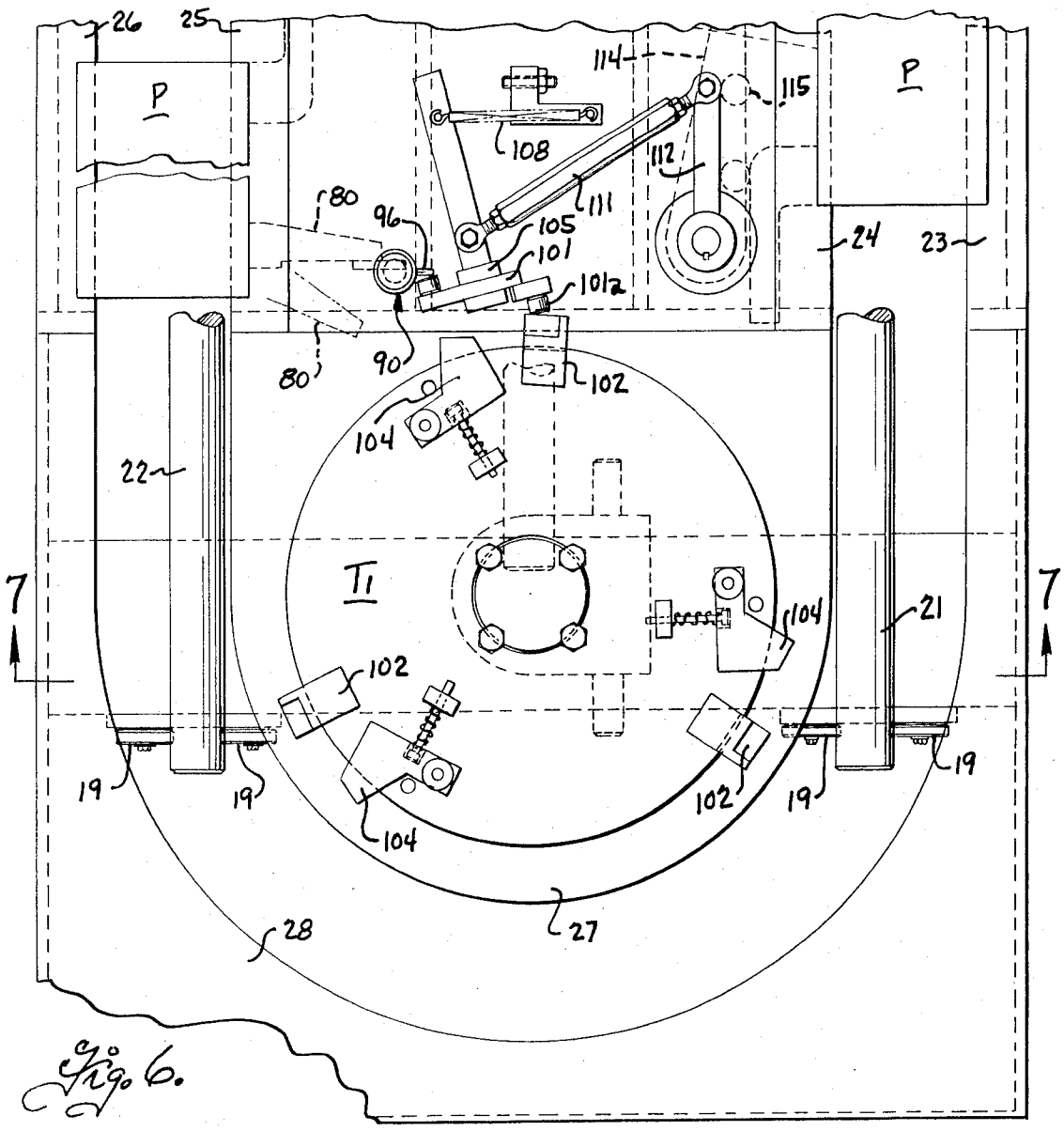

26
25
P
P
114
115
108
112
111
80
96
105
101
101a
24
23
80
90
102
104
22
T1
7
7
104
21
102
102
19
19
19
19
19
104
28
27

Fig. 6.

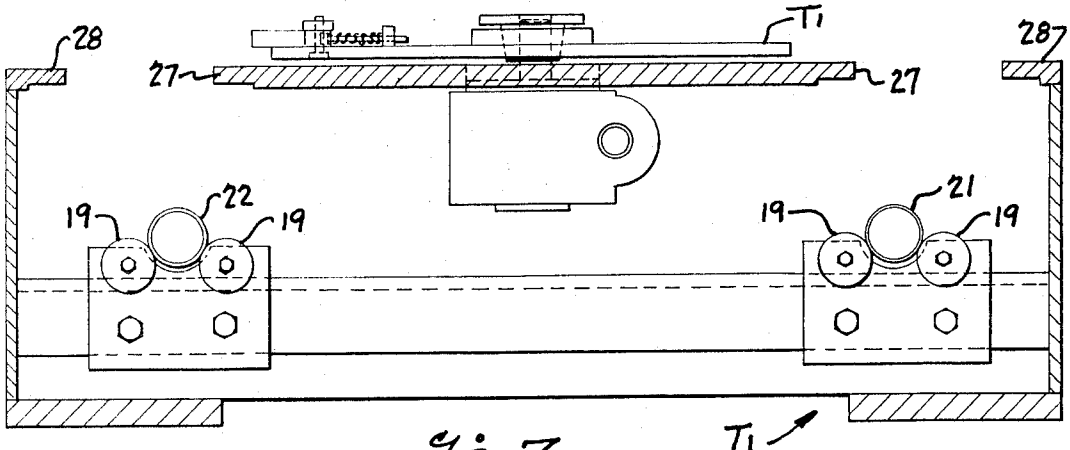

28
T1
28
27
27
19
22
19
19
21
19
T1

Fig. 7.

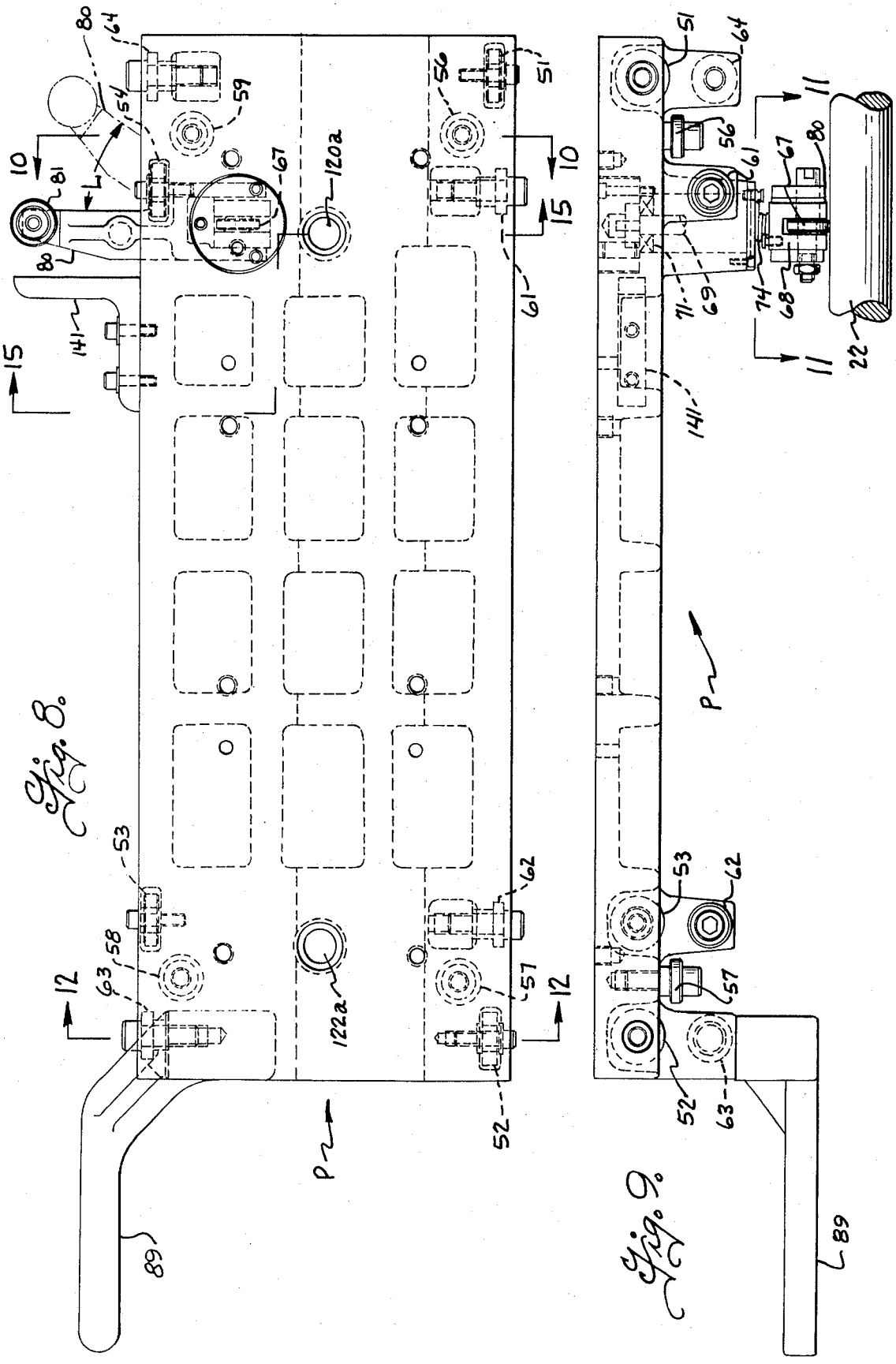
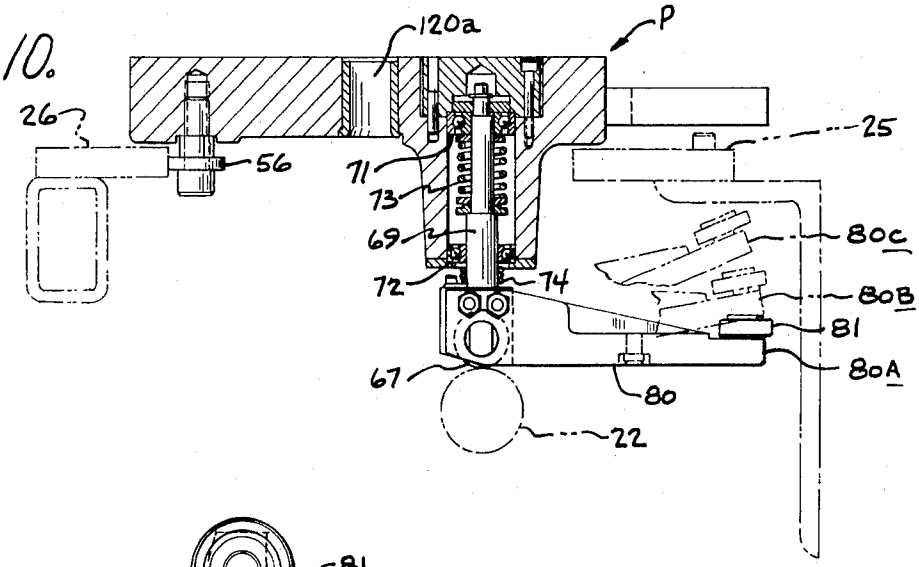

80
64
54
59
67
120a
56
51
10
81
L
80
61
15
141
15
53
58
63
12
122a
62
57
12
52
P
89
51
64
56
61
67
80
11
69
71
74
68
22
11
141
P
53
62
57
52
63
89

Fig. 8.

Fig. 9.

Fig. 10.



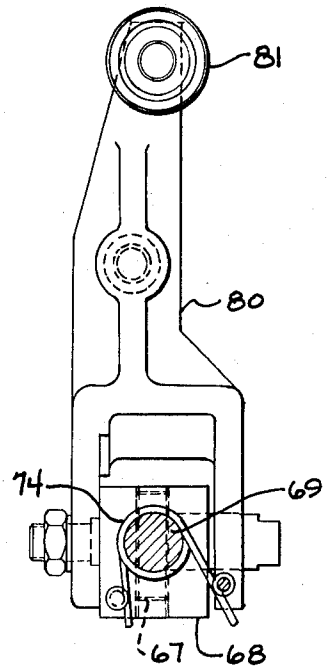


Fig. 11.

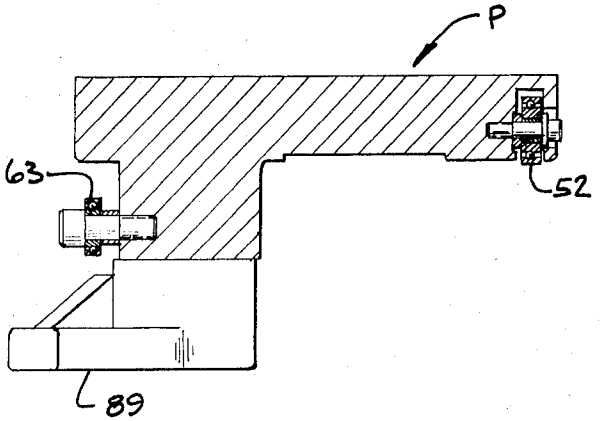


Fig. 12.

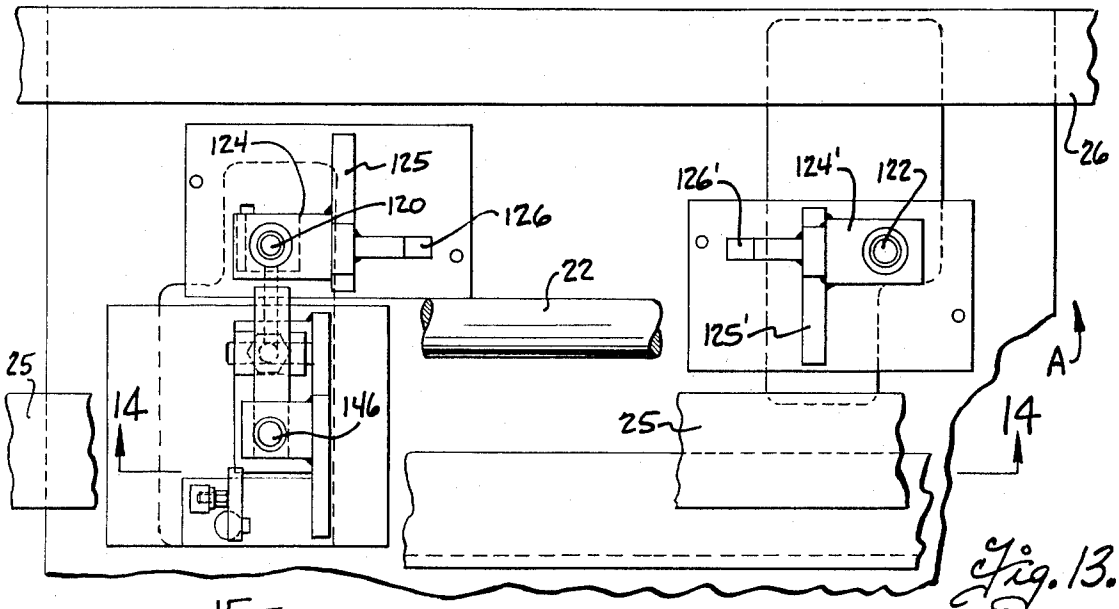

124
125
120
126
22
126'
124'
122
26
125'
A
25
14
146
25
14

Fig. 13.

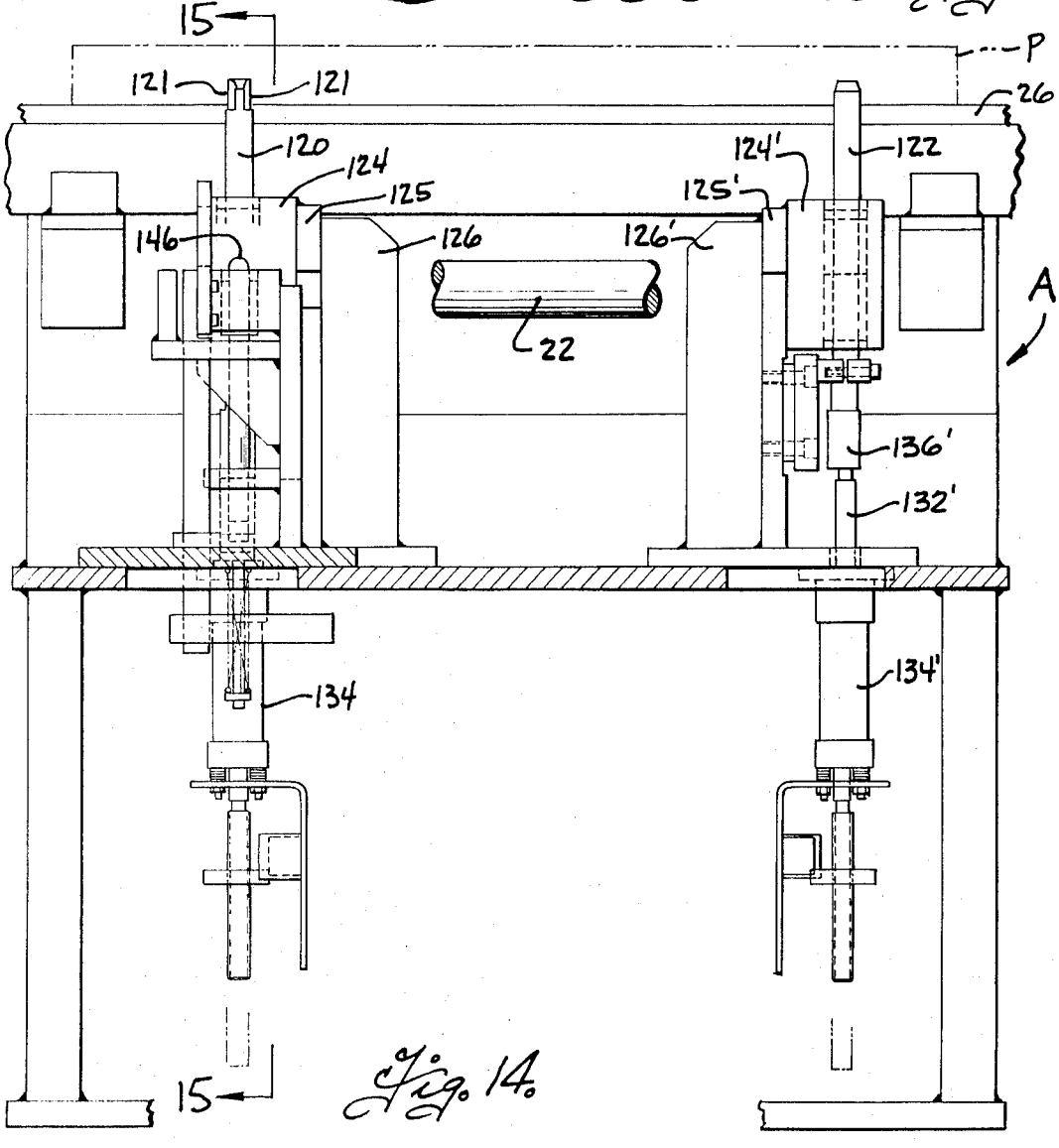

15
P
121
121
26
120
124
125
124'
122
125'
146
126
126'
A
22
136'
132'
134
134'
15

Fig. 14.

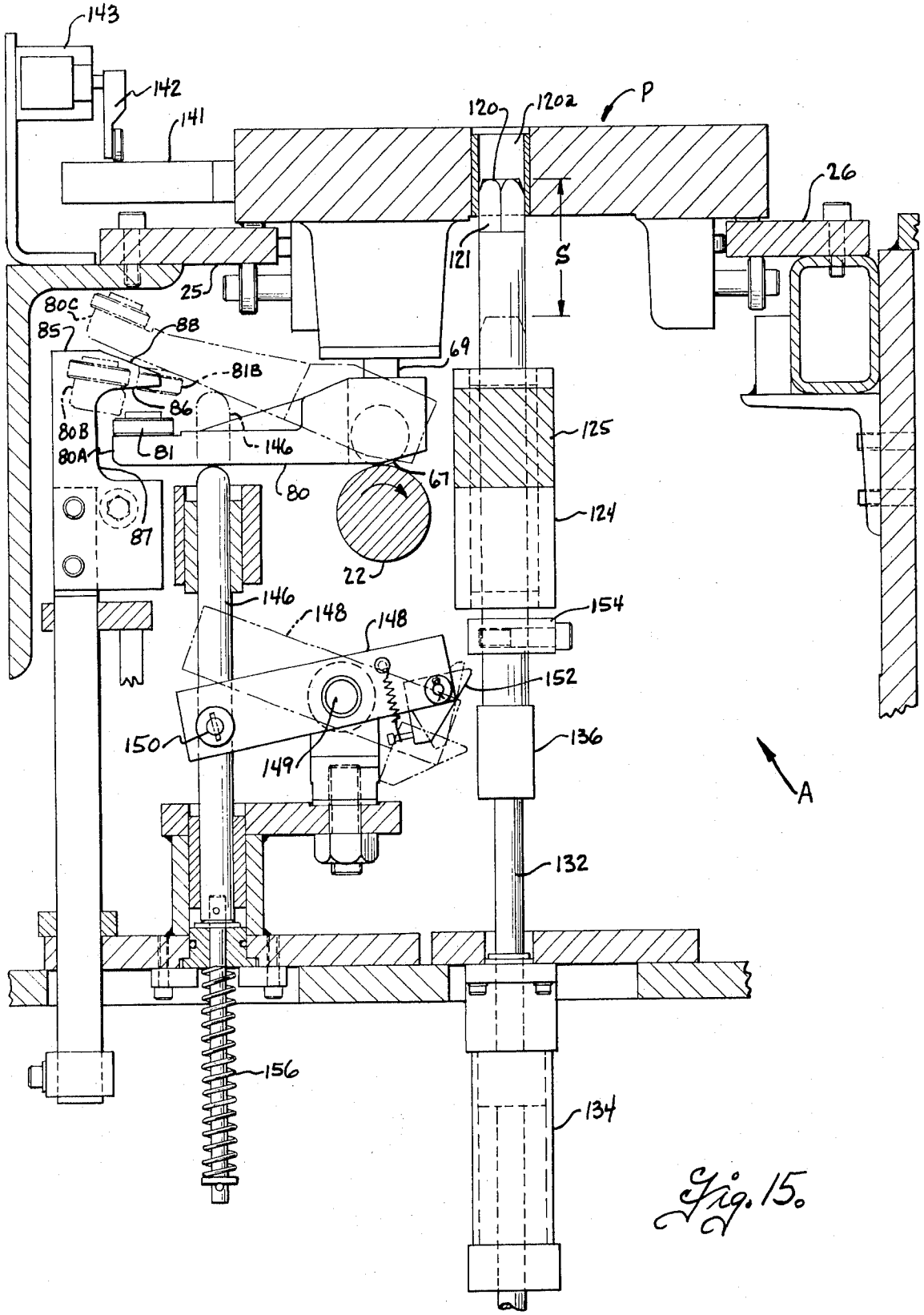

143
142
141
120
120a
P
26
121
S
25
80C
85
88
69
81B
86
80B
80A
81
146
125
124
67
80
87
22
146
148
148
154
152
150
149
136
A
132
156
134

Fig. 15.

CONVEYOR SYSTEM

BACKGROUND

The invention pertains to conveyor systems and more particularly, to a conveyor system in which propulsion is achieved by traction between a drive wheel and a longitudinal rotary shaft.

One early patent disclosing a rotary drive shaft and a pair of travelling friction wheels engaged therewith at an angle to its axis, was issued May 7, 1889 to Whitcomb R. Judson, U.S. Pat. No. 402,674. This mechanical movement has been adapted for street railways (see U.S. Pat. No. 423,872 issued Mar. 18, 1890 to said Judson); for air pressure controls (see U.S. Pat. No. 2,578,026 issued Dec. 11, 1951 to Daniel G. Taylor); for door openers (see U.S. Pat. No. 2,619,346 issued Nov. 25, 1952 to Warren F. Weathers); and for conveyor systems (see U.S. Pat. No. 3,356,040 issued Dec. 5, 1967 to Per Borje Fonden). In a conveyor system it is frequently desirable to stop a pallet or support at a work station and to quickly and easily accelerate it away from the work station. Sometimes it is desirable to allow selective pallets to pass a stop as, for example, when no work is to be performed on the workpiece carried by the pallet.

SUMMARY

The present invention relates generally to improvements in conveyor systems of the type having a longitudinal rotary shaft and a drive wheel frictionally engaged therewith.

It is an object of the present invention to provide a conveyor system in which a pallet or support is quickly and easily accelerated and decelerated.

Another object of this invention is to provide a conveyor system of the type described in which the angular position between the drive wheel and rotary shaft is selectively controlled.

Still another object is to provide a conveyor system in accordance with the foregoing object in which the position is controlled by an arm operatively connected to the drive wheel. Yet another object is to provide a conveyor system in accordance with the above objects and including a stop for engaging the control arm to stop the pallet or support and in which the arm and stop may be moved relative to each other to allow the pallet to again be driven.

A further object is to provide apparatus in accordance with the foregoing object in which the control arm is mounted for movement between a stop position and at least one other position spaced therefrom.

A still further object is to provide a conveyor system in accordance with the above objects in which a plurality of pallets or supports are driven, and including apparatus to prevent collision between adjacent pallets.

A yet further object of the present invention is to provide a conveyor system in accordance with the foregoing object and including means mounted on each pallet to engage the arm of a successive pallet in various positions of the arm.

These, and other objects and advantages of the present invention, will become apparent as the same becomes better understood from the following detailed description when taken in conjunction with the accompaning drawings.

DRAWINGS

FIG. **1** is a front elevation of a machine incorporating the present invention;

FIG. **2** is a top plan view thereof;

FIG. **3** is a fragmentary top plan view of the right hand end of the apparatus shown in FIG. **2**, and on an enlarged scale;

FIG. **4** is a cross-sectional view taken generally along line **4—4** of FIG. **3**;

FIG. **5** is a view taken generally along broken line **5—5** of FIG. **3** and with portions broken away for a better illustration of the parts;

FIG. **6** is a fragmentary top plan view of the left hand end of the apparatus shown in FIG. **2**, and on an enlarged scale;

FIG. **7** is a cross-sectional view taken generally along line **7—7** of FIG. **6**; **0**

FIG. **8** is a top plan view of a pallet or support constructed in accordance with the present invention;

FIG. **9** is a front elevation of the pallet shown in FIG. **8**;

FIG. **10** is a cross-sectional view taken generally along line **10—10** of FIG. **8** and showing portions of the machine as well as positions of the control arm in phantom lines;

FIG. **11** is a top view of the control arm as seen from line **11—11** in FIG. **9**;

FIG. **12** is a cross-sectional view taken along line **12—12** of FIG. **8**, but showing the rearwardly extending stop in elevation;

FIG. **13** is a top plan view of a work station constructed in accordance with the present invention;

FIG. **14** is a longitudinal sectional view taken generally along line **14—14** of FIG. **13**; and

FIG. **15** is a cross-sectional view taken along line **15—15** of FIG. **14** and with the cross-section through the pallet being taken along broken line **15—15** of FIG. **8**.

DESCRIPTION

Reference is now made more particularly to the drawings which illustrate the best presently known mode of carrying out the invention and wherein similar reference characters indicate the same parts throughout the several views.

Referring to FIGS. **1** and **2**, a machine indicated generally by the numeral **20** has two longitudinal rotatable drive shafts **21** and **22** mounted parallel to each other. The drive shafts **21** and **22** are journaled in a plurality of spaced rollers such as shown at **19** in FIGS. **6** and **7**. The rollers are located so the tops of the shafts are unobstructed for a purpose hereafter explained. A pair of spaced tracks **23** and **24** are arranged parallel to shaft **21** to define a pathway along which pallets P may move. At the left end of the machine, as seen in FIG. **2**, is a turntable T1 associated with an inner arcuate track **27** which interconnects tracks **24** and **25**; and an outer arcuate track **28** which interconnects tracks **23** and **26**. Similarly, at the right end of the machine is a turntable T2 associated with an inner arcuate track **31** interconnecting tracks **24** and **25**; and an outer arcuate track **32** interconnecting tracks **23** and **26**. In this manner, the tracks form a definite trackway or pathway in the form of a closed loop conveyor.

A motor M is arranged to drive gear boxes **41** and **42** connected to shafts **21** and **22**, respectively, by means

of a transverse drive shaft **43.** A third gear box **44** is located intermediate the other two gear boxes to rotate a third shaft **45** to drive the turntables T1 and T2. A plurality of work stations, such as shown at A, B and C, are provided at spaced locations along the tracks. One of the pallets P, carrying a workpiece, can be advanced to one of the work stations where the pallet is stopped and an operation performed on the workpiece. By way of example, the work station may have a unit such as disclosed in U.S. Pat. No. 3,609,839 issued Oct. 5, 1971 to J. T. Gonzales et al., and assigned to the assignee of the present invention. The unit disclosed in that patent may be advantageously driven from shaft **45** if desired. After the operation is performed on the workpiece, the pallet is then conveyed to a succeeding station. The manner in which the pallet is stopped at the work station and conveyed away from the work station is hereafter described in detail.

Referring now to FIGS. **8–12,** the pallet or support P will be described in detail. For reference, it should be understood that the front end of the pallet is shown at the right in FIGS. **8** and **9,** while the rear end is at the left. Each pallet is provided with a plurality of wheels **51-54** which engage the upper side of the trackway. Since the trackway shown in FIGS. **1** and **2** contains an arcuate portion, wheels **53** and **54** are positioned nearer each other so that they can track around the smaller radius rails **27** and **31.** Four other wheels **56-59** are mounted for rotation about a vertical axis to engage the inner edge of the rails and prevent side sway of the pallet as it is conveyed. Finally, four wheels **61-64** are provided for engaging the bottom side of the tracks. In this manner, the pallets are conveniently permanently mounted in the trackways with the utmost stability.

Each pallet P is provided with a freely rotatable driving wheel **67** which is pressed against the top of the driving shaft **21** or **22.** Wheel **67** is rotatably mounted in a yoke **68** (see FIG. **9**) at the lower extremity of a shaft **69** (see FIG. **10**). Shaft **69** is rotatably mounted in bearings **71** and **72** and the wheel **67** is pressed against the drive shaft by means of a compression spring **73,** circumjacent shaft **69.** A helical tension spring **74** exerts a force on the yoke **68** to resiliently urge the axis of rotation of the driving wheel **67** at an angle relative to the axis of rotation of the drive shaft, the driving wheel and drive shaft being so oriented that the drive wheel in the angular position thereof contacts the drive shaft along a horizontal tangent thereto. When the drive shaft **21** or **22** is rotated, the wheel **67** will roll against the drive shaft. When the axis of the wheel **67** is disposed at an angle, for example 35°, to the axis of the drive shaft, the rotation of the latter produces a longitudinal force on the drive wheel. This longitudinal force is the driving force of the pallet and the drive wheel will follow a helical path along the drive shaft.

An outwardly extending arm **80** is connected to the yoke **68** and extends past the side of the pallet as best seen in FIG. **8.** The arm **80** is thus swingable with the drive wheel **67** and moves between a stop position shown in solid lines in FIG. **8** and a drive position shown in phantom lines in FIG. **8** and disposed at an angle L which is the aforementioned **35** degrees. Stops may be associated with the pallet assembly to limit the movement between the two aforementioned positions. The arm **80** advantageously carries a roller **81** at its outer extremity for a purpose which will hereafter become apparent.

Referring now to FIGS. **10** and **15,** it can be seen that the arm **80** can assume three different vertical positions, **80A, 80B, 80C,** the latter two of which are shown in phantom lines in those FIGS. A stop, as indicated at **85** in FIG. **15** may be provided at each station. In the intermediate vertical position **80B,** the arm **80** is initially at the drive position and the roller **81** will engage the stop **85** as shown at **81B** in FIG. **15,** and swing the arm **80** and wheel **67** to the aforementioned stop position. When lifted to the uppermost position **80C,** it can be seen that the arm **80** will pass over the stop **85.** Torsion spring **74** will then urge the arm **80** to the aforedescribed drive position and the pallet will then be driven away from the stop. The lowermost position **80A** may be considered a by-pass position since the arm will proceed past the stop **85** in this position. Preferably, the stop **85** is shaped for this purpose. As shown, the stop **85** is generally C-shaped, having a roller engaging leg **86** and a recessed portion **87.** The upper edge **88** is inclined downwardly at an angle about tangent to drive shaft **22** to allow clearance for arm **80** when in the uppermost position **80C.** A detent (not shown) may be provided to hold the arm **80** in the lower position **80A.** The lower position is a particularly advantageous position since the pallet P will then bypass all work stations. This may be utilized, by way of example, when the workpiece carried by the pallet has been rejected and no further operations are to be performed thereon. In this manner, any pallet with its arm in the bypass position **80A** is ignored by the work stations and causes no delay in the operation thereof.

Referring again to FIGS. **8, 9** and **12,** it can be seen that each pallet has a rearwardly extending stop **89** which engages the arm **80** of a succeeding pallet P. It should be understood that the arm **80** preferably engages the stop **89** in all of its above-mentioned vertical positions; however, it is absolutely necessary that it engages the stop **89** in the two lower positions **80A, 80B** to stop a succeeding pallet from running into the preceding pallet. This is advantageous when the preceding pallet has been stopped at a work station. This combination also allows the pallets to be moved independently of each other without any other controls along the conveyor system.

A stop arrangement, generally designated **90,** is provided at the entrance of each turntable T1 and T2 to stop the incoming pallet P if there is another pallet at the outlet of the turntable. As best shown in FIG. **4,** the stop arrangement **90** includes an upright shaft **92** slidably mounted through a support **93** and resiliently urged by a compression spring **94** to a raised position. At the lower end of shaft **92** are stop fingers **90*a*** and **90*b*** for engaging the roller **81** when the arm is in positions **80A** and **80B,** respectively. An actuating finger **96** is provided intermediate the ends of shaft **92** and is associated with an actuating arm **101** which is pivotally mounted intermediate its ends. A plurality of ramps **102** are mounted around the periphery of the turntables T1 and T2. The ramps are arranged to engage a roller **101*a*** and cause the actuating arm **101** to be moved to an actuating position to depress the shaft **92.** In this manner, the stops **90*a*** and **90*b*** are moved to a release position allowing a pallet to be advanced into the turntable. A plurality of L-shaped fingers **104** are arranged around the periphery of the turntable and

may engage a roller or detent (not shown) on the pallet P and feed it from drive shaft **22** to drive shaft **21** in the case of turntable T1 and vice versa for turntable T2. Other mechanism may be used for the turntable if desired, for example, a belt conveyor, a chain conveyor, or the like.

As indicated previously, actuating arm **101** is movable between an actuating position to engage finger **96** an an inoperative position which is illustrated in FIGS. **3** and **6.** For this purpose, actuating arm **101** is swingably mounted on a yoke **105** which is pivotally mounted by an upright shaft **106.** The entire mechanism is urged to the actuating position by spring **108,** and is moved to the inoperative position by means of lever arms **111** and **112** in response to a pallet P at the outlet of the turntable. Such a pallet may be sensed by an electric eye or other arrangement and, in the embodiment shown, its position is mechanically sensed. As shown, a sensing arm **114** carrying a plurality of rollers **115** is rigidly secured to arm **112.** The rollers **115** are positioned for engagement by the side of pallet stop **89** as can be seen in FIGS. **3** and **6.** The engagement by the pallet stop **89** deflects arm **114** inwardly thereby transmitting motion through arms **112** and **111** to pivot the actuating arm **101** to an inoperative position.

In addition to starting or stopping the movement of the pallet P, it is also possible to control its movement at a lesser speed than maximum. This may be accomplished by controlling the angle of inclination between the axis of the drive wheel **67** and the axis of the drive shaft **21** or **22.** For this purpose, a cam surface **117** may be provided generally parallel to one of the drive shafts, as shown in FIGS. **2** and **3.** The cam surface preferably has a tapered inlet **118** to engage the roller **81** and another surface spaced from the drive shaft **22** a distance so that the roller **81** will keep the arm **80** at the desired angle to the drive shaft. By so doing, the speed of the pallet can be selectively reduced through a given zone. This is advantageous, for example, should one wish to have a drying operation incorporated in the conveyor system. Speed slowdowns are also useful for inspection purposes, loading stations and the like. After passing the cam surface **117,** the spring **74** would again urge the wheel **67** to the maximum angle with regard to the drive shaft.

It is deemed evident from the above description that the pallet P may move freely and easily along the rails. At the work stations, for example work station A, it is desirable that the pallet P be securely held in position during the time it is stopped. For this purpose, front and rear locating or positioning pins **120** and **122,** respectively (see FIGS. **13–14**), are mounted in an upright position to move upwardly into corresponding openings **120***a* and **122***a* (see FIG. **8**) in the pallet P. In the embodiment illustrated, each opening is defined by a sleeve having a force fit in a larger opening in the pallet. Both locating pins **120** and **122** are tapered at their tops to overcome slight misalignment with the openings **120***a* and **122***a* when the locating pins are raised upwardly. The rear locating pin **122** is round in cross section to align the pallet both laterally and longitudinally. The top portion of the front locating pin **120** is relieved as at **121** on each of the longitudinal sides, as shown in FIG. **14,** so that it serves to engage the corresponding opening **120** only at the lateral sides thereof, as shown in FIG. **15.** In this manner, very slight differences in the positions of the openings **120***a* and **122***a* can be accommodated.

As explained above, the locating pins **120** and **122** are mounted in an upright position for movement in a vertical direction. As shown in FIG. **15,** the locating pin **120** is movable between a lower or release position shown in phantom lines and a raised or inserted position shown in full lines. The stroke S of the locating pin **120** is indicated in that FIG. Locating pin **120** is slidably mounted by means of a sleeve **124** which is held in position by brackets **125** and **126.** The lower end of the locating pin **120** is connected to the rod **132** of a pneumatic actuator **134** by means of a coupling **136.** Locating pin **122** is similarly mounted, and the identical structure to that described above is indicated by the same numerals with the postscript prime (') and further description is deemed unnecessary.

When the pallet P approaches the work station A, the arm **80** will engage the stop **85** when the arm is in its intermediate position **80B.** This will cause the pallet to be stopped in the manner previously described. An outwardly extending L-shaped finger **141** secured adjacent the front of the pallet P simultaneously engages the lever arm **142** of a switch **143** (see FIG. **15**). Switch **143** controls the supply of fluid under pressure to the actuators **134** and **134'**. Switch **143** may be in the supply line or it may be arranged to control another switch in the supply line. This causes the actuators to move to their extended or raised position shown in FIGS. **14** and **15** and extend the locating pins **120** and **122.** After a preselected time lapse, another switch (not shown) may be actuated to cause the actuators **134** and **134'** to retract the locating pins. The time lapse can be selected dependent upon the duration of the operation at the work station.

After the work has been completed at the work station and the locating pins retracted, a kick-off rod **146** is extended from its lower position shown in FIG. **15** to the extended position shown in phantom lines in that FIG. The kick-off rod engages the bottom side of the arm **80** and raises it to the upper position **80C** where it passes over the stop **85.** The spring **74** urges the wheel **67** to the previously described angle with the drive shaft and the pallet P is driven from the work station.

A particularly advantageous arrangement is provided to coordinate retraction of the locating pin **120** with the raising of the kick-off rod **146.** For this purpose, a lever **148** is pivotally mounted intermediate its ends on a pivot shaft **149.** One end of lever **148** is disposed adjacent the lower portion of locating pin **120** while the other end is operatively connected to kick-off rod **146** by means of a pin **150.** At the one end of lever **148** is a detent **152** which is spring urged to the position shown in full lines. At this position, the detent is engaged by a collar **154** mounted on the lower end of locating pin **120.** As the locating pin **120** is retracted, collar **154** engages detent **152** and swings the lever arm to raise the kick-off rod **146.** When the lever arm **148** and kick-off rod **146** are in the raised position, the collar **154** passes by the detent **152** and the kick-off rod **146** is returned to its lower position by means of compression spring **156.** Because of the mounting of the detent **152,** it can be seen that it will swing out of position when the locating rod **120** is raised and collar **154** passes by it. Its spring will then urge the detent to the position shown in solid lines to again be engaged by the

collar **154** when the locating rod **120** is again retracted. In this manner, the kick-off arm is extended when the locating pin **120** is retracted.

While a preferred embodiment of the invention has herein been illustrated and described, this has been done by way of illustration and not limitation, and the invention should not be limited except as required by the scope of the appended claims.

What is claimed is:

1. In a conveyor system including pallets mounted for movement along a definite pathway by frictional contact between a rotating drive shaft arranged parallel to the pathway and at least one drive wheel carried by the pallet, the drive wheel being pivotally mounted on the pallet for movement between a drive position oblique to the longitudinal axis of the drive shaft and a stop position parallel to said axis, and means for resiliently urging the drive wheel toward the drive position; the improvement comprising; an arm extending laterally of said pathway and operatively connected to the drive wheel for moving the drive wheel from the drive position to the stop position; means mounting at least a portion of the arm for vertical movement between a first normal position and at least one other position vertically spaced therefrom; a stop mounted adjacent the pathway for engagement by the arm when in its first position to stop the pallet; and the stop being shaped so that it is not engaged by the arm when the arm is in said other position.

2. A conveyor system as set forth in claim **1** including a pallet mounted stop for engaging the arm of a successive pallet in all positions of the arm to stop the successive pallet when the preceding pallet is stopped.

3. A conveyor system as set forth in claim **2** in which the drive position is at an angle of approximately 35° from the stop position; and in which the means for resiliently urging the drive wheel toward the drive position is a spring which is operative in all positions of the arm.

4. A conveyor system as set forth in claim **2** including a roller at the outer end of the arm for engaging said stop.

5. A conveyor system as set forth in claim **4** including a cam face mounted adjacent the drive shaft to engage the roller when the arm is in normal position and deflect the arm and hence the drive wheel to a position intermediate its drive position and its stop position, whereby the movement of the pallets is retarded but not stopped.

6. A conveyor system as set forth in claim **1** in which the means mounting at least a portion of the arm for vertical movement provides a third position vertically spaced from said other two positions; and the stop being shaped so that it is not engaged by the arm when in said third position.

7. A conveyor system as set forth in claim **6** including means for holding the arm in said third position so that the pallet passes the stop.

8. A conveyor system as set forth in claim **7** wherein the normal position is intermediate the other two positions, and the third position is below the normal position.

9. A conveyor system as set forth in claim **7** including a pallet mounted stop for engaging the arm of a successive pallet in at least the normal and third positions of the arm to stop the successive pallet when the preceding pallet is stopped.

10. A conveyor system as set forth in claim **1** in which the pathway is defined by two parallel tracks; each track having an upper surface and an inner surface facing the opposite track; and the pallet having a plurality of wheels rotatably mounted thereon for engaging the upper and inner surfaces of the tracks.

11. A conveyor system as set forth in claim **10** including a second rotating shaft laterally spaced from the other shaft and a second pair of parallel tracks parallel to the second shaft; two arcuate tracks interconnecting the pairs of parallel tracks to further define said pathway; and means associated with the arcuate tracks for conveying the pallets from the first pair of tracks, across the arcuate tracks, to the second pair of tracks.

12. In a conveyor system including: a frame, a drive shaft rotatably mounted on the frame, means for rotating the drive shaft, a plurality of supports mounted for movement parallel to the drive shaft, each support having a drive wheel frictionally engaged with the drive shaft, and the drive wheel being pivotally mounted for movement between a drive position oblique to the axis of the drive shaft and a stop position in which the wheel axis is parallel to the drive shaft axis, the improvement comprising: an arm extending laterally of the drive shaft and operatively connected to the drive wheel for moving the drive wheel from the drive position to the stop position; stop means supported on the frame spaced from the drive shaft and located for engagement by the arm to stop the pallet; means for effecting relative movement between the arm and stop means to disengage the arm; means for returning the drive wheel to the drive position upon such disengagement; and means mounting at least a portion of the arm for vertical movement between a first normal position where it can engage the stop and another position where it does not engage the stop.

13. The combination of claim **12** including means for releasably holding the arm in said other position.

14. The combination of claim **13** in which said other position is below the normal position, the means mounting at least a portion of the arm for vertical movement provides a release position vertically spaced above the normal position, and the stop being shaped so that it is engaged only when the arm is in said normal position.

15. The combination of claim **14** including a second rotating drive shaft laterally spaced from and generally parallel to said drive shaft; the drive shafts each having ends; and means at the ends of the drive shafts for conveying the supports from the end of one drive shaft to a position in which the drive wheel of the support is engaged with the other drive shaft; thereby providing a closed loop conveyor system.

16. The combination of claim **12** including means on each support for engaging the arm of a successive support in various positions thereof to stop the successive support when the preceding support is stopped.

17. A conveyor system comprising, in combination, a frame; first and second drive shafts rotatably mounted on the frame in spaced relation to each other; means for rotating the drive shafts; a first pair of tracks mounted parallel to the first drive shaft; a second pair of tracks mounted parallel to the second drive shaft; a pair of arcuate tracks interconnecting the first and second pairs of tracks; a plurality of vehicles movably supported on the tracks; a drive wheel on each vehicle; means mounting the drive wheel for engagement with

the drive shafts and at a position oblique to the axis of the drive shafts to drive the vehicle as the drive shafts are rotated; a transfer mechanism associated with the arcuate tracks for transferring the vehicle from the first pair of tracks to the second pair of tracks; and means associated with the transfer mechanism for rendering it inoperative when there is insufficient room on the second pair of tracks for another vehicle.

18. A closed loop conveyor system comprising: a frame; a first drive shaft rotatably mounted on the frame; a second drive shaft rotatably mounted on the frame laterally spaced from and generally parallel to the first drive shaft; means for rotating the drive shafts; a first pair of tracks mounted parallel to the first drive shaft; a second pair of tracks mounted parallel to the second drive shaft; said first and second pairs of tracks each having ends; a pair of arcuate tracks at the ends of and interconnecting the first and second pairs of tracks; thereby providing a closed loop; a plurality of vehicles movably supported on the tracks; a drive wheel on each vehicle; means mounting each drive wheel for engagement with the drive shafts and at a drive position oblique to the axis of the drive shafts to drive the vehicle as the drive shafts are rotated; a transfer mechanism associated with each pair of arcuate tracks for transferring the vehicle from the first pair of tracks to the second pair of tracks; and means associated with the transfer mechanism for rendering it inoperative when there is insufficient room for another vehicle.

19. The combination of claim **18** in which each drive wheel is mounted for movement between the drive position and a stop position in which the wheel is not driven by the drive shaft; an arm operatively connected to each drive wheel and extending outwardly therefrom for moving the drive wheel from the drive position to the stop position when the arm is contacted; and a vehicle-mounted stop for contacting the arm of a successive vehicle to stop the vehicle when the preceding vehicle is stopped.

20. The combination of claim **18** in which each drive wheel is mounted for movement between the drive position and a stop position in which the wheel is not driven by the drive shaft; an arm extending laterally of the drive shaft toward the inside of the said closed loop, and operatively connected to the drive wheel for moving the drive wheel from the drive position to the stop position; stop means supported on the frame at the inside of said closed loop and located for engagement by the arm to stop the vehicle; and means for effecting relative movement between the arm and the stop means to disengage the arm.

* * * * *