United States Patent [19]

Swartz

[11] **3,769,915**

[45] **Nov. 6, 1973**

[54] **SWITCHING APPARATUS**

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[73] Assignee: **FMC Corporation,** San Jose, Calif.

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[21] Appl. No.: **221,221**

[52] **U.S. Cl.** ..... **104/172 BT,** 104/88, 104/130

[51] **Int. Cl.** **B65g 17/44,** B61g 3/04

[58] **Field of Search** ..... 104/172 BT, 130, 104/88, 172 R

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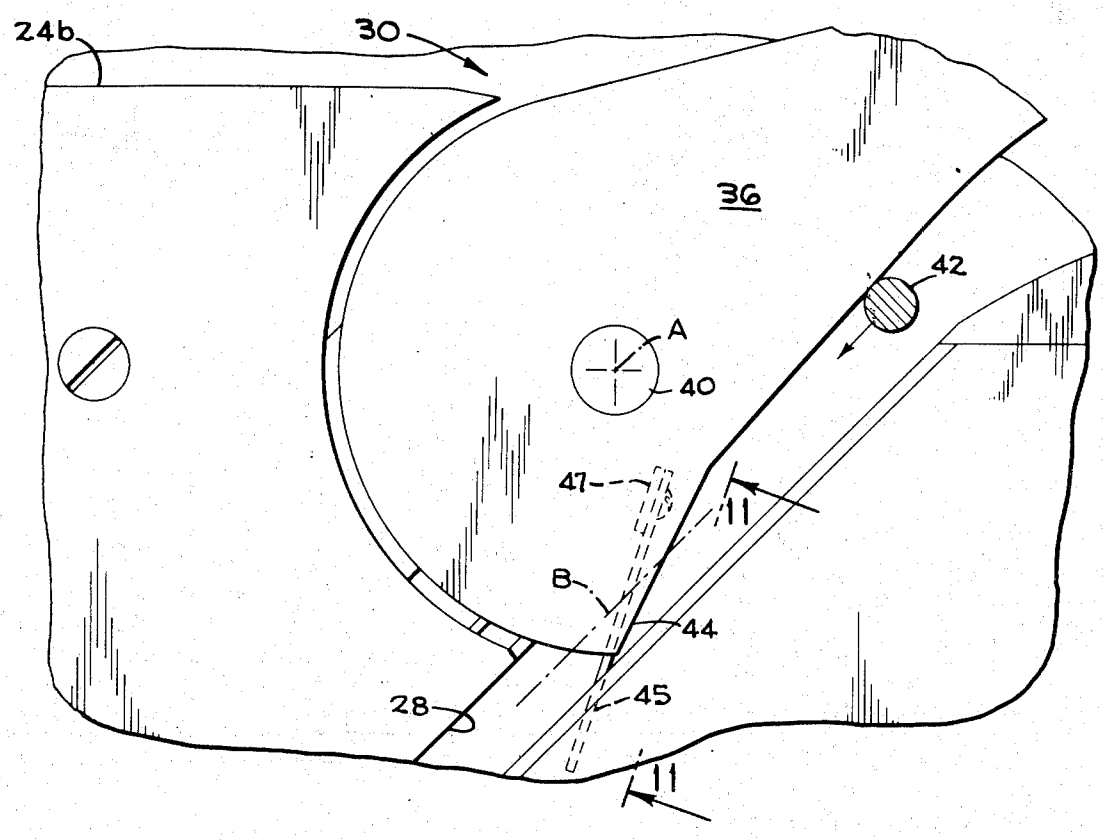
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Primary Examiner—Gerald M. Forlenza
Assistant Examiner—Richard A. Bertsch
Attorney—F. W. Anderson et al.

[57] **ABSTRACT**

A conveying system has a plurality of trucks which are towed about an area by a chain beneath the surface of the floor. The floor has slots through which a tow pin on the truck depends for engagement with the chain. Switch plates in the floor are movable to permit diversion of a truck from an upstream slot to a selected one of two downstream slots. A resilient member on the downstream side of the switch plate extends into the path of a tow pin traveling past the switch plate in the selected downstream slot. Engagement of the resilient switch member by the tow pin urges the switch plate into the opposite position to connect the upstream slot with the other downstream slot.

8 Claims, 12 Drawing Figures



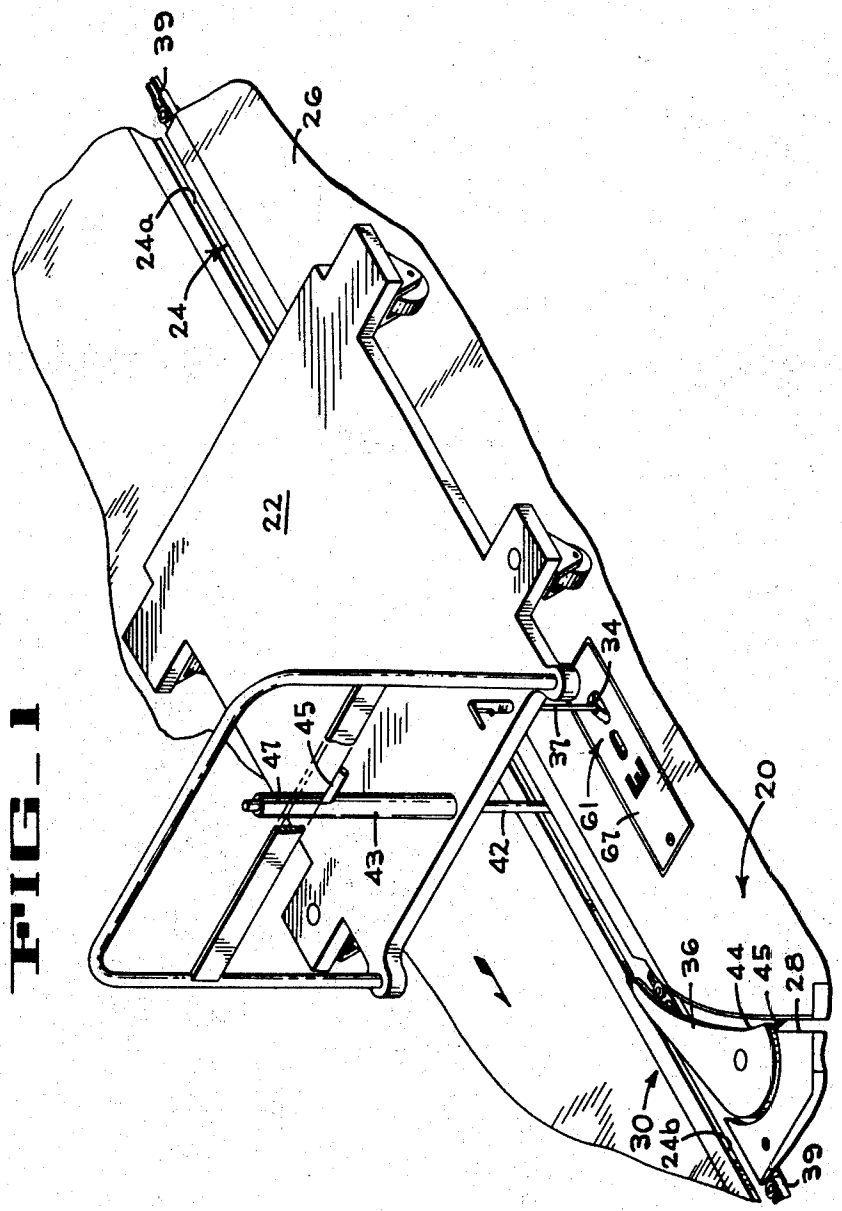
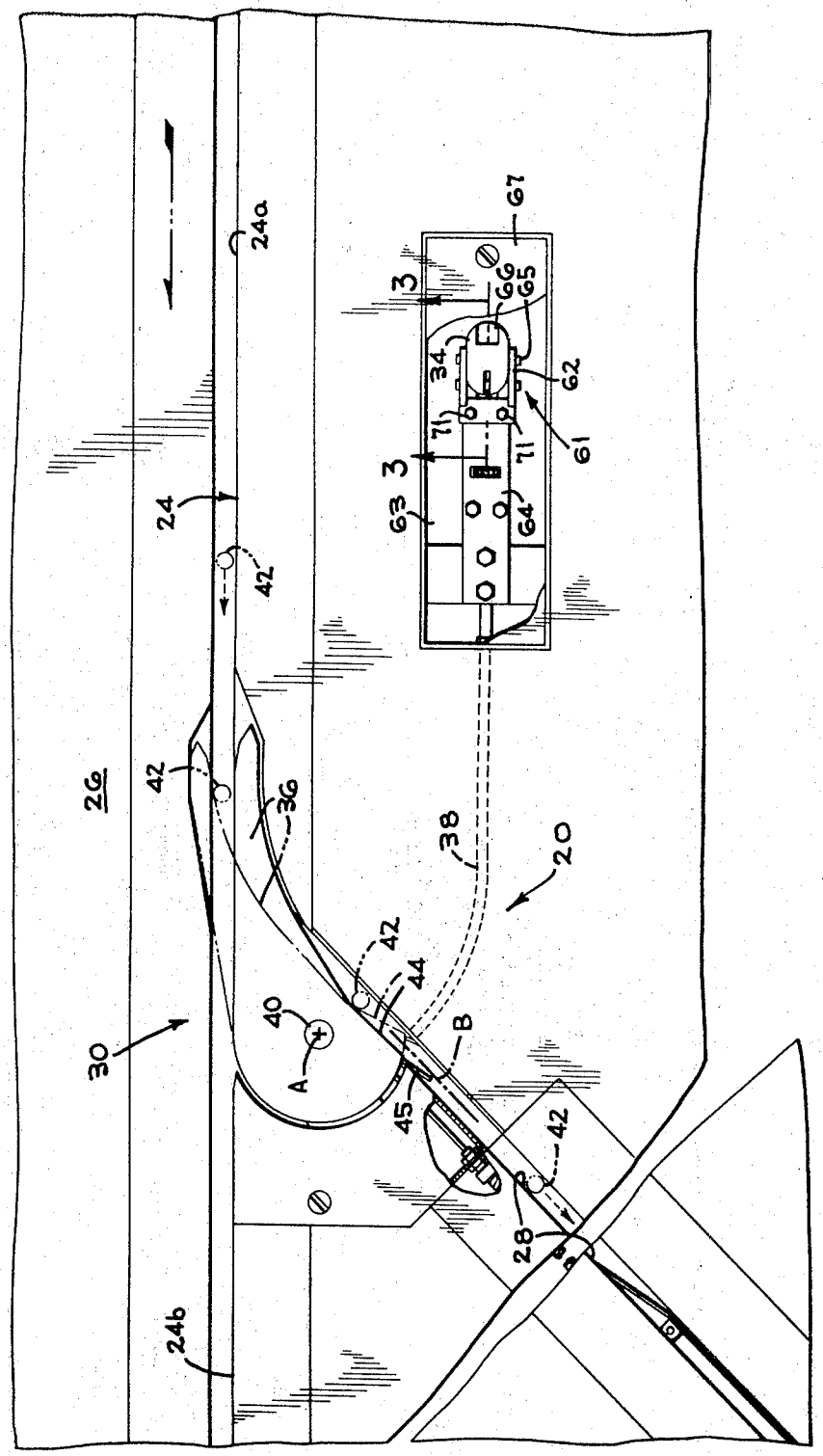


FIG_1

FIG_2



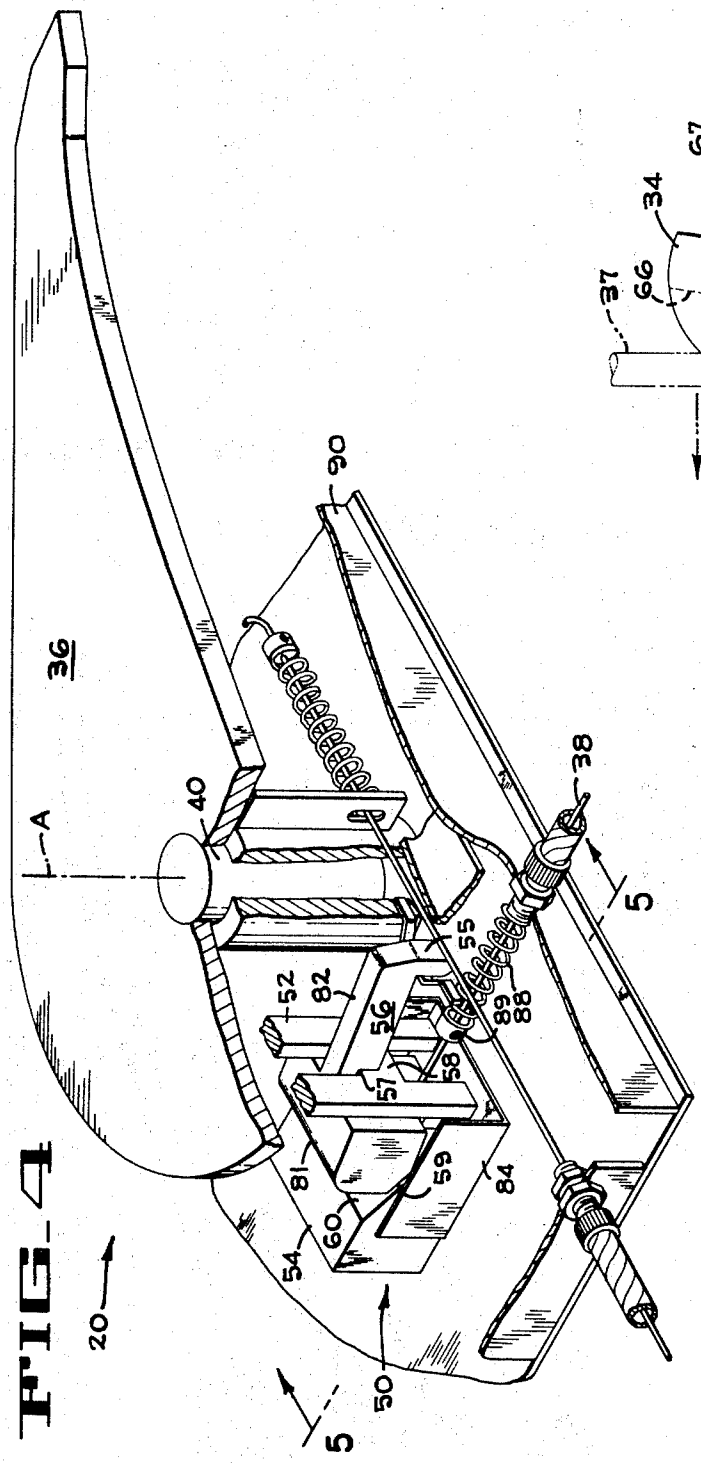

36
40
A
90
38
5
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52
82
56
89
88
57
58
81
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84
60
54
50
20
5

FIG. 4

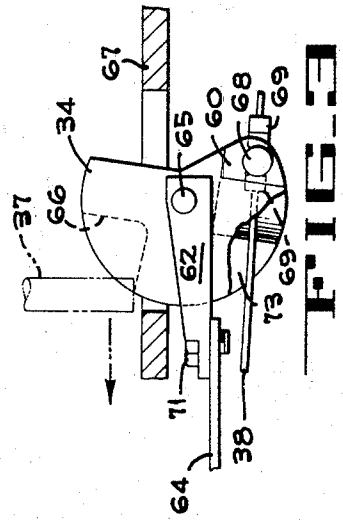

67
34
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60
68
69
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66
62
73
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71
38
64

FIG. 5

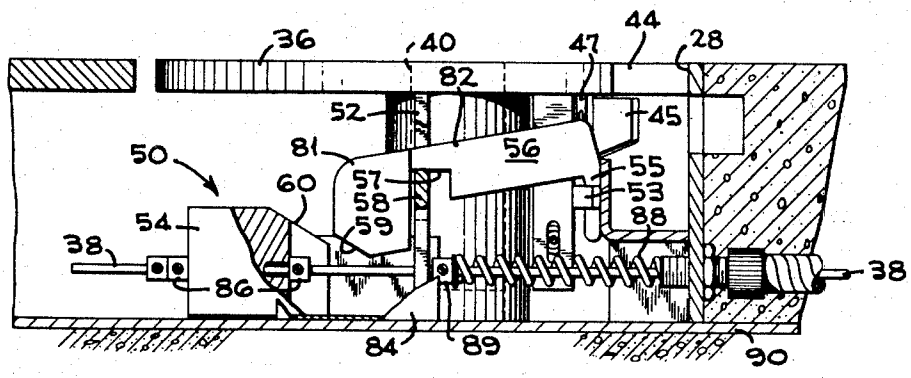


FIG_5

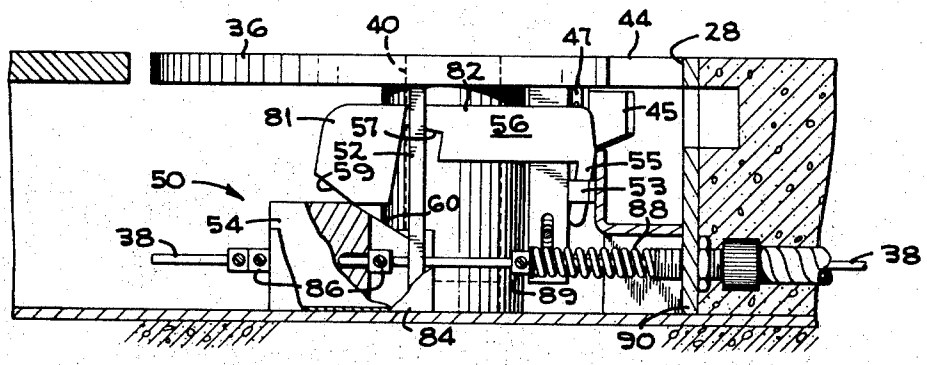


FIG_6

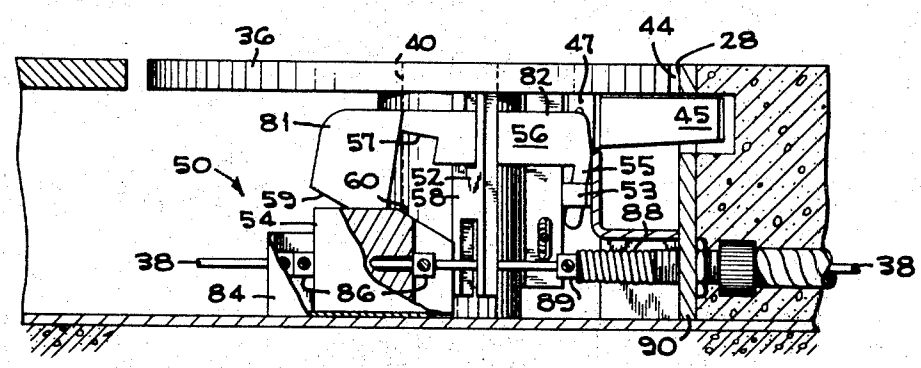


FIG_7

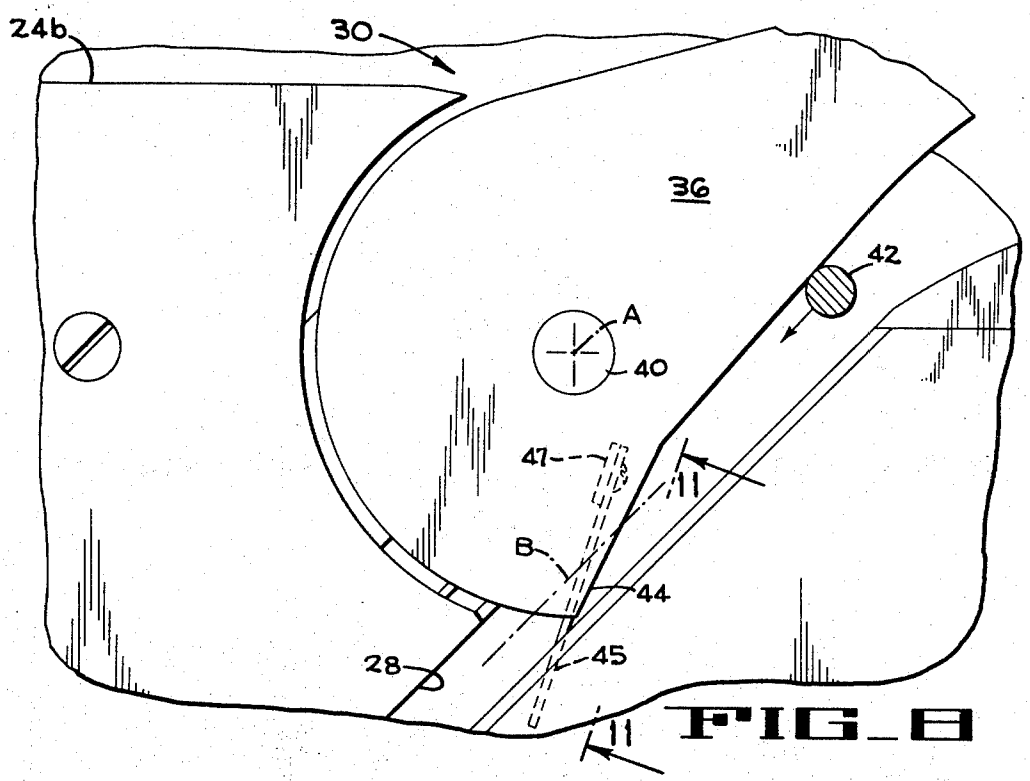


FIG_8

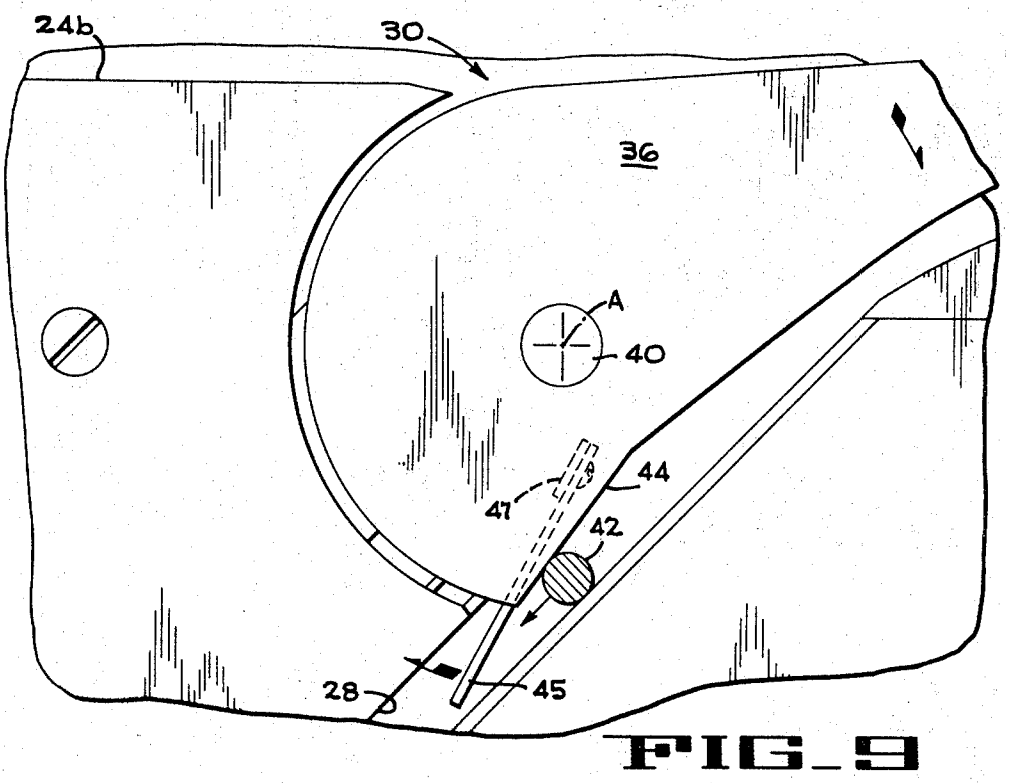


FIG_9

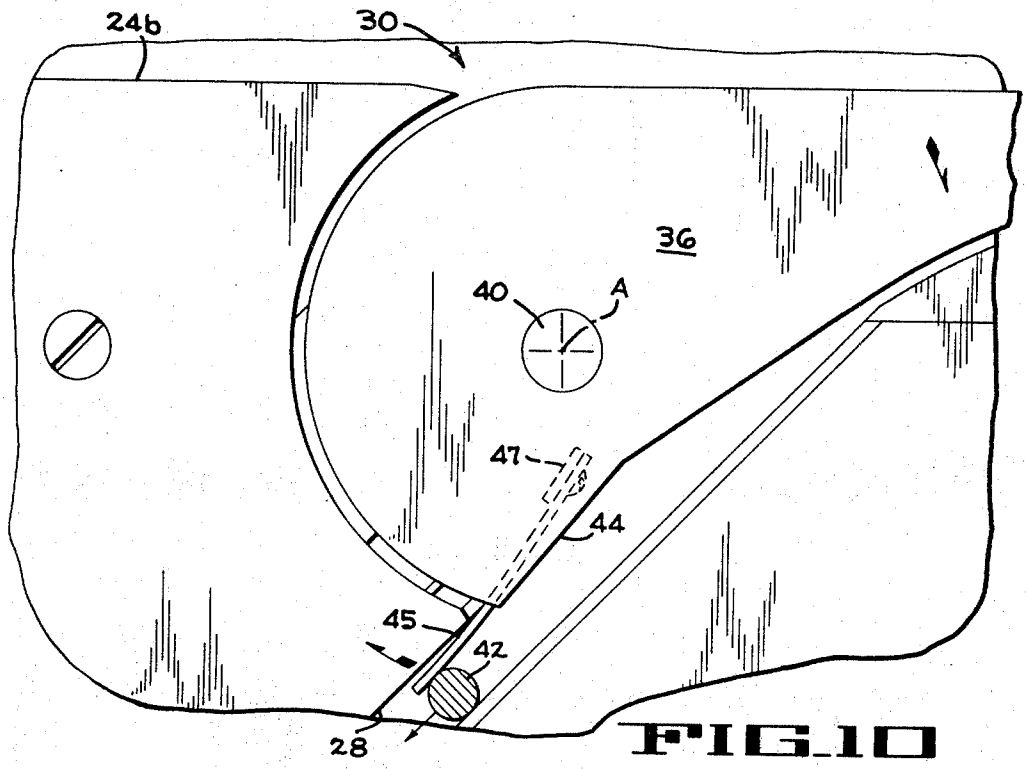
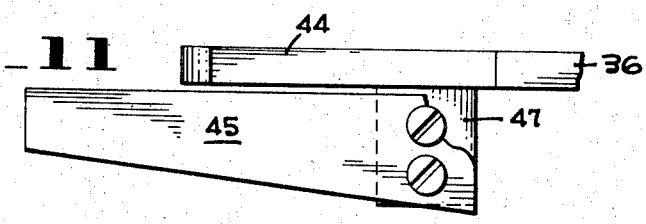


FIG_10

FIG_11



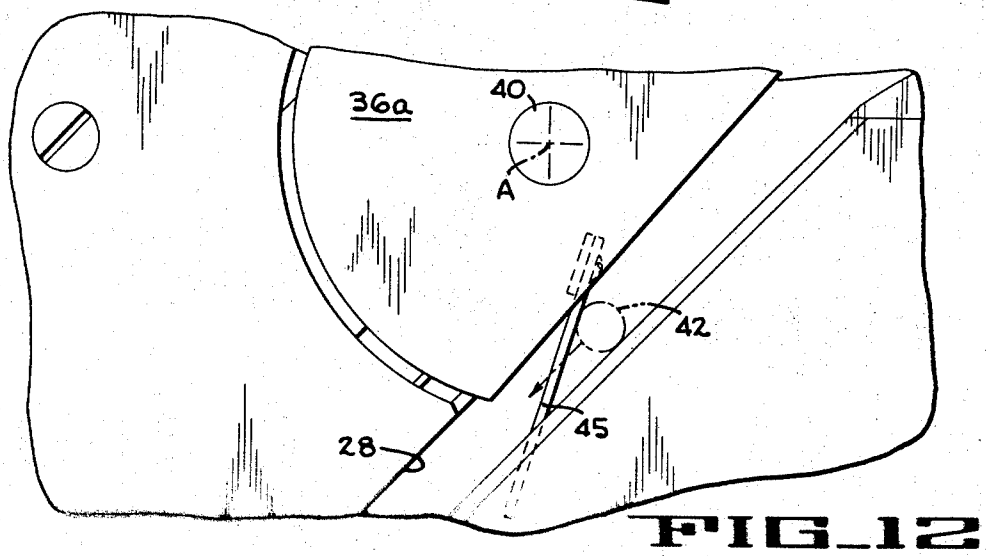


FIG_12

SWITCHING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to conveying systems of the type in which trucks are used to carry material about an area, such as in a warehouse or factory. In a typical conveying system in which goods are transported on trucks, the trucks have two pins which extend downwardly into slots in the floor. A driving chain in a slot engages the tow pin of a truck to tow the truck along the floor. The slots in the floor form a network which usually includes switch plates by which a truck is directed from an upstream slot to a selected one of two downstream slots. Frequently, the upstream slot and one of the downstream slots form the main line of the network and the other downstream slot forms a branch line into which it is desired to divert a particular truck. The truck may have a code member, or members, which will engage a code reader to throw the switch from a normal, main line open, position to a branch line open position to divert the truck off the main line.

2. Description of the Prior Art

It has been recognized heretofore, as disclosed in patents U.S. Pat. No. 2,868,139, U.S. Pat. No. 3,103,183, and U.S. Pat. No. 3,261,300, that it is desirable to provide means for returning the switch plate to a main line open position after it has been switched to a branch line open position and has diverted a tow truck to the branch line. When this is done, the system is in condition to pass trucks along the main line, past a particular reset switch, until another truck, bearing a code member corresponding to that switch, arrives to again actuate the switch to a branch line open position.

In one type of switching apparatus, as shown, for example, in the patent U.S. Pat. No. 3,556,012, a camming surface on the switch plate extends into the path of a tow pin moving past the switch plate into the branch line when the switch plate is in the branch line open position. This camming surface is downstream of the pivot axis of the switch plate so that when the tow pin of a truck moving into the branch line engages this camming surface, the switch plate is pivoted to a main line open position from the branch line open position.

It will be appreciated that the camming surface on the switch plate must be precisely machined so that as the switch plate is pivoted by the tow pin, the tow pin will firmly seat the switch in the main line open position but still permit the tow pin to pass the camming surface and move into the branch line. If the camming surface does not extend far enough into the path of the tow pin, the switch will not be completely shifted; if the camming surface extends too far into the path of the tow pin, the tow pin will jam between the camming surface and the wall of the branch line slot. In short, apparatus in which a camming surface is used on the switch plate to throw the switch to a closed position requires precision adjustment when installed, and requires periodic adjustments to compensate for wear.

It is also known to provide a two part return arm, as shown in the patents U.S. Pat. No. 2,897,769 and U.S. Re No. 25,288, connected by a lost motion joint. A spring in the joint urges one part of the arm into the path of the tow pin so that the tow pin, acting on the yieldable arm, will close the switch.

SUMMARY OF THE INVENTION

In the present invention, a resilient member, such as a leaf spring, is connected to the switch plate to extend into the path of a tow pin entering the branch line slot. When the leaf spring is engaged by the tow pin, the switch is shifted to its opposite, branch-line-closed position. The leaf spring extends far enough into the path of the tow pin so that the switch plate is shifted fully to the opposite position. At the same time, the tow pin can continue its travel into the branch line slot because the leaf spring will deflect under the force applied thereto by the tow pin. The positioning of the leaf spring in the path of the tow pin is not at all critical since the tow pin can deflect the spring to the extent necessary to pass the spring. If the tow pin, leaf spring, or switch plate should be subjected to wear, the leaf spring will still effectively shift the switch plate fully to the opposite position, without periodic adjustment, and, of course, the tow pin will still deflect the spring from its path for continued movement into the branch line. The one piece leaf spring is more yieldable at its outer end than at its inner end so that although there is an initial firm closing force on the switch plate, the spring yields more readily as the tow pin advances along the leaf spring to prevent hang up of the tow pin.

The leaf spring can be used alone to close the switch plate, or can be used in conjunction with a less protruding camming surface which does not extend as far into the path of the tow pin as does the leaf spring. In the latter instance, the initial movement of the switch plate will be effected by engagement of the tow pin with the camming surface. Final movement of the switch plate to the opposite position will be effected by engagement of the tow pin with the leaf spring.

It is therefore one object of the present invention to provide improved mechanism for shifting a switch plate in a conveying system.

It is another object of the present invention to provide mechanism for shifting a switch plate in response to passage of a conveyor truck which does not require precise machining and adjustment for operation nor periodic adjustment to compensate for wear.

It is yet another object of the present invention to provide mechanism to apply an initially firm but increasingly yieldable force to close a switch plate as a conveyor truck moves past the switch.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in perspective of a part of a conveying system incorporating the mechanism of the present invention.

FIG. 2 is a plan view showing a part of the network of two pin receiving slots of the system of FIG. 1 as well as mechanism for switching a truck to a branch line.

FIG. 3 is a view taken on the line 3—3 of FIG. 2.

FIG. 4 is a view in perspective, with parts broken away, of switching mechanism of the system of FIG. 1.

FIGS. 5, 6 and 7 are elevational views, with parts broken away, of the latching mechanism for the switching mechanism, as taken on the line 5—5 of FIG. 4, FIG. 5 showing the switching mechanism latched with the switch plate in a main-line-open position; FIG. 6 showing the latch releasing; and FIG. 7 showing the latch fully released.

FIG. 8 is a fragmentary plan view of the switch plate in the branch line open position with the tow pin first entering the branch line.

FIG. 9 is a view similar to FIG. 8 but with the tow pin camming the switch plate toward a main-line-open position.

FIG. 10 is a view similar to FIG. 8 but with the tow pin engaged with the leaf spring to fully shift the switch plate to a main-line-open position for latching.

FIG. 11 is a view taken on the line 11—11 of FIG. 8.

FIG. 12 is a plan view of a switch plate showing a modification of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The improvement of the present invention is utilized on switching apparatus which finds its primary use in a tow truck conveying system wherein towed trucks or dollies **22** are towed by a driven linked chain **39** (FIG. 1) along an endless main slot, designated generally at **24**, in a reference surface such as the floor **26** of a warehouse. The main slot **24** is intersected at preselected spaced intervals by spur, or branch line, slots **28** which define junctions, such as junction **30**, at which selected ones of said trucks may be diverted by the switching apparatus **20**. For convenience of description, the main slot **24** will be designated **24***a* upstream of junction with branch slot **28** and is designated **24***b* downstream of said junction.

A typical truck **22** is shown in FIG. 1 while being towed down main slot **24**. Near the forward edge of the truck **22** is mounted a vertically slidable tow pin **42** which is manually movable between an operative position, as shown with the lower end of the pin extending through the slot and terminating beneath the floor **26**, and a raised inoperative position. The tow pin **42** is moved to its inoperative position by raising it within sleeve **43** by means of the handle **45** so that its lower end is above floor level. To leave the tow pin in its inoperative position, the handle **45** is merely rotated above the sleeve **43** until it will not slip down into the slot **47**. In its operative position, the tow pin's lower end releasably engages the chain **39** so that when the tow truck **22** has been diverted into the shunt slot **28** by the switching apparatus **20**, the tow pin will easily slide laterally away from the chain and pass with free motion down the shunt slot **28**.

Disposed on the truck, in alignment transversely of the truck with the tow pin **42**, is a code probe, or pin, **37**, which is mounted in a manner similar to the manner in which the tow pin **42** is mounted. The code probe is movable from a lower operable position, wherein the lower end of the probe is slightly elevated from the floor **26**, to a raised inoperable position, and serves in the lower operable position to trip coded reader heads **34** which actuates the switching apparatus, as will be explained more fully later. The lateral position of the code probe, which is different on different trucks, determines which reader head will be engaged and to which spur line the truck will be diverted.

The switching apparatus **20** basically comprises the reader head **34** (FIG. 2), a switch plate **36**, and a push-pull cable **38** which operatively connects the reader head and the switch plate. As best seen in FIG. 2, when a truck **22** progresses down main slot **24** in the direction of the arrow, it will trip reader head **34** if it is coded to be diverted into the associated shunt slot **28**. The reader head **34** rotates as the truck **22** passes thereover and pulls cable **38** which functions to rotate the switch plate **36** from the main-line-open, full line position of FIG. 2 to the phantom line, branch-line-open position where the tow pin **42** depending from the truck **22** will be diverted into the shunt slot **28**.

The entire reader head assembly, generally designated **61** in FIG. 2, is mounted in a housing **63** having a top **67** with a hole therein through which the reader head **34** protrudes. The reader head **34** is a generally hemispherically shaped trigger with two spaced apart, like arms **60** depending from the bottom thereof to fixedly receive one end of the push-pull cable **38**. The reader head **34** is rotatably mounted on a horizontal shaft **65** extending between the two arms of a bracket member **62** which is bolted to a leaf spring **64** by bolts **71**, to give the reader head vertical resiliency. A notch **66** is cut in the surface of the hemispherical portion of the reader head **34** to disengagingly receive the bottom end of an appropriately positioned code probe **37** on truck **22** which passes over the switch. The probe **37** catches in the notch **66**, which normally is in a position approximately 90° clockwise from the position shown in FIG. 3, and rotates the reader head counterclockwise about the shaft **65** to the position shown in FIG. 3. The push-pull cable **38** is secured by lock nuts **69** to a cross shaft **68** which extends between the two depending arms **60** of the reader head and is rotatable therein. Therefore, as reader head **34** is rotated counterclockwise by a probe **37**, the two depending arms **60** of the reader head **34** are moved generally from left to right, as viewed in FIG. 3, pulling cable **38** which rotates switch plate **36** from a branch-line-closed to a branch-line-open position as will be described later. A notch **73**, cut in the back part of the hemispherical portion of reader head **34** fits over cable **38** when the reader head is rotated to allow for a full rotation, as seen in FIG. 3.

The switch plate **36** (FIG. 2) is rotatably mounted adjacent the junction of the main slot **24** and the shunt slot **28** on a vertical post **40** so that it can rotate about axis of rotation A between a branch-line-open and a branch-line-closed position. In its branch-line-open position, shown by phantom lines in FIG. 2, the switch plate **36** presents an abutment across the main slot **24** to divert the tow pin **42** of a truck **22** traveling along the main slot **24** into the adjacent shunt slot **28**. Formed on a portion of the switch plate **36** adjacent the shunt slot **28**, is a camming surface **44** which presents an abutment across the shunt slot when the switch plate is in its branch-line-open position. The camming surface **44** is positioned on the switch plate downstream of the pivot axis A of the switch plate. Consequently, the tow pin **42** of a truck which has been diverted into the shunt slot will engage the camming surface **44** and thereby initiate rotation of the switch plate clockwise to its branch-line-closed position, shown by solid lines in FIG. 2, so that other trucks will not be diverted by the switch plate **36** unless they trip the associated reader head **34**.

The above described mechanism is more fully described in my copending patent application Ser. No. 797,485 filed Feb. 7, 1969 and issued as U.S. Pat. No. 3,590742.

In one form of the present invention, the camming surface **44** extends into the path B of tow pin **42** only far enough to initiate clockwise rotation of switch plate

36, as shown in FIG. 8, but not far enough to move the switch plate to the fully branch-line-closed position. Consequently, the tow pin will easily travel past the camming surface without chance of a hang up on the camming surface, as shown in FIG. 9. The location of camming surface 44 relative to slot 28 is not critical because the engagement of the tow pin with the camming surface is not relied on to urge the switch plate into the extreme position where the main line is open, in which extreme position the switch plate is latched.

A flexible leaf spring 45 is secured by means of a clip 47 to the underside of the switch plate 36 at a point on the branch line side of the switch plate and downstream (with respect to the travel of the tow pin 42 in the branch slot 28) from the pivot axis A of the switch plate. The leaf spring 45, which is supported in cantilever manner on the switch plate, extends into the path of a tow pin in slot 28 far enough to require flexure of the spring, as shown in FIG. 10, when the tow pin 42 passes the pin, after the switch plate is fully moved to the main-line-open position shown in solid lines in FIG. 2 and latched in that position. The extension of the leaf spring to such an extent into the path of the tow pin assures positive latching of the switch plate. It will be noted that a cantilever, resilient member, such as leaf spring 45, is increasingly deflectable, the farther a force is applied thereto from its mounting end. Thus, the spring member 45, when initially engaged by the tow pin 42, will apply a firm closing force to the switch plate. However, as the tow pin moves out along the leaf spring, the spring will yield more and more so that after the switch plate closes and latches, there will be no danger of the tow pin hanging up on the leaf spring 45.

Push-pull cable 38 is operably connected to the switch plate 36 through a latch assembly generally designated 50 in FIGS. 4, 5, 6 and 7, which is disclosed more fully in my copending U.S. patent application Ser. No. 797,485 filed Feb. 7, 1969 and issued as U.S. Pat. No. 3,590742. The latch assembly 50 consists of an H-shaped member 52 welded to and depending from the lower surface of the switch plate 36, a block 54 which is slidable within a U-shaped guide 84 into engagement with the H-shaped member 52 and which is fixedly attached to the end of cable 38 by locknuts 86 (FIG. 6), and a catch arm 56 which extends through the upwardly projecting legs of the H-shaped member 52. The catch arm 56 has a large rear portion 81 (see FIG. 4), and a relatively narrow portion 82 in which a notch 57 is cut to mate with and overlie the medial portion 58 of the H-shaped member when the switch plate 36 is in its closed position. The catch arm 56 also has a cam surface 59 on its large rear portion 81 that is adapted for operable engagement with a cam surface 60 on block 54. The end 55 of catch arm 56, that is opposite cam surface 59, is shaped like a hook and defines a pivot point at which the catch arm can pivot on looped bracket 53, which is secured to one wall of the shunt slot 28 (see FIGS. 5, 6 and 7).

The manner in which the latch assembly functions to move the switch plate 36 to a branch-line-open position and prevent movement of the switch plate when the associated reader head has not been tripped, is best illustrated in FIGS. 5, 6 and 7. FIG. 5 shows the positioning of the associated elements of the latch assembly 50 in their normal position when the switch plate 36 is in its branch-line-closed position. It should be noted that notch 57, in the underside of portion 82 of the catch arm 56, is mated with the medial portion 58 of the H-shaped member 52. While in this position, the notch 57 prevents the H-shaped member from moving any appreciable amount, which also prevents the switch plate 36 from moving any appreciable amount because the H-shaped member is secured to the underside of the switch plate.

When a probe 37, depending from a truck 22, trips a reader head 34 associated with the switch plate 36, the reader head rotates, as shown in FIG. 3, and pulls the cable 38 to the right as viewed in the FIGS. 5, 6 and 7. The movement of cable 38 to the right also causes block 54 to move to the right since it is secured to the cable by locknuts 86. Movement of block 54 to the right forces the large rear end 81 of catch arm 56 upwardly because of the interaction of cam surfaces 59 and 60. This can be seen in FIG. 6 which shows the positioning of the latch assembly elements shortly after the block 54 has begun to be pulled to the right. It is to be noted that in this intermediate position, notch 57 in the catch arm has been raised out of its mating relationship with the medial portion 58 of the H-shaped member 52 so that the H-shaped member is no longer restricted from movement. Also, the front face of block 54 has come into contact with the face of the H-shaped member 52.

Further movement of the block 54 to the right causes the block 54 to slide under the large rear portion 81 of catch arm 56, FIG. 7, and the elevated non-mating position of the notch 57 allows the block to push the H-shaped member 52 to the right so that it rotates counterclockwise, as viewed in FIG. 4, causing the switch plate 36 to rotate accordingly into its branch-line-open position. Note (FIG. 1) that the cam surface portion 44 of the switch plate 36, and the leaf spring 45, present an abutment across branch slot 28 when the switch plate is in its branch-line-open position, so that a tow pin 42 of a diverted truck 22 can contact the cam surface and leaf spring to force the switch plate back into a closed position.

After the probe 37 has passed over reader head 34, a compressing spring 88 forces the reader head 34 back to a normal position approximately 90° clockwise from the position shown in FIG. 3. At the same time the block 54 is moved by spring 88 back into the normal position shown in FIG. 5. Spring 88 is a coil spring that circumferentially surrounds cable 38 and has one end effectively abutting a stationary wall of the housing 90 of the switch plate, and has its other end abutting a collar 89 that is secured to the cable 38. As can be seen in FIGS. 5, 6 and 7, as cable 38 is pulled to the right by the reader head 34, spring 88 is compressed to that, when probe 37 has passed over reader head 34 and no longer rotates it to actuate the switch, the spring 88 expands back into its normal configuration, and in so doing forces the block 54 back into its normal position, as shown in FIG. 5, and rotates the reader head 34 back to its normal position. The return of block 54 to its normal position however does not change the position of the switch plate 36, the H-shaped member 52, or the catch arm 56. Although it is not positively held, the switch plate 36 remains in its open position until it is closed by a tow pin 42 contacting its cam surface 44 and leaf spring 45. As can be seen in FIG. 7, the forward portion 82 of catch arm 56 lies above and is spaced from the medial portion 58 of the H-shaped member when the switch plate 36 is in the branch-line-

open position and the block **54** is in contact with the member **52.** The catch arm **56** remains so positioned, until the block **54** returns to its normal position whereupon the narrow portion **82** of latch **56** drops and rests on the medial portion **58** of the member **52.** When the switch plate **36** subsequently is moved to its opposite extreme position by the camming surface **44** and the leaf spring **45,** the H-shaped member rotates to the left as viewed in FIG. **7,** dropping the catch arm into its normal latching position, shown in FIG. **5,** when the medial portion **58** of the H-shaped member gets positioned under notch **57.** The switching assembly is then latched in the branch-line-closed position ready for another truck **22** to trip the reader head **34** for actuation of the switch in an identical manner.

It will be understood that leaf spring **45** can be utilized alone, without camming surface **44,** to shift the switch-plate to the branch-line-closed position, as shown in FIG. **12.** In this modification, the spring **45,** as in the first described embodiment, is connected under the switch plate **36***a* at a point adjacent the branch line slot and downstream from the pivot axis A of the switch plate. As in the embodiment previously described, the leaf spring **45** extends into the slot to an extent that the pin **42** cannot pass the spring without deflecting it. Thus, a tow pin **42** traveling downstream in the branch line slot **28** will engage the leaf spring **45** and shift the switch plate to the branch-line-closed position. The flexure of the spring as the tow pin passes will, as in the previously described embodiment, exert a closing force on the switch plate which will positively urge the switch plate to the closed position where it will latch by the dropping of the latch arm **56** as shown in FIG. **5.**

In both embodiments of the invention disclosed, the adjustment of the spring is not critical since it can be positioned to completely block the path of the tow pin without stopping the tow pin. Instead, the spring will deflect and urge the switch plate in a positive manner to the extreme branch-line-closed position where the switch plate will be latched. Also, in both embodiments of the invention, the deflectability of the spring increases as the tow pin moves to the outer end of the spring to minimize the chance of a hang up of the tow pin at the switch. At the same time, a firm closing force is applied to the leaf spring when the tow pin initially engages the spring.

Although the best mode contemplated for carrying out the present invention has been herein shown and described, it will be apparent that modification and variation may be made without departing from what is regarded to be the subject matter of the invention.

I claim:

1. In a conveying system having a truck with a depending tow pin in the floor and having a network of slots with a drive member therein to engage the tow pin, said network including an upstream slot and two downstream slots joined at a junction having a switch member pivotable about a pivot axis between two extreme positions to divert the truck tow pin at the junction from the upstream slot to a selected downstream slot, the improvement comprising a resilient member connected at one end to the switch member downstream of said pivot axis and extending into the path of a tow pin in one of said slots when the switch member is in one of said extreme positions for engagement by the tow pin to urge the switch member toward the opposite extreme position, said resilient member increasingly deflectable as it extends outwardly from its connected end.

2. The apparatus of claim **1** in which said resilient member is a leaf spring which extends across and beyond said one slot when the switch member is in said one extreme position.

3. The apparatus of claim **1** in which said resilient member is a leaf spring which extends across said one slot and beyond the downstream end of said switch plate when the switch member is in said one position.

4. The apparatus of claim **1** in which said resilient member extends across and beyond said one slot when the switch member is in said one extreme position and in which said resilient member extends along one side of said one slot when the switch member is in the opposite extreme position and the resilient member engages the tow pin.

5. The apparatus of claim **4** in which said resilient member is a leaf spring.

6. In a conveying system having a truck with a depending tow pin and having a network of drive slots in the floor to receive the tow pin, said network including an upstream slot and two downstream slots joined at a junction having a switch plate pivotable about a pivot axis between two extreme positions to divert the truck tow pin at the junction from the upstream slot to a selected downstream slot, said switch plate having a cam surface downstream of the pivot axis and extending into the path of a tow pin in one of said downstream slots when in one extreme position for engagement by the tow pin to urge the switch member toward the opposite extreme position, the improvement comprising a resilient member connected at one end to the switch member downstream of said pivot axis and extending into the path of a tow pin in said one slot downstream from said cam surface for engagement by the tow pin after the tow pin passes the cam surface to urge the switch plate into the opposite extreme position, said resilient member increasingly deflectable as it extends outward from its connected end to facilitate passage of the tow pin after the switch is closed.

7. The apparatus of claim **6** in which said resilient member is a leaf spring which extends down-stream from said cam surface and across and beyond said one slot when the switch member is in said one position.

8. In a conveying system having a truck with a depending tow pin and having a network of slots in the floor to receive the tow pin, said network including an upstream slot and two downstream slots joined at a junction having a switch plate pivotable about a pivot axis between two extreme positions to divert the truck tow pin at the junction from the upstream slot to a selected downstream slot, said system including latching mechanism to secure the switch plate in an extreme position when the switch plate is urged into said extreme position, said switch plate having a cam surface downstream of the pivot axis and extending into the path of a tow pin in one of said downstream slots when in one extreme position for engagement by the tow pin to urge the switch member toward the opposite extreme position, the improvement comprising a resilient member connected to the switch member downstream of said pivot axis and extending across said one slot in the path of a tow pin downstream from said cam surface for engagement by the tow pin after the tow pin passes the cam surface to urge the switch plate into the opposite extreme position for latching therein.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,769,915

DATED : November 6, 1973

INVENTOR(S) : HORACE M. SWARTZ

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 9, change "two" to --tow--.
Col. 4, line 65, change "3,590742" to --3,590,742--.
Col. 5, line 40, change "3,590742" to --3,590,742--.
Col. 8, line 43, change "down-stream" to --downstream--.

Signed and sealed this 29th day of April 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks