United States Patent

[11] 3,532,059

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[54] **TOW LINE CONVEYOR SWITCH SYSTEM**
9 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **104/88,** 335/206
[51] **Int. Cl.** **B61l 13/04,** H01h 36/02
[50] **Field of Search** 104/172, 88, 96; 335/153

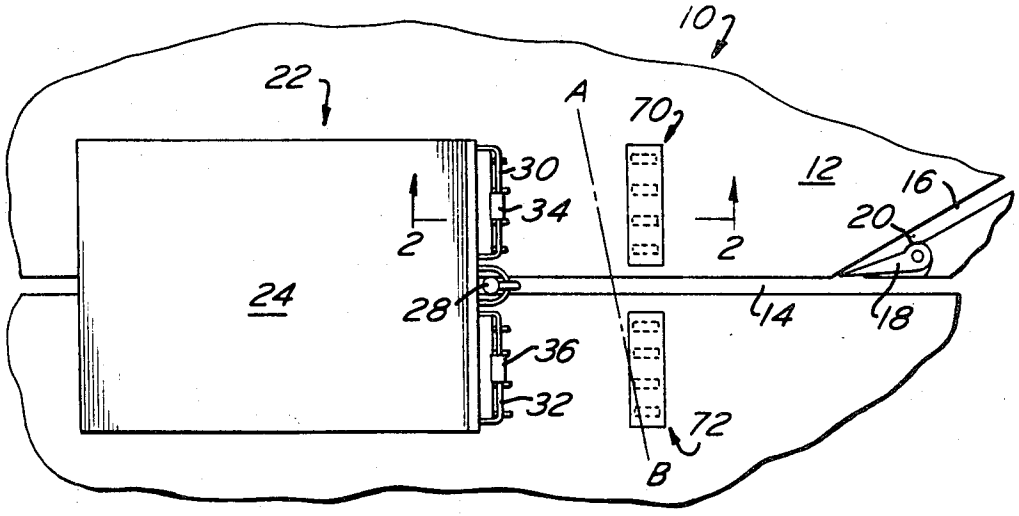
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Assistant Examiner—Robert Saifer
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ABSTRACT: A tow line switching system is disclosed having two banks of reed switches, one bank on each side of the main slot. In order to switch a truck from movement along the main slot to movement along a shunt slot, magnetic means on the truck must activate two adjacent switches in each bank. The system provides for greater possible error in skew and provides for selectivity to change a cart designation at a date subsequent to installation of the system.



Patented Oct. 6, 1970 3,532,059

FIG. 1

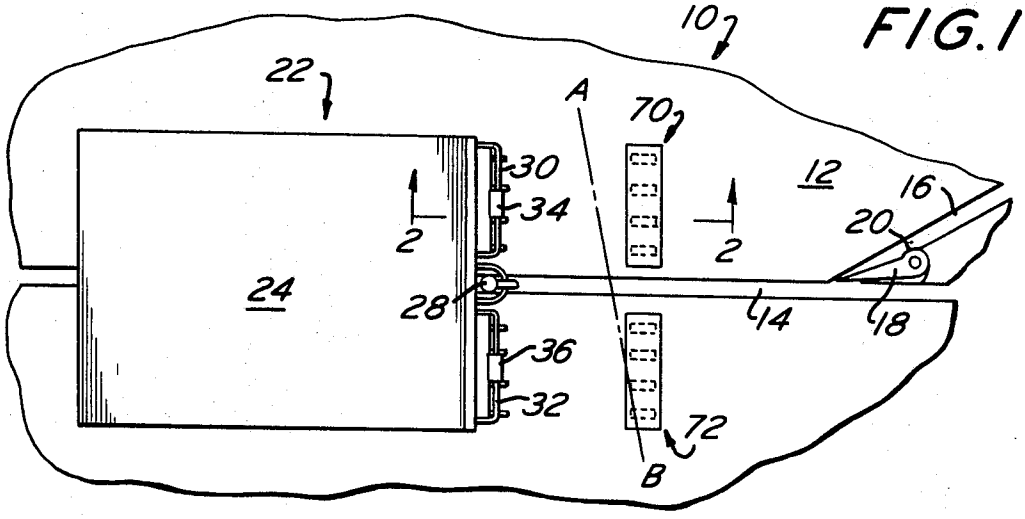
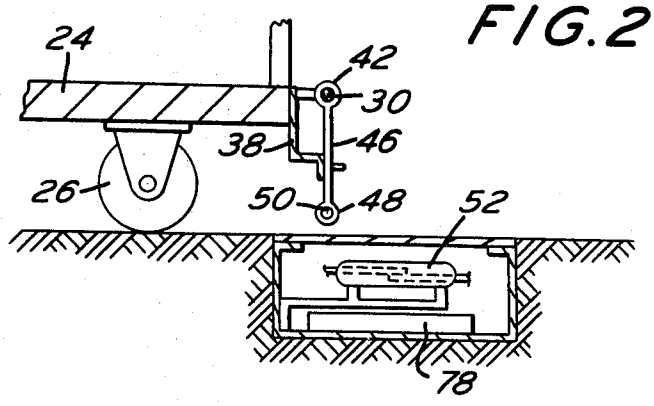


FIG. 2



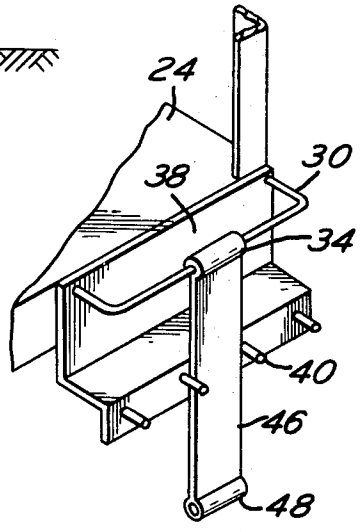


FIG. 3

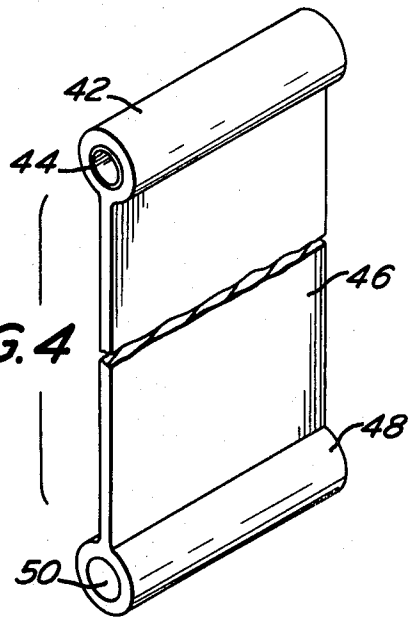


FIG. 4

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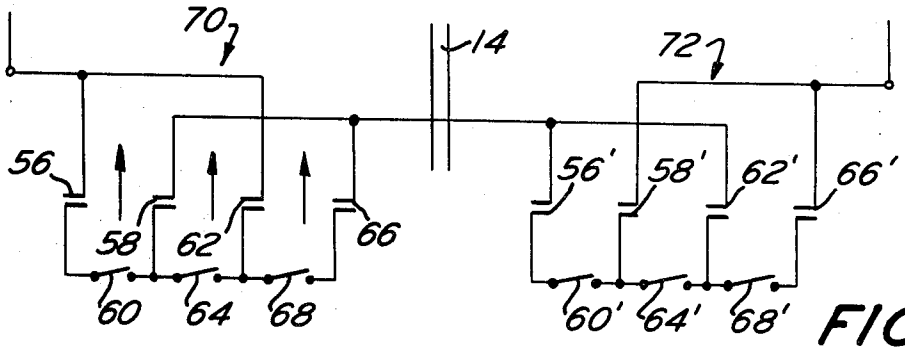


FIG. 5

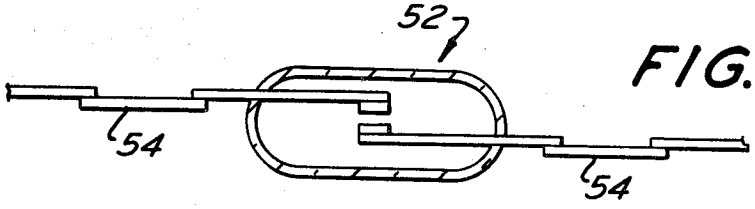


FIG. 6

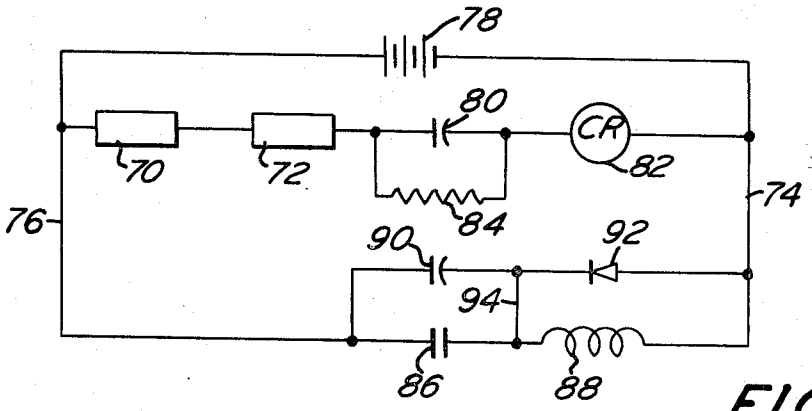


FIG. 7

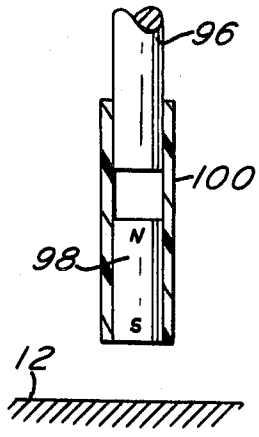


FIG. 8

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TOW LINE CONVEYOR SWITCH SYSTEM

The present invention is directed to an improvement in tow line conveyor switch systems. Many such systems are known to those skilled in the art including systems wherein floor mounted switches are operated by a magnet supported by a tow line vehicle. For example, see U.S. Pat. 2,816,516. When switches as disclosed in said patent are utilized to operate a diverter, the system after substantial use malfunctions due to skew.

Skew results from a variety of factors including bent magnet supports, the position of the truck or vehicle with respect to the main slot as occasioned by the vehicle going around a curve, etc. Magnet supports frequently bend due to contact with high spots in a floor. A normal poured concrete floor varies plus or minus one-fourth inch. It is necessary for the magnet to be sufficiently close to the switches so as to operate the same. In doing so, the magnet frequently picks up tramp metal due to the fact that the magnet is generally only one-fourth inch from the floor. Tramp metal is small pieces of metal on the floor. Prior systems have a "skew" tolerance of approximately one-half inch. The present invention provides for a skew tolerance which is at least double that used heretofore.

During operation of the system, it is often desirable to change the code requirement for a particular shunt slot. In most systems, this is difficult or impossible to do. The only variable available to the user of a system is to manipulate the position of the magnet on the truck so that the truck will be dispatched to a preselected shunt slot. The system of the present invention provides for greater selectivity and enables the code setting for a magnet to be changed at will so that a particular truck will go to a preselected shunt slot or provide for a plurality of shunt slots that temporarily have the same code setting.

It is an object of the present invention to provide a tow line conveyor switch system which provides for a substantially greater skew tolerance.

It is another object of the present invention to provide a tow line conveyor switch system which permits the shunt slot coding to be varied at will at any time.

It is another object of the present invention to provide a tow line conveyor switch system wherein vehicle supported magnets may be adjustably positioned across the front of the truck and spaced from the floor by a greater distance than was permitted heretofore.

It is another object of the present invention to provide a novel tow line conveyor switch system wherein battery operated reed switches are utilized in pairs to effect a switching operation of the vehicle from movement along the main slot to movement along a shunt slot.

Other objects will appear hereinafter.

FIG. 1 is a partial top plan view of a system in accordance with the present invention.

FIG. 2 is a sectional view taken along the line 2–2 in FIG. 1.

FIG. 3 is a partial perspective view of a portion of the vehicle shown in FIG. 1.

FIG. 4 is an enlarged perspective view of the magnet support member.

FIG. 5 is a schematic wiring diagram.

FIG. 6 is a sectional view of a typical reed switch which may be used in accordance with the present invention.

FIG. 7 is a schematic wiring diagram.

FIG. 8 is a partial sectional view of an alternate magnet support.

Referring to the drawing in detail, wherein like numerals indicate like elements, there is shown in FIG. 1 a tow line conveyor switch system designated generally as **10**. The system **10** includes a reference surface such as a floor **12** having a main slot **14**. The slot **14** is intersected at spaced points therealong by shunt slots **16**, only one of which is shown in FIG. 1.

The intersection between the main slot **14** and shunt slot **16** is controlled by a diverter **18** having a cam surface **20** thereon. Per se, a diverter of this type is well known to those skilled in the art and is preferably of the type shown in U.S. Pat. 3,103,183. The diverter **18** is preferably biased to a position where it projects across the main slot **14** by means of a spring. The diverter **18** is latched in the position illustrated and may be delatched by operation of a solenoid.

A vehicle such as a tow truck **22** is provided for movement along main slot **14**. Vehicle **22** includes a base **24** on which material may be supported. Base **24** is supported by wheels **26**. An upright tow pin **28** is supported at the front of a vehicle **22** and projects downwardly into the main slot **14** for guidance thereby and contact with a conveyor which will propel the vehicle **22** along the main slot **14**.

As shown more clearly in FIGS. **1** and **3**, a rod **30** is provided on one side of the tow pin **28** and a similar rod **32** is provided on the other side of the tow pin **28**. A selectively movable magnet support member **34** is supported by a rod **30**. A similar magnet support member **36** is supported by rod **32**. The various positions for the magnet support members are defined by forwardly extending pins **40**. Pins **40** and the rods are supported by a plate **38** on the front end of the vehicle **22**.

As shown more clearly in FIG. **4**, the magnet support members **34** and **36** each include a first upper cylindrical portion **42** having a bushing **44** therein. Bushing **44** is slidably supported by rod **30**. A lower cylindrical portion **48** is interconnected with portion **42** by means of a flat center portion **46**. Center portion **46** has its widest dimension transverse with respect to the direction of movement of the vehicle. A magnet **50** is horizontally supported by the cylindrical portion **48**. The magnet support members are preferably made from plastic and are of a shape which can be easily extruded. Polyethylene or rubber are the preferable plastic materials since they have the highest degree of memory and will therefore be less susceptible to having permanent deformation or bends.

In FIG. **6**, there is illustrated a conventional reed switch which may be utilized in the circuitry to be described hereinafter. The conductors at each end of the reed switch **52** are interrupted and coupled together by means of a small strip of Mu metal **54**. A Mu metal is a commercially available alloy having extremely high permeability.

In FIG. **5**, there is illustrated a first bank of switches designated generally as **70** and adapted to be located on one side of the main slot **14**. A similar bank of switches is adapted to be located on the other side of the main slot **14**. The banks are interconnected as illustrated. The bank **70** includes reed switches **56** and **58** which may be connected in series with one another by closing manually operable switch **60**. Reed switches **62** and **58** may be connected in series with one another by closing manually operable switch **64**. Reed switches **62** and **66** may be connected in series with one another by closing manually operable switch **68**. Bank **72** is identical with bank **70**, hence corresponding primed numerals are utilized.

The circuitry illustrated in FIGS. **5** and **7** is adapted to be mounted within a housing below floor level as shown in FIG. **2**, except for the manually operable switches **60**, **64**, **68**, **60'**, **64'** and **68'**. The latter mentioned switches are preferably located on a control panel or vertical column whereby they are readily accessible to an operator of the system.

Referring particularly to FIG. **7**, it will be noted that conductors **74** and **76** are connected across a direct current source which preferably is a 12 volt battery **78**. Switch banks **70** and **72** are in series with each other and with a 100 μf capacitor **80** and the coil of a contact relay **82**. A 100 kΩ ½ watt resistor **84** is connected in parallel with capacitor **80**. Contacts **86**, controlled by the relay **82**, are connected in series with a solenoid coil **88** across the conductors **74** and **76**. A .25 μf capacitor **90** is connected in parallel with contacts **86** and a diode **92** is connected in parallel with the solenoid coil **88**. A conductor **94** extends between the conductor for contacts **86** and the conductor containing the diode **92**.

The solenoid operated by coil **88** for delatching the diverter **18** is not shown. The solenoid may be coupled to the switch plate in the manner shown in copending application Ser. No. 486,182 for Tow Truck System, filed on September 9, 1965, now U.S. Pat. No. 3,388,674.

As shown more clearly in FIG. 8, the magnet 98 may be vertically disposed instead of horizontally disposed as shown in FIG. 4. Magnet 98 is supported from the rod 96 by means of a plastic sleeve 100.

The operation of the system 10 is as follows:

Let it be assumed that switches 64 and 64' have been closed. Hence, the magnet supported by member 34 must pass between switches 58 and 62 and the magnet supported by member 36 must pass between switches 58' and 62' in order to operate the solenoid whereby the vehicle 22 will be diverted from movement along slot 14 to movement along slot 16. When this occurs, reed switches 58 and 62 as well as reed switches 58' and 62' close. This completes the current flow from direct current source 78. Capacitor 80 charges, thereby energizing the relay coil 82. The effective charging pulse lasts for approximately 52 milliseconds. In this manner, there will be no battery drain if a vehicle stops directly over the reed switches. Resistor 84 discharges the capacitor 80 after the reed switches open.

During the effective period of the pulse, contacts 86 are closed and a circuit is completed through the solenoid coil 88. During the period that coil 88 is on, the solenoid is operated to delatch the diverter 18 which under spring pressure moves to a position wherein it obstructs the main slot 14. When the tow pin 28 moves through the shunt slot 16, it will engage the surface 20 on the diverter 18 and cam the diverter 18 to the position shown in FIG. 1.

Capacitor 90 prevents arcing of the contacts 86. Diode 92 prevents a counterflow of current through the coil 88.

If the magnet support members are skewed at the time they pass over their respective switches, the skew tolerance may be as much as 2 inches. Thus, if the magnets form a line designated as A-B in FIG. 1, the distance from the switches to line A-B may be as much as 2 inches without interfering with the operation of the system. The Mu strips 54 extend the on time for the switches so that once the switches are operated, they will stay closed for a greater length of time, notwithstanding the fact that the magnets are five-eights to 1 inch away from the reference surface 12. The horizontally disposed magnet 50 provides for a longer uninterrupted pulse while at the same time being further away from the switches than was possible heretofore.

As described above, it was assumed that switches 64 and 64' were closed. If the magnet does not pass sufficiently close to the switches 58 and 62 so as to simultaneously close both of them, there will be no completed circuit to the relay 82. Hence, the particular vehicle will not be shunted along slot 16. If at any time it is desired to change the coding requirement for a particular shunt slot, it is only necessary to open switch 64 and close one of the other switches such as switch 60 or 68. Also, it is possible to open all of the manually operable switches so that no vehicles will be shunted from slot 14 to slot 16 even though the magnets on the vehicles are positioned to effect operation of diverter 18. Further, vehicles having either of two different magnet positions can be shunted into slot 16 such as by closing switches 60, 64, 60' and 64'.

When positioning the various switches 56, 58, 62, etc., they will be at different distances from the main slot 14. The most desirable distance which gives the maximum number of combinations with "cross talk" between adjacent switches is to position the switches at intervals of 1 inch. If single reed switches were utilized instead of the circuitry described above wherein two reed switches are in series, the effective area to either side of the switch where the magnet must pass is one-fourth inch, thereby providing a path having a total width of one-half inch. Because two switches are in series in the circuitry as described above, the total width of the path is now 1 inch without cross talk. Because of this increased width of the path, the magnet may be horizontal and thereby have the advantages of longer uninterrupted pulses and greater spacing from the reference surface 12.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. A tow line switching system comprising a reference surface having a main guide slot, a vehicle supported by the surface having a tow pin extending downwardly through the slot for contact with the conveyor, a shunt slot intersecting the main guide slot at an acute angle, a diverter having a first position wherein it obstructs the shunt slot and is movable to a second position wherein it obstructs the main guide slot, a magnet supported by said vehicle and adjustable across a front portion of the vehicle, an electrical circuit supported by said reference surface responsive to said magnet for initiating movement of the diverter from its first position to a second position and for minimizing the effect of skew of said vehicle, said circuit comprising at least two magnetically responsive switches coupled in series so that each must be operated by said magnet in order for said circuit to initiate movement of said diverter, said switches being spaced at different distances from said guide slot, and said switches being operated by the magnet only when the magnet passes between parallel vertical planes containing said switches, said vertical planes being generally parallel to said main guide slot.

2. A system in accordance with claim 1 wherein said magnet is horizontally disposed with its longitudinal axis generally perpendicular to said slot.

3. A system in accordance with claim 1 wherein said circuitry includes a source of direct current, said circuitry including first and second banks of magnetically responsive switches, said banks being on opposite sides of said main guide slot and disposed in said reference surface, each bank of switches including manually operable switches between adjacent magnetically responsive switches, at least two magnetically responsive switches of each bank being coupled directly to said source of current.

4. A system in accordance with claim 1 wherein said magnet is supported by a member having a cylindrical portion at one end supported by the vehicle, said member having a cylindrical portion at the opposite end, said magnet being mounted in said last-mentioned cylindrical portion.

5. A system in accordance with claim 1 wherein said circuit includes a source of direct current.

6. A system in accordance with claim 1 including first and second banks of said magnetically responsive switches, said banks being being on opposite sides of said main slot and disposed in said reference surface, each bank of switches including four reed switches, each reed switch being in series with an adjacent switch in its bank, said banks being disposed in series in said circuitry.

7. A system in accordance with claim 1 including a strip of Mu metal in series with each switch.

8. A system in accordance with claim 1 including a manually operable switch coupled to said circuit between said magnetically responsive switches.

9. In a tow line switching system having a main slot intersected by shunt slots with a diverter controlling each intersection, electrical circuitry for controlling said diverter, said circuitry including a bank of magnetically operable switches on each side of the main slot, each bank comprising pairs of said switches in series, a manually operable switch between and in series with the switches of each pair of switches, and said banks being in series, so that a pair of said magnetically operable switches of each bank must be operated to complete a circuit effective for controlling said diverter.