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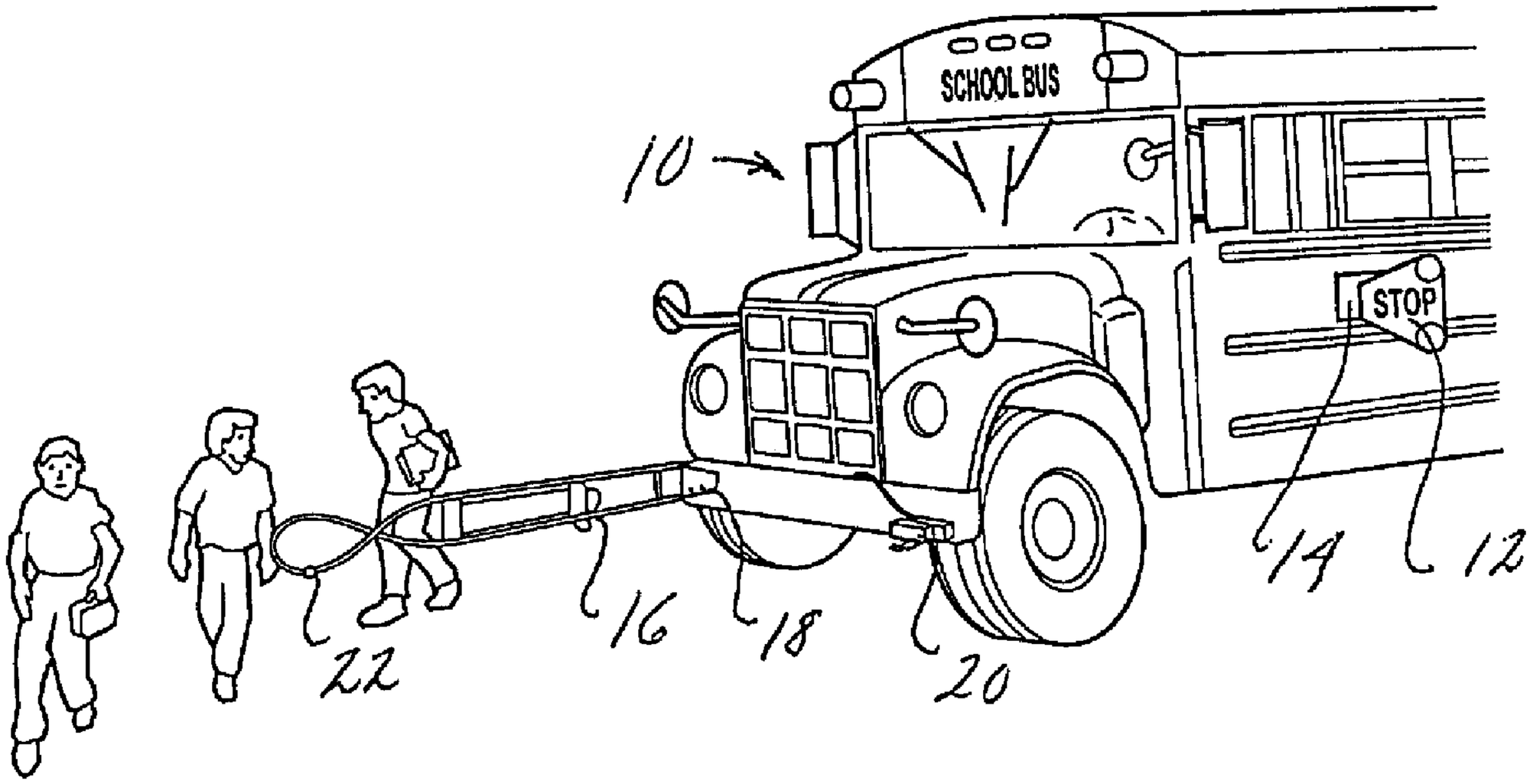
(54) Title: LATCHING SYSTEM FOR VEHICLE SAFETY DEVICE



(57) Abrégé/Abstract:
A latching system for maintaining a stop-arm or crossing-arm in place adjacent a vehicle such as a school bus using an electromagnet that can be energized to hold the arm in place and de-energized to release the arm.

Abstract of the Disclosure

A latching system for maintaining a stop-arm or crossing-arm in place adjacent a vehicle such as a school bus using an electromagnet that can be energized to hold the arm in place and de-energized to release the arm.

LATCHING SYSTEM FOR VEHICLE SAFETY DEVICES

Background of the Invention

The present invention relates generally to safety devices mounted on vehicles, such as crossing-arms and stop signs mounted on school buses, and more particularly to a latching system for maintaining the safety devices securely in place when the vehicle is moving while permitting such safety devices to be readily deployed when desired.

For safety reasons, it is common practice for many vehicles to be provided with safety devices that move between a retracted position along side of the vehicle when not needed, and an extended or deployed position extending outwardly from the vehicle when needed.

A familiar example is a school bus that may include safety devices in the form of stop signs that are mounted on the side of the school bus to move between a retracted position at the side of the school bus and a deployed position at which it extends outwardly at an angle of ninety degrees so as to be visible to motorist in other vehicles near the school bus to warn such motorist that children are entering or exiting the school bus. Similarly, crossing-arms are mounted on the front bumper of school buses to move between a retracted position along the length of the bumper and an extended position extending outwardly and perpendicularly from the bumper, and thereby creating a barrier that requires small children to walk around the extended crossing-arm so that they will be visible to the driver of the school bus. Typical examples of safety devices of this type are disclosed in greater detail in U. S. Patent Nos. 4,339,744 and 4,697,541.

These safety devices are usually mounted to the school bus by a pivotal mounting connecting one end of the safety device to the school bus in cantilever fashion, and the safety device is operated by an electric or vacuum operated motor to pivot the safety

device outwardly about the one pivoted end. By virtue of this cantilevered mounting arrangement, the extending length of the safety device is not securely held in place, even when the safety device is at its retracted position along side the bus. For example, a typical crossing-arm may have an extending length of about five feet, and its only connection to the school bus is at its pivotal connection at one of its ends.

Wind gusts can be severe enough, in some cases, to cause the safety device to move away from its retracted position, and when the school bus is in operation and moving, the inherent bouncing and bumpy motion created by such movement, combined with the aforesaid generally insecure cantilever mounting of the safety device, results in significant vibration of the safety device about its pivotal mounting. Such vibration, and the lack of a secure attachment of the safety device to the vehicle, can (and usually does) result in excessive wear on the bearings and other parts of the operating mechanism used for deploying and retracting the safety device, which over time can cause the safety device to malfunction, or at least require excessive maintenance.

Additionally, when a school bus is stopped with the safety device in its retracted position (e. g. when the school bus is parked), the safety device, particularly a crossing-arm, provides a tempting opportunity for a child to attempt to manually pull the safety device away from the bus to its extended position, which not only creates a dangerous situation for the child, but also can cause damage to the safety device and/or its operating system.

Some efforts have been made to develop a mechanical latch to engage the safety device and mechanically hold it in place, but these devices have not be successful -- primarily because there is too much vibration of the safety device to be successfully restrained by a mechanical latch, and also because it was not practical to develop a

mechanical latch which could be readily mounted on the wide variety of school bus bumpers and mounts which carry the safety devices.

Accordingly, there exists a need for a latching system that can securely maintain a safety device in place when it is not being used, yet permit deployment of the safety device when necessary.

Summary of the Invention

The present invention provides a latching system for selectively maintaining in place a safety device, pivotally mounted on a surface of a vehicle, for movement between a retracted position adjacent such surface, and an extended position at which it extends outwardly from the vehicle. The latching system includes an electrically-operated latching device mountable on the vehicle and operable between a first condition at which it engages the safety device and maintains it securely in place adjacent the vehicle, and a second condition at which it releases the safety device to permit movement thereof between its retracted and extended positions. An electrical control circuit is provided for operating the latching device to maintain the latching device in its first condition when the vehicle is moving, and for operating the latching device to maintain the latching device in its second condition when said vehicle is stopped.

In the preferred embodiment of the present invention, the electrically-operated latching device is an electromagnet, and the safety device is either a crossing-arm or a stop-arm. If the safety device is a crossing-arm, the electromagnet is mounted on the bumper of a school bus, and the crossing-arm has a portion thereof, which is composed of magnetically attractive material and which is disposed to be adjacent the electromagnet when the crossing-arm is at its retracted position along the length of the bumper. This portion may either be a part of the crossing-arm itself, if it is made of metal, or if the

crossing-arm is made of plastic or other non-magnetic material, a piece of magnetically attractive material may be attached to the crossing-arm.

Also, in the preferred embodiment of the present invention, the safety device is operated between its retracted and extended positions by an electric motor, and a control switch is mounted in the door of the vehicle and is operated by the movement of the door which causes the electric motor to move the crossing-arm from its retracted position to its extended position when the door is open, and to move the crossing-arm from its extended position to its retracted position when the door is closed. This control switch operates the electrical control circuit to cause the electromagnet to be energized when the door is closed and to be de-energized when the door is open.

Brief Description of the Drawings

Fig. 1 is a general view of a school bus, illustrating an extended stop-arm and an extended crossing-arm which are operable with the present invention;

Fig. 2 is a perspective view, illustrating a crossing-arm being maintained in place by a latching system of the present invention;

Fig. 3 is a perspective view, similar to Fig. 2, illustrating the crossing-arm after it has been released by the latching system and is moving to or from its deployed position;

Fig. 4 is a detail view, illustrating a plastic crossing-arm being maintained in place by a latching system of the present invention;

Fig. 5 is a detail view, illustrating a stop-arm being maintained in place by the latching system of the present invention; and

Fig. 6 is a schematic view, of the electrical control circuit forming part of the latching system of the present invention.

Description of the Preferred Embodiments

Looking now in greater detail at the accompanying drawings, Fig. 1 shows a typical school bus 10 having mounted there on at one side of the school bus 10 a stop-arm 12 that is operated by a conventional and well known electro-mechanical operating unit 14 which, as will be described in greater detail below, causes the stop-arm 12 to be moved between a retracted position extending along the side of the school bus 10, and a deployed or extended position at which it extends outwardly at a ninety-degree angle from the school bus so that it is visible to motorists behind and in front of the school bus 10. Similarly, a crossing-arm 16 is pivotally mounted to an operating unit 18 that may be identical to the operating unit 14 to move the crossing-arm 16 between a retracted position along side the front bumper of the school bus 10 and a deployed or extended position as shown in Fig. 1 at which it extends outwardly at a ninety degree angle from the front bumper of the school bus 10 so as to provide a barrier that requires school children to walk around the crossing-arm 16 at a location that is visible to the driver in the school bus 10 as compared to walking directly in front of the school bus 10 along the front bumper where small children may not be visible to the driver. As will be seen in Fig. 1, and as is well known in the art, the stop arm 12 and the crossing 16 are pivotally mounted at one end thereof to there respective operating units 14, 18, and they are supported in cantilevered fashion by the pivotal mounting to the operating units 14,18.

In accordance with the present invention, an electromagnet 20 is mounted on the front bumper of the school bus 10 as best seen in Figs. 2 and 3, and the crossing-arm 16, which is preferably in form of a "figure-8" design as disclosed in US Patent No. 4,697,541, and if the crossing-arm 16 is not made of a magnetically attractive material, a small plate 22 of magnetically attractive material may be attached to the crossing-arm 16 at a location that will position plate 22 at the electromagnet 20 when the crossing-arm 16

is at its retracted position as shown Fig. 2. If, on the other hand, the crossing-arm 16 is itself made of magnetically attractive material, such as steel, the plate 22 is unnecessary, and the crossing-arm 16 itself is arranged to be positioned adjacent the electromagnet 20 when the crossing-arm 16 is at its retracted position.

Figs. 4 and 4A show an alternate embodiment of the present invention in which the crossing-arm 16' is made of a strip of relatively thin plastic material, and the magnetically attractive plate 22' is secured to the end of the crossing-arm 16' so as to be adjacent the electromagnet 20 when the crossing-arm 16' is at its retracted position.

As illustrated in Fig. 5, the electromagnet 20 may also be used to maintain a stop-arm 12 in place, and since most stop-arms 12 are made of steel or other magnetically attractive materials, the electromagnet 20 is positioned so that it will be adjacent to the stop-arm when it is in its normal retracted position along side the operating unit 14. If the stop-arm 12 is made of a non-magnetic material, then a plate similar to the plate 22 can be secured to the stop-arm 12 in the same manner as that described above in connection with the crossing-arm 16.

As is well known in the art, and as explained in greater detail for example in US Patent Nos. 4,339,744, 4,559,518, and 4,983,949, it is a common practice to operate the stop-arm 12 and the crossing-arm 16 using a door switch 24 which is mechanically opened and closed by the door of the school bus 10. Briefly summarized, in such known systems, when the school bus 10 stops to either let children enter or exit the school bus 10, the driver will open the door of the school bus which closes the door switch and thereby connects the motor 30 (see Fig. 6) of the operating units 14 and 16 to the battery 26 of the school bus 10, and these motors 30 then cause the stop-arm 12 and crossing-arm 16 to be pivoted outwardly from their retracted positions to their extended positions as shown in Fig. 1. After the children have safely entered or exited the school bus 10, the

driver closes the door of the school bus 10 which opens the door switch 24, and the electrical control circuit 32 for the operating units 14, 18 operates the motors 30 to return the stop-arm 12 and crossing-arm 16 to their retracted position along side the school bus 10. In accordance with one feature on the present invention, this existing and known door switch 24 is utilized to operate the electromagnet 20 of the present invention.

More specifically, as schematically illustrated in Fig. 6, the door switch 24 is arranged in circuit with the existing battery 26 of the school bus 10 through the ignition switch 28 for the school bus 10, and the door switch 24 controls the motors 30 for the stop-arm 12 and the crossing-arm 16 in the conventional and known manner as that discussed above. The door switch 24 also controls the electromagnet 20. The door switch 24 is normally open when the door of the school bus 10 is closed, and the control circuit 32 for the electromagnet 20 operates to energizes the electromagnet 20 whenever the door switch 24 is open, and to de-energize the electromagnet 20 whenever the door switch 24 is closed.

Accordingly, since the door of the school bus 10 will always be closed when the school bus 10 is moving, the electromagnet 20 will be energized, and the adjacent stop-arm 12 or crossing-arm 16 will be maintained in place and held against the electromagnet 20, so as to reduce or eliminate the normal vibration of the cantilever-mounted safety device caused by the irregular movement of the school bus 10 as it moves along uneven road surfaces, particularly unpaved rural roads which are frequently encountered by school buses.

However, once the school bus 10 stops and the door of the school bus 10 is opened, the door switch 24 will cause the control circuit 32 to de-energize the electromagnet 20, and the stop-arm 12 or crossing-arm 16 will then be released by the electromagnet 20 so that it ca be readily moved between its retracted and extended

positions by the motors 30 in the conventional manner described above. Thus, the electromagnet 20 does not interfere in any way with the normal operation of the stop-arm 12 and the crossing-arm 16, yet it is operable to always maintain the stop-arm 12 and crossing-arm 16 securely in place along side school bus 10 during movement of the school bus 10.

In the preferred embodiment of the present invention, the door switch 24, which already exists on most school buses, is effectively used to also control the electromagnet 20. However, it will be understood that any conventional switch arrangement could be used in place of the door switch 24 to energize the electromagnet 20 when the bus is moving, and to de-energize the electromagnet 20 whenever it is necessary to operate the stop-arm 12 and/or crossing-arm 16. Also, in the preferred embodiment of the present invention, the electromagnet 20 is positioned so that it will be located near the outer most end of the cantilever-mounted crossing-arm 16 or stop-arm 12 to thereby provide the maximum stability when the electromagnet 20 is energized, but the electromagnet 20 could be located at any position that will provide effective stabilization of the stop-arm 12 and the crossing-arm 16. It is also within the scope of the present invention to simply reverse the magnetism of the elements 20 and 22, whereby 22 would be a permanent magnet, and 20 would be a demagnifier, such as a solenoid, which when energized, would cancel the magnetism of the permanent magnet and release the safety device. In this type of system, the element 20 would be de-energized when the door is closed and the school bus is moving, and energized when the school bus door is open.

It will therefore be readily understood by those persons skilled in the art that the present invention is susceptible of broad utility and application. Many embodiments and adaptations of the present invention other than those herein described, as well as many variations, modifications and equivalent arrangements, will be apparent from or

reasonably suggested by the present invention and the foregoing description thereof, without departing from the substance or scope of the present invention. Accordingly, while the present invention has been described herein in detail in relation to its preferred embodiment, it is to be understood that this disclosure is only illustrative and exemplary of the present invention and is made merely for purposes of providing a full and enabling disclosure of the invention. The foregoing disclosure is not intended or to be construed to limit the present invention or otherwise to exclude any such other embodiments, adaptations, variations, modifications and equivalent arrangements, the present invention being limited only by the claims appended hereto and the equivalents thereof.

Claims

1. A latching system for selectively maintaining in place a safety device pivotally mounted on a surface of a vehicle for movement between a retracted position adjacent such surface and an extended position at which it extends outwardly from the vehicle, such latching system comprising:

(a) an electrically-operated latching device mountable on said vehicle and operable between a first condition at which it engages said safety device and maintains it securely in place adjacent said vehicle, and a second condition at which it releases said safety device to permit movement thereof between said retracted and extended positions thereof; and

(b) an electrical control circuit for operating said latching device to maintain said latching device in said first condition when said vehicle is moving, and for operating said latching device to maintain said latching device in said second condition when said vehicle is stopped.

2. A latching system as defined in claim 1, wherein said electrically-operated latching device is an electromagnet, and wherein at least a portion of said safety device is made of magnetically attractive material.

3. A latching system as defined in claim 2, wherein said safety device and said electrically-operated latching device are mountable on a bumper of the vehicle.

4. A latching device as defined in claim 3, wherein said portion of magnetically attractive material is a separate piece mountable on said safety device at a location adjacent said electromagnet when said safety device is at said retracted position thereof.

5. A latching system as defined in claim 1, wherein said electrically-operated latching device is mountable on a bumper of the vehicle.

6. A latching system as defined in claim 1, wherein said control circuit includes an electrical switch mountable at a door in said vehicle and operable by said door to cause said control circuit to be maintained in said first condition thereof when said door is closed, and to cause said control circuit to be maintained in said second condition thereof when said door is open.

7. A latching system as defined in claim 1, wherein said safety device is a crossing-arm.

8. A latching system as defined in claim 1, wherein said safety device is a stop-arm.

9. In combination with a vehicle having a safety device pivotally mounted on a bumper of a vehicle for movement between a retracted position adjacent said bumper and an extended position extending outwardly from said bumper, a latching system comprising:

(a) an electromagnet mounted on said bumper and operable between a first energized condition at which it engages said safety device and maintains it securely in place adjacent said bumper, and a second de-energized condition at which it releases said safety device to permit movement thereof between said retracted and extended positions thereof; and

(b) an electrical control circuit for operating said electromagnet to maintain said electromagnet in said first energized condition when said vehicle is moving and for operating said electromagnet to maintain said electromagnet in said second de-energized condition when said vehicle is stopped.

10. The combination as defined in claim 9, wherein said crossing-arm is operated between said retracted and extended positions there of by an electric motor, wherein said electrical control circuit includes a control switch mounted in the door of said vehicle, and operated by said door to cause said electric motor to move said crossing-

arm from its retracted position to its extended position when said door is open, and to move said crossing-arm from its extended position to its retracted position when said door is closed, and wherein said control switch operates said electrical control circuit to cause said electromagnet to be energized when said door is closed and to be de-energized when said door is open.

11. The combination as defined in claim 9, wherein said crossing-arm includes at least a portion there made of magnetically attractive material that is disposed on said crossing-arm to be adjacent to and in contact with said electromagnet when said crossing-arm is in said retracted position.

12. The combination as defined in claim 10, wherein said crossing-arm is made of a plastic material, and wherein said portion of magnetically attractive material is attached to said crossing-arm.

13. A latching system as defined in claim 9, wherein said safety device is a crossing-arm.

14. A latching system as defined in claim 9, wherein said safety device is a stop-arm .

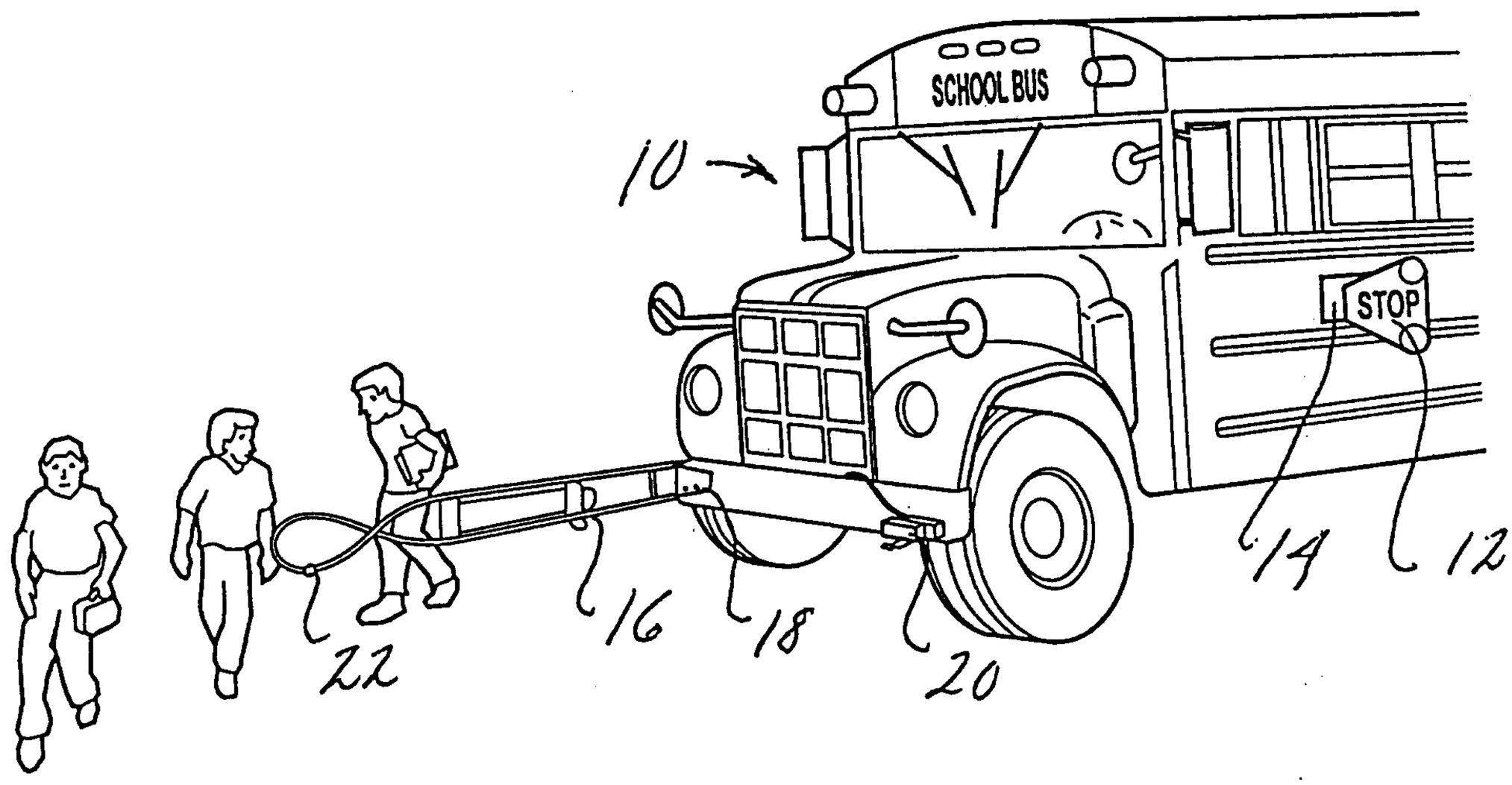


Fig. 1

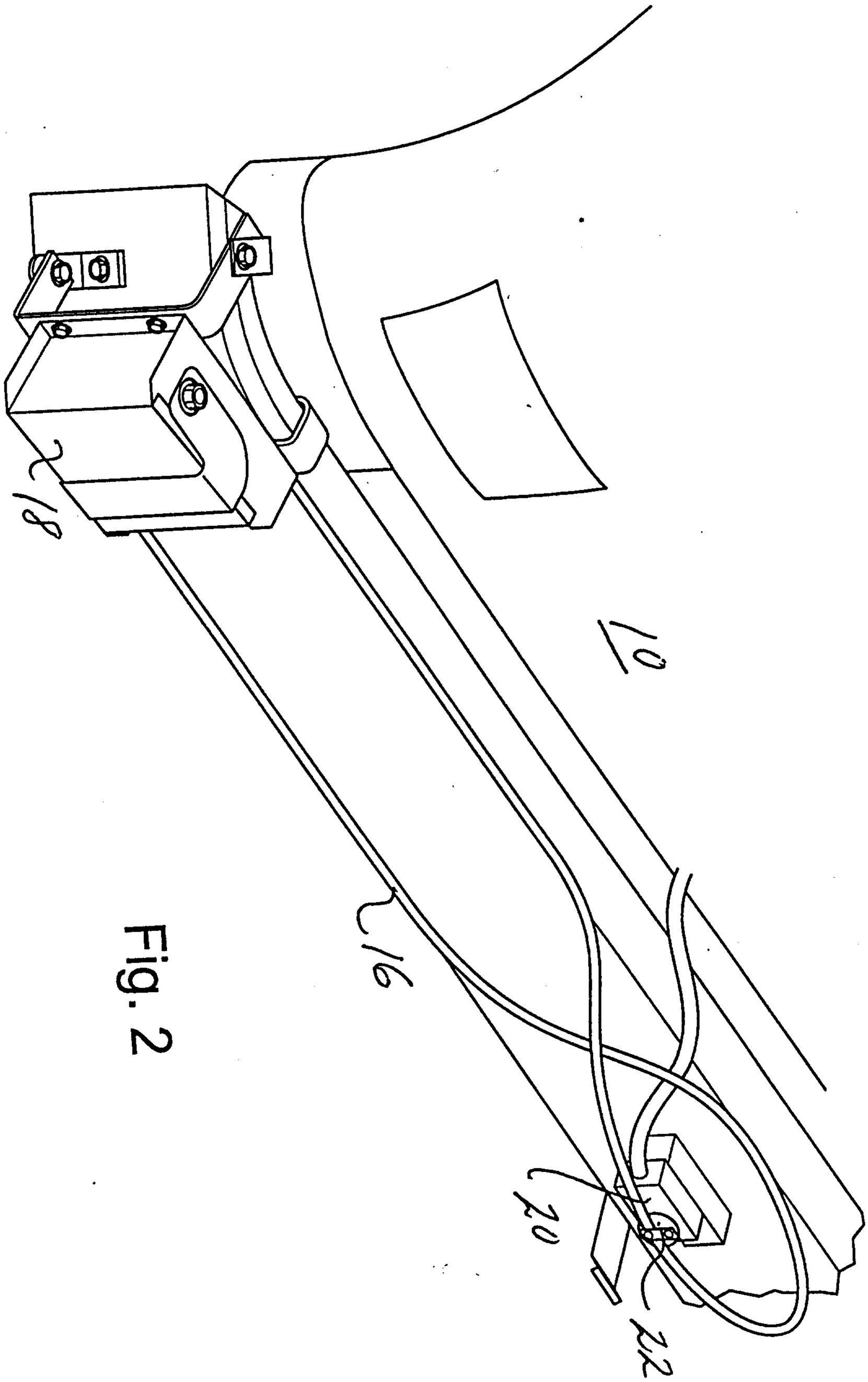


Fig. 2

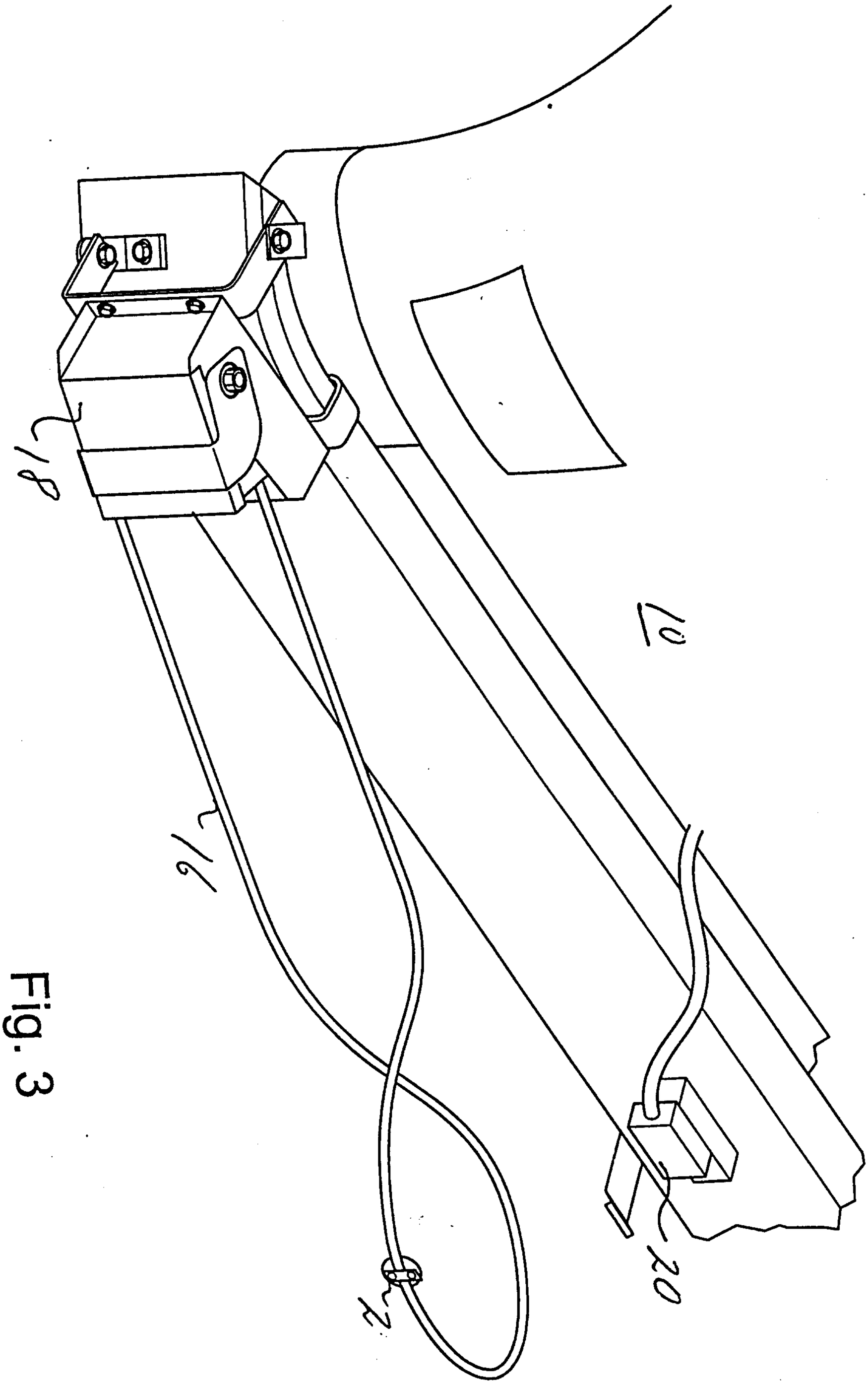


Fig. 3

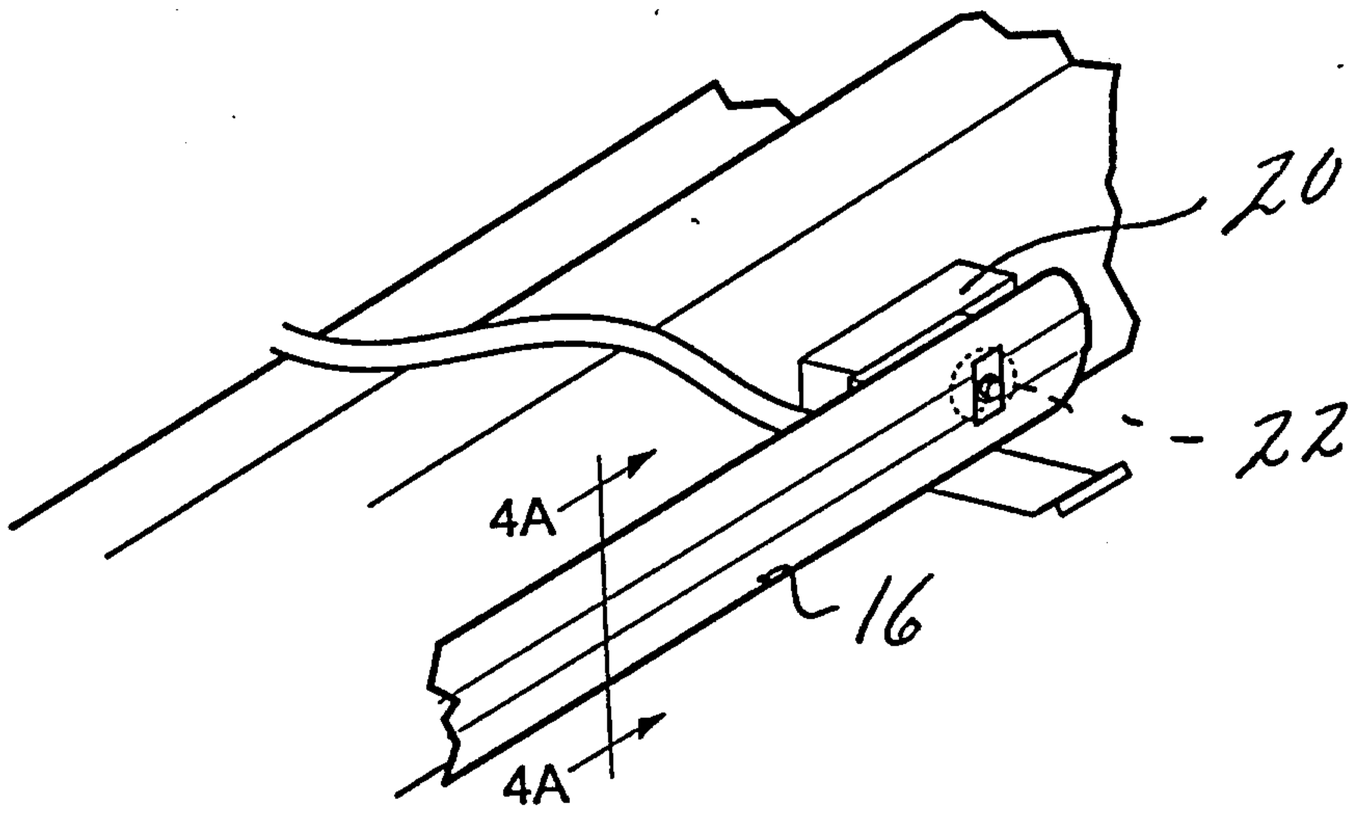


Fig. 4

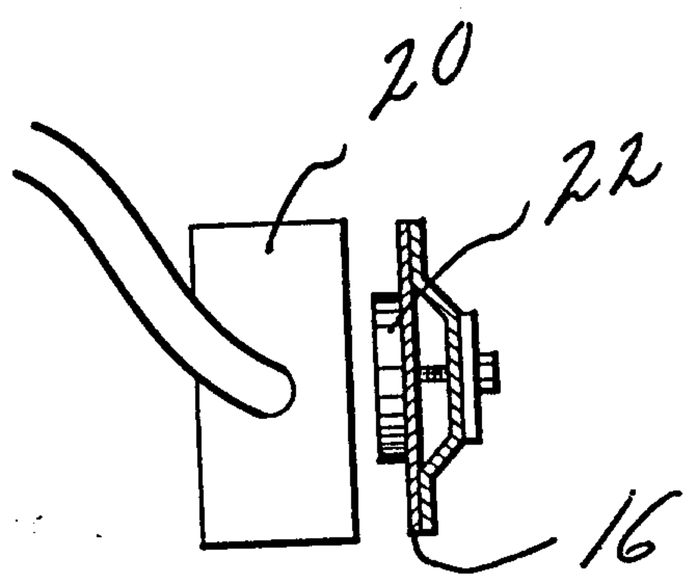


Fig. 4A

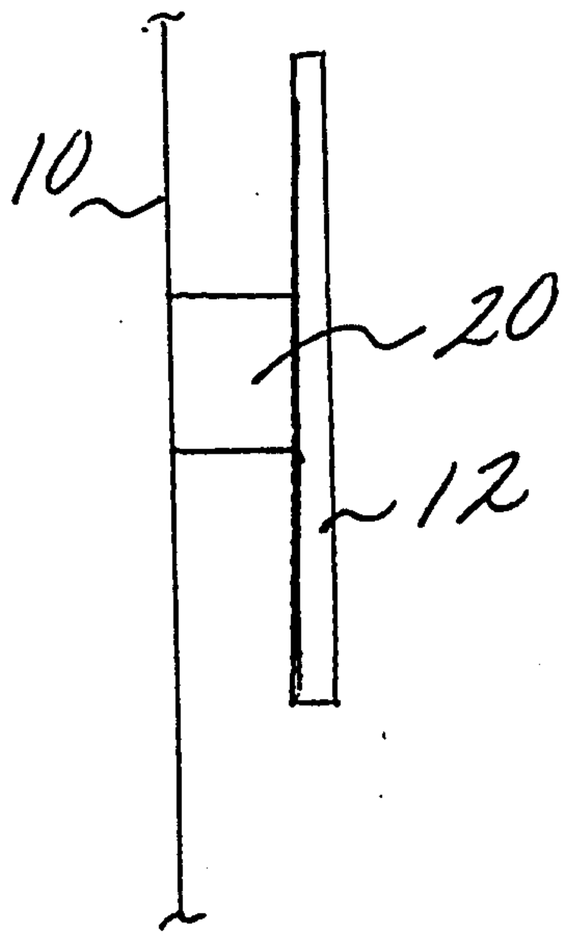

10
20
12

Fig. 5

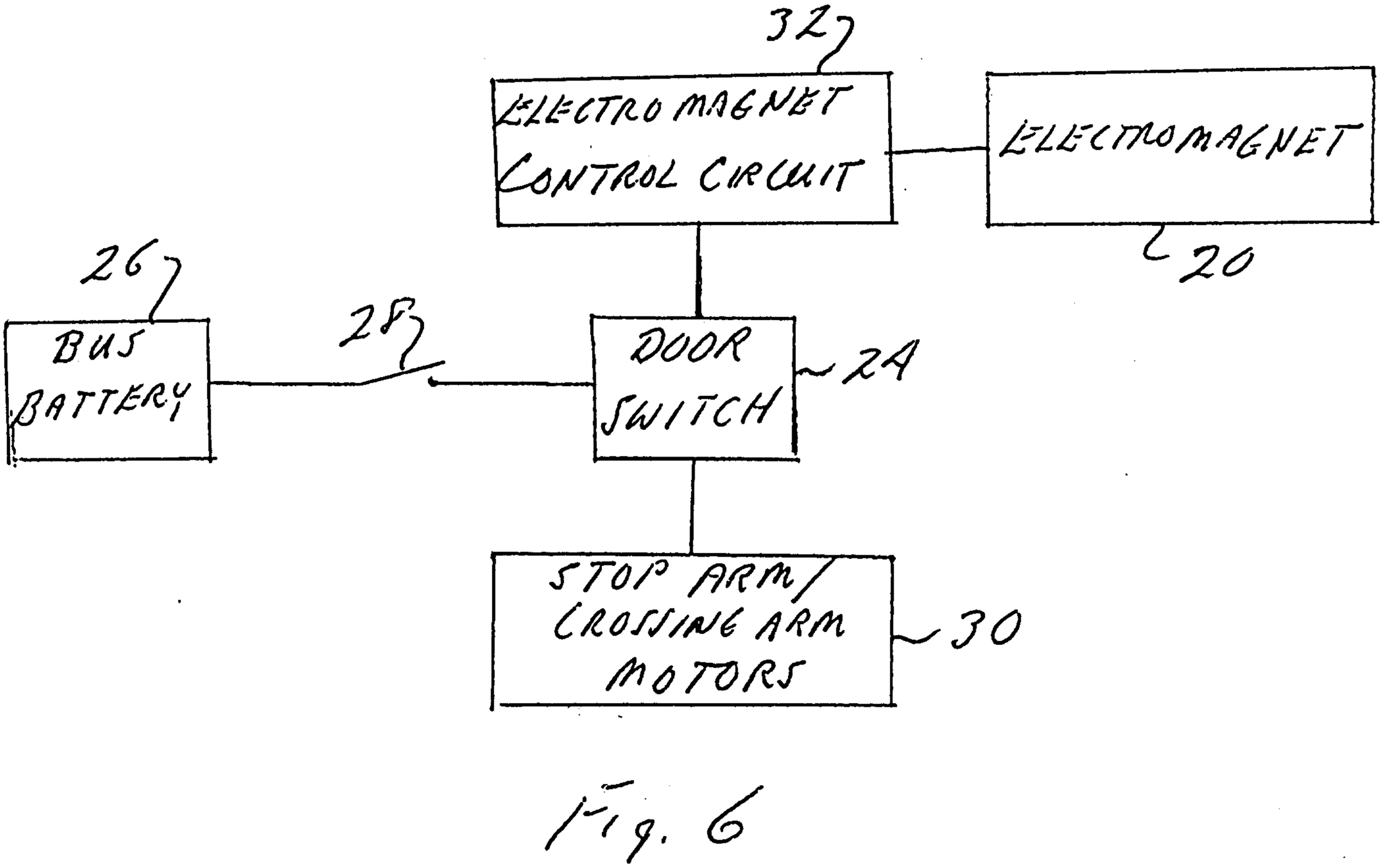
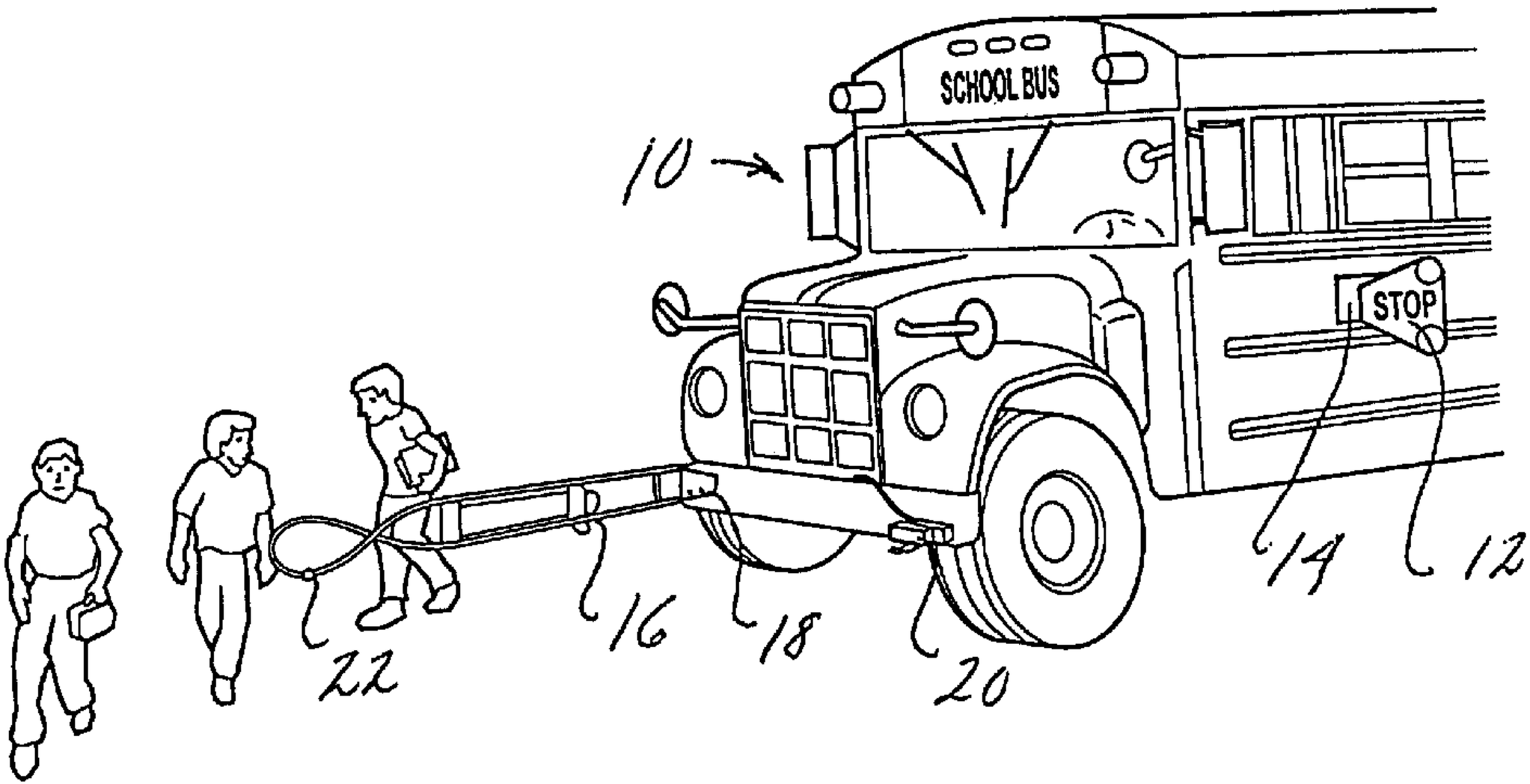

32
ELECTRO MAGNET CONTROL CIRCUIT
ELECTROMAGNET
20
26
BUS BATTERY
28
DOOR SWITCH
24
STOP ARM/ CROSSING ARM MOTORS
30

Fig. 6


SCHOOL BUS
STOP
10
12
14
16
18
20
22