Nov. 29, 1966 TADASHI MATSUDAIRA ETAL 3,288,992

DERAILMENT DETECTOR ACTUATED BRAKE SYSTEM

Filed July 30, 1964 2 Sheets-Sheet 1

FIG. 1

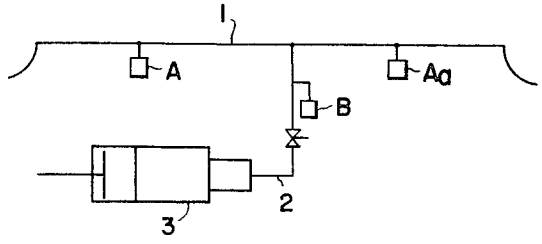


FIG. 2

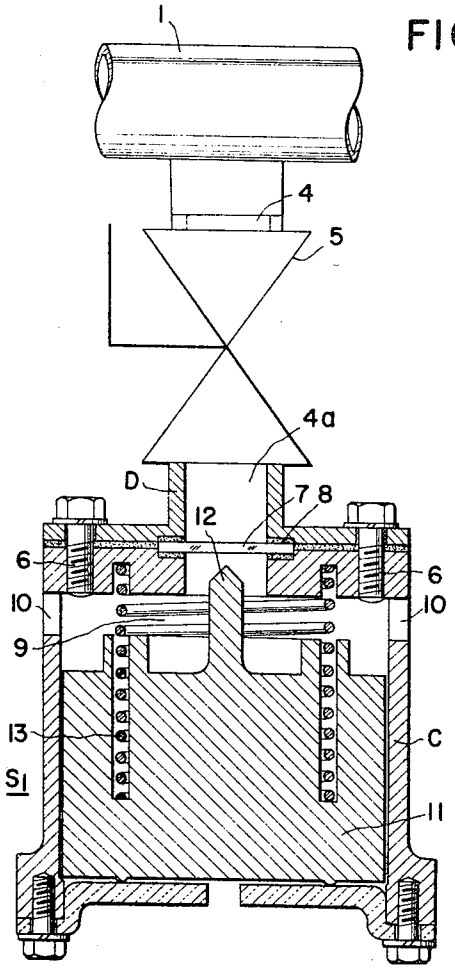
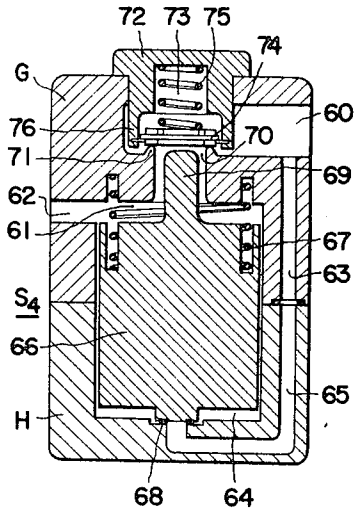


FIG. 5



DERAILMENT DETECTOR ACTUATED BRAKE SYSTEM

Filed July 30, 1964 2 Sheets-Sheet 2

FIG. 3

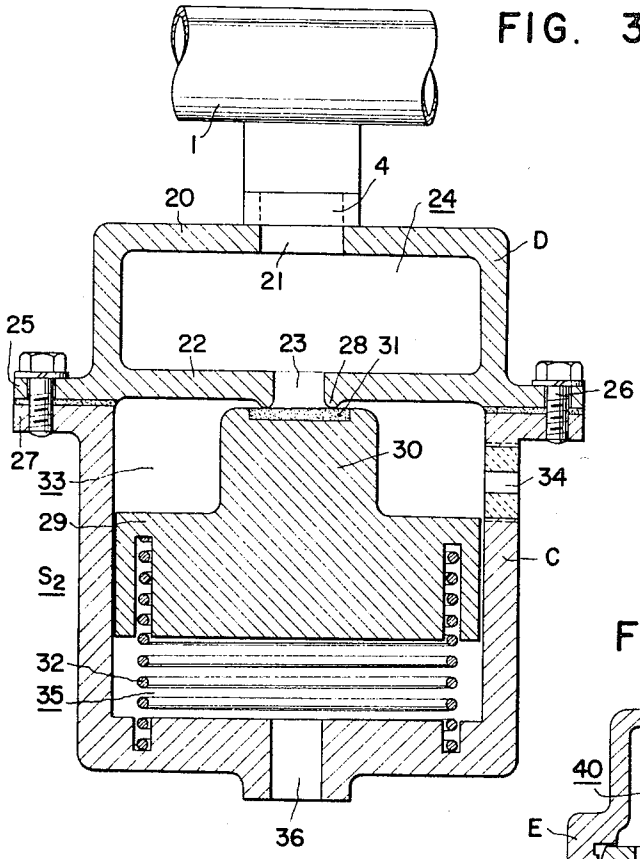
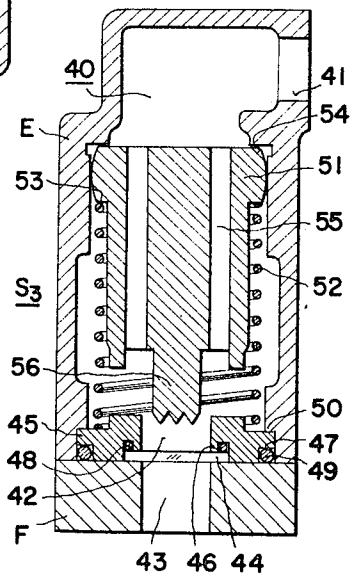


FIG. 4



United States Patent Office 3,288,992 Patented Nov. 29, 1966

3,288,992

DERAILMENT DETECTOR ACTUATED BRAKE SYSTEM

Tadashi Matsudaira and Yoshio Nomura, Tokyo-to, Japan, assignors to Nippon Kokuyu Tetsudo (known in English as Japanese National Railways), Tokyo-to, Japan, a juridical person organized under the Public Law of Japan

Filed July 30, 1964, Ser. No. 386,334
3 Claims. (Cl. 246—173)

This invention relates to a system for detecting derailments of railway vehicles and automatically initiating emergency operation and a safety device therefor, and more particularly to a system which will automatically vent the pressurized air within the brake pipe of the railway vehicles to brake the latter if derailment should occur.

When one or more railway cars of a running passenger or freight train are derailed for some reason, the train often continues to run without the derailment being noticed by the engine driver, brakeman, or conductors if the derailed cars are in the middle of the train. In such a case, the derailed wheels of the cars will often override a branch point of the track or other installations with resultant overturning of the derailed cars. This overturning usually has influence upon the railway cars which have not been derailed, and, consequently, the damage by the derailment is made greater.

Accordingly, it is desirable that when any car of a railway train is derailed, the train be automatically braked so as to stop after a short run, and the trainmen can notice the derailment.

When cars of a railway train are derailed, they are usually caused to run on the ties or ballasts and, consequently, are subjected to an extremely high vertical acceleration due to vibrations or shocks. This acceleration due to derailment is far greater than that under the normal running condition, and it has been found that this acceleration can be utilized for detecting derailment.

A principal object of this invention is to provide a safety device which will automatically vent a brake pipe of the braking system for the railway train to brake the latter when one or more railway cars of the train are derailed.

Another object of this invention is to provide a safety device of the above character which will automatically restore the braking system, after a braking operation, into the state operable for subsequent braking operation.

Another object of this invention is to provide a safety device of the above character which will operate railway.

The foregoing and other objects of this invention will become more apparent and clear from the following detailed description of preferred non-limiting embodiments of the invention, taken in connection with the accompanying drawings, in which the same or equivalent members are indicated by the like reference numerals and characters, and in which:

FIG. 1 is a schematic diagram of a braking system to which the safety devices according to this invention have been applied.

FIG. 2 is a vertical section of a first embodiment of this invention;

FIG. 3 is a vertical section of a second embodiment of this invention;

FIG. 4 is a vertical section of a third embodiment of this invention; and

FIG. 5 is a vertical section of a fourth embodiment of this invention.

Referring now to FIG. 1, there is shown a schematic diagram of a braking system for railway vehicles, provided with the safety device according to this invention. In this figure, the reference numeral **1** designates a brake pipe in the conventional braking system for railway vehicles. The brake pipe **1** is provided with a branch pipe **2** communicating with a pneumatic braking device **3**, which includes a control valve, an air reservoir and a brake cylinder (not shown) as is well known.

The safety device according to this invention may be attached to the brake pipe **1** or branch pipe **2** as shown at A, A_a or B, at the nearest position to the axles.

Referring to FIG. 2, there is illustrated one embodiment of the safety device of the present invention, which is shown as being connected to the brake pipe **1**. From the brake pipe **1** there extends a pipe **4** having a cut-off valve **5** which is connected to the safety device S_1.

The safety device has a cylindrical housing C and a cap D which is secured onto the housing C by means of bolts **6** and provided with a pipe 4_a connecting the device S_1 to the valve **5**. A breakable plate **7** of a material which is brittle but of high strength, such as glass, is secured between the housing C and cap D with a packing **8** disposed therearound, and prevents communication from the pipe 4_a to the interior chamber **9** of the housing C. The plate **7** is made sufficiently thick so as not to be broken by the air pressure in the pipe 4_a. The chamber **9** within the housing C communicates with the atmosphere through vent ports **10** and is always under atmospheric pressure.

Within the housing C there is disposed a weight **11** which is vertically slidable along the side wall of the housing and includes a sharpened projection **12** thereon confronting the breakable plate **7**. The weight **11** is urged toward the bottom wall of the housing C by means of a coiled compression spring **13** inserted between the top wall of the housing C and the top face of the weight **11**. The force of the spring **13** is so determined that the weight **11** will not be caused to rise by vibrations or shocks as occur under the usual running conditions of the train. The weight **11** is confined by the side wall of the housing C and is slidable only vertically by the guiding action of the housing.

The safety device S_1 as described above must be vertically attached to the railway vehicle. It may be secured to the floors of the vehicles and connected with the brake pipe or secured directly to the brake pipe without being otherwise supported.

According to such construction and arrangement of the device, the shocks or vibrations as will occur under the normal running condition of railway cars cannot cause the vertical movement of the weight **11** relative to the housing C. However, if even one pair of wheels of a railway car are derailed and run on the ties and other objects, a very high acceleration will be imparted to the derailed railway car with the result that the weight **11** will overcome the force of the spring **13** and plunge upwardly. Thus, the sharpened end of the projection **12** on the weight **11** will strike against the lower surface of the breakable plate **7** to break it. Once a small break occurs, the pressurized air within the pipe 4_a will make the break larger and will be rapidly vented through the broken plate, the chamber **9** and the ports **10** into the atmosphere. Thus, the air pressure within the brake pipe **1** will be reduced, thereby causing the braking device **3** to operate to brake the train according to known principle.

After the train is stopped by the braking action, the braking system may be put into the original operable condition simply by manually closing the cut-off valve **5**. The breakable plate **7** is readily replaceable. Thus, it is apparent that the restoration of the braking system including the safety device may be easily effected.

When the braking system is operated with reduced air pressure within the brake pipe as aforementioned, all of the cars in the train, including those not derailed, will come under the influence of the braking system. Therefore, the train will be quickly braked and automatically stopped

even if a pair of wheels of an intermediate car of the train are derailed. Thus, the derailment will not cause overturning of the train. Moreover, since the sudden reduction of air pressure in the air pipe **1** and the sudden retardation of the train may be readily noticed by the engine driver and other trainmen, they can promptly resort to appropriate measures for the derailment.

In FIG. 3, another embodiment of the safety device of the present invention is illustrated. This safety device S_2 is also shown as being connected to the brake pipe **1** having the pipe **4**, and comprises a housing C and a cap D secured onto the housing C. The cap D is in the form of a cylinder having a top wall **20** with an opening **21** therein and a bottom wall **22** with an opening **23**, and is connected to the pipe **4** at the portion of the opening **21**. The top and bottom walls **20** and **22** and the side wall of the cap D define a chamber **24** therein. The cap D is also provided with a peripheral flange **25**, which is placed on a peripheral flange **27** extending from the upper edge of the housing C to be bolted to the flange **27** as shown at **26** with a packing therebetween. The opening **23** in the wall **22** has at the lower edge thereof an annular projection **28** forming a seat for a packing which will be hereinafter described.

A weight **29** is arranged within the housing C for vertical sliding movement therealong and is provided on the upper face thereof with a projection **30** having thereon a packing **31**. The weight **29** is urged upwardly by means of a coiled compression spring **32** arranged between the weight and the bottom wall of the housing C so that the packing **31** on the projection **30** is always in tight contact with the seat **28** thereby closing the opening **23**.

The force of the spring **32** urging the weight upwardly is selected so as to be slightly less than the sum of the downward force of the pressurized air acting on the projection **30** through the opening **23**, the gravitational force acting on the weight, and a downward force which is caused by the acceleration of the weight **29** in the case of derailment of the railway car.

The internal chamber **33** of the housing C above the weight **29** is in communication with the atmosphere through a throttled vent port **34**. The internal chamber **35** of the housing below the weight is also in communication with the atmosphere through a port **36**.

In the normal running condition of the railway car, the pressurized air within the chamber **24** cannot flow into the atmosphere, since the packing **31** on the top of the projection **30** is in tight engagement with the seat **28** so as to close the opening **23**. However, if any derailment occurs with the resultant vertical acceleration imparted to the railway car, the weight **29** will be driven downwardly to cause the packing **31** to leave the seat **28**. Once the packing **31** moves away from the seat **28** through a small distance, the pressurized air within the chamber **24** of the cap D will flow into the chamber **33** above the weight **29** thus increasing the air pressure therein and then flow into the atmosphere through the vent port **34**. In this case, the air pressure within the chamber **33** of the housing will be maintained at a pressure lower than that in the chamber **24** but higher than the atmospheric pressure since the vent port **34** is throttled and restricts the flow of air therethrough.

This air pressure within the chamber **33** will act upon the entire upper surface area of the weight **29**, which is larger than the transverse sectional area of the opening **23** and will, therefore, produce a downward force sufficient to compress the spring **32**. Accordingly, once the weight **29** moves downwardly, the chamber **24** will be continuously maintained in communication with the atmosphere and the pressurized air within the brake pipe **1** will be continuously vented into the atmosphere, thus causing the braking system to operate.

When the brake pipe pressure is reduced to a considerable low value after the train has been stopped by the braking action, the air pressure within the chamber **33** of the housing C will be corresponding reduced. Under such circumstances, the downward force due to the air pressure within the chamber **33**, acting upon the upper surface of the weight **29**, will be overcome by the force of the spring **32** so that the weight **29** will be moved upwardly until the packing **31** is brought into tight engagement with the seat **28** to close the opening **23**.

In the operation above mentioned, the port **36** cut in the bottom wall of the housing C serves to release the air within the chamber **35** into the atmosphere when the weight **29** moves downwardly, and prevents the air within the chamber **35** from being compressed, thereby eliminating the resistance to the downward movement of the weight **29**.

The safety device S_2 as described above in connection with FIG. 3 has the same function of affording safety in the event of derailments as the device of FIG. 2; that is, the device of FIG. 3 has the function of detecting derailments and then causing the brake pipe pressure to be reduced so as to actuate the braking system, as in the case of the device of FIG. 2.

In addition to this safety function, the device of FIG. 3 has a self-restoring characteristic capable of making the weight **29** return upwardly to its original position in response to the substantial reduction of the brake pipe pressure due to the venting of the air. This self-restoring characteristic of the device is very convenient since the braking system, after the stoppage of the train, automatically returns to its original state operable for braking without any corrective measures on the part of an operator.

Referring to FIG. 4, there is illustrated another embodiment of the present invention. The safety device S_3 shown in this figure is of breakable plate type and is constructed so as to afford a more reliable operation. The device S_3 comprises a housing E and a base F forming the bottom of the housing. The housing E is in the form of a cylinder and includes an internal chamber **40** therethrough having an upper horizontal opening **41** and a lower opening **42**, said upper opening **41** communicating with a brake pipe **1** (not shown).

The base F is in the form of a relatively thick circular plate and includes a central vent port **43** therethrough axially aligned with the chamber **40** of the housing E.

On the upper surface of the base F there is placed a breakable plate **44** of a material such as glass so as to cover the upper end of the vent port **43**. The base F also supports thereon an annular block **45** having an inner shoulder **46** formed at the inner lower edge thereof and an outer shoulder **47** formed at the outer lower edge thereof. The annular block **45** is in axial alignment with the base F and the peripheral edge of the breakable plate **44** is engaged with the inner shoulder **46** of the block **45** with an annular packing **48** therebetween. Another annular packing **49** is also fitted within the outer shoulder **47** of the block **45**.

The cylindrical housing E has an inner shoulder **50** at the lower edge thereof which is adapted to engage the upper peripheral edge of the block **45**. Thus, when the housing E is rigidly secured to the base F, the annular block **45** is held between the shoulder **50** and the base F and the breakable plate **44** is also secured between the block **45** and the base F. Once such an assembly is completed, the packings **48** and **49** create an airtight condition, and the breakable plate **44** prevents communication from the chamber **40** to the port **43**.

In the chamber **40** of the housing E there is disposed a weight **51** which is always urged upwardly by means of a coiled compression spring **52** inserted between the upper face of the block **45** and a shoulder **53** of the weight **51**. The weight **51** is vertically movable against the force of the spring **52** and in its uppermost position engages with a portion **54** of reduced diameter within the housing. Vertical passages **55** extend through the weight **51** and permit the introduction of pressurized air into the space below the weight **51**. The weight **51** is provided with a projection **56** extending downwardly from the

bottom thereof to confront the breakable plate **44**. The force of the spring **52**, upwardly urging the weight **51**, is selected so as to be slightly less than the sum of the gravitational force on the weight **51** and the downward force exerted upon the weight due to acceleration caused by derailment of the vehicle.

Under normal running condition of the railway vehicle, the members of the device S_3 are in the state shown in FIG. 4, in which the weight **51** is held at rest in its uppermost position, and the pressurized air introduced into the chamber **40** below the weight **51** is prevented from being vented into the atmosphere by the breakable plate **44**.

However, if derailment occurs with the resultant vertical acceleration imposed on the vehicle, the weight **51** will be driven downwardly so that the downwardly extending projection **56** thereof will forcibly strike and break the breakable plate **44**. In this case, even though a complete breakage of the plate **44** cannot be attained, with the plate being only cracked to a degree to allow air to pass therethrough, the pressurized air within the chamber **40** will be vented into the atmosphere through the port **43**, which venting will create a pressure difference between the space above the weight **51** and that below the weight due to the throttling effect of the channels **55**, so that the weight will be pushed downwardly to completely break the plate **44**. When the breakable plate **44** is completely broken, the pressurized air within the brake pipe will flow in substantial quantity through the upper space of the chamber **40**, the channels **55**, the lower space of the chamber **40**, and the vent port **43** to be vented into the atmosphere. Thus, the vehicle braking operation is carried out.

Referring to FIG. 5, a still another embodiment of the present invention will be described. The device S_4 illustrated in this figure is of the self-restoring type, as shown in FIG. 3, in which a valve arrangement is used to vent the air upon derailment.

The device comprises an upper cylindrical housing G, and a lower cylindrical housing H secured to the upper housing G by any suitable means. The upper housing G has therein a substantially horizontal inlet chamber **60**, a downwardly opening central chamber **61** communicable with the inlet chamber **60**, and a vent port **62** horizontally extending from the central chamber **61**. The upper housing G also has therein a vertical passage **63** extending downwardly from the horizontal inlet chamber **60**.

The lower housing H is in the form of a cup and includes therein an upwardly opening chamber **64** and an L-shaped passage **65** communicating with the bottom of the chamber **64**. When these upper and lower housings G and H are assembled, the chamber **61** of the housing G and the chamber **64** of the housing H together form an internal chamber extending axially through the device, and the passages **63** and **65** also form a passage leading from the inlet chamber **60** to the bottom of the chamber **64**.

Within the internal chamber of the device there is disposed a weight **66** which is movable axially along the wall of the chamber and is urged downwardly by means of a coiled compression spring **67** inserted between the top wall of the chamber **61** and the top face of the weight **66**. The weight **66**, in its downwardly urged, lowermost position, tightly closes the opening of the passage **64** through a packing **68** interposed therebetween. The weight **66** is provided on its top with a projection **69** which is upwardly extended into a channel **70** which connects the inlet chamber **60** to the central chamber **61** and is provided at the uppermost peripheral edge thereof with a valve seat **71**.

Through the top wall of the housing G there is provided an inverted cup-shaped member **72** having a downwardly opening chamber **73**. On the valve seat **71** there rests a valve plate **74** pressed thereagainst by a compression spring **75** disposed within the chamber **73**. The valve plate **74** is vertically movable against the force of the spring **75** and along guide extensions **76** of the member **72**.

The inlet chamber **60** is connected at its outer end to a brake pipe (not shown) and is in communication with the chamber **73** of the member **72**. Since the chamber **61** is under atmospheric pressure, and a force is exerted upon the upper surface of valve plate **74** by both the spring **75** and the pressurized air within the chamber **73**, the valve plate **74** is normally in tight engagement with the valve seat **71**.

The force of the spring **67** is selected so as to be slightly less than the total value of the upward force exerted on the bottom of the weight **66** by the pressurized air within the channel **65** when the weight is closing the latter and the upward force due to the acceleration which occurs in the event of derailment.

In the normal running condition of the railway vehicle, the device S_4 is maintained in the state shown in FIG. 5 with the valve plate **74** in tight engagement with the valve seat **71**, and the air pressure within the inlet chamber **60** and, therefore, within the brake pipe is maintained at a desired level without the air being vented into the atmosphere. However, if derailment occurs, the weight **66** will be impelled upwardly by the resulting acceleration. Once the weight **66** leaves the bottom of the chamber **64** through even a small distance, the pressurized air within the channel **65** will flow into the chamber **64** below the weight **66** and push the latter upwardly because the surface area of the weight acted upon by the pressurized air from the channel **65** is thereby increased, so that the upward force due to the pressurized air from the channel **65** overcomes the gravitational force upon the weight and the force of the spring **67**.

This upward movement of the weight causes the projection **69** thereof to lift the valve plate **74** so as to allow the pressurized air within the brake pipe to be vented into the atmosphere through the chambers **60** and **73**, the channel **70**, the chamber **61**, and the port **62**. Thus, the braking operation will be effected.

When the air pressure within the brake pipe is reduced to a substantial degree, both the gravitational force acting upon the weight and the force of the spring **67** cause the weight to move downwardly into engagement with the bottom of the chamber **64** thus preventing the communication between the chamber **64** and the channel **65**, while the valve plate **74** returns to its initial position in which it is in tight engagement with the seat **71**, as shown in FIG. 5.

In the embodiment shown in FIG. 5, the valve plate **74** may be replaced by a breakable plate, for example, of glass, tightly secured on the seat **71**. In such a case, the breakable plate will be broken by the projection **69** upon the upward movement of the weight **66**, thereby venting the pressurized air.

When a braking system of electrically operated type is to be employed, electric contacts may be provided at the portion of the breakable plate or the valve arrangement of the device according to this invention, so as to be closed by the movement of the weight upon derailment to establish an electric circuit for braking. In such a case, the electric circuit for braking may be utilized for actuating an emergency alarm which may be installed in the engine driver's cab or a trainman's room.

While preferred embodiments of this invention have been shown and described in the foregoing disclosure, it is to be understood that this invention may be modified or changed without departing from the spirit and scope of this invention as set forth in the following appended claims.

What is claimed is:

1. A safety device adapted to be connected to a brake pipe of the pneumatic braking system of a railway vehicle for detecting derailment of the vehicle and automatically causing braking action, said device comprising a housing adapted to be connected with the brake pipe in communicating relation thereto and having a vertical-

ly extending internal chamber therein, said chamber having a vent port leading to the atmosphere, intercepting means for normally preventing communication from said brake pipe into said chamber, a weight vertically movable within said chamber, and spring means for urging said weight toward one vertical end of said chamber so as to hold the weight at rest under normal running condition of the vehicle but to allow the same to move vertically by the force of acceleration due to derailment of the vehicle against the force of the spring means toward the other vertical end of the chamber, the relation between said intercepting means and said weight being such that when the weight moves toward said other vertical end of the chamber, said intercepting means is caused to allow communication from said brake pipe into said chamber, thereby venting the pressurized air within the brake pipe into the atmosphere through said vent port to cause braking action of the brake system.

2. The safety device according to claim 1, wherein said intercepting means is a breakable plate of a material which is brittle but of high strength, secured between said brake pipe and said chamber, and is adapted to be broken by the movement of said weight toward said other vertical end of said chamber.

3. The safety device according to claim 1, wherein said intercepting means is a normally closed valve means adapted to be opened by the movement of said weight toward said other vertical end of said chamber.

References Cited by the Examiner

UNITED STATES PATENTS

998,513	7/1911	Hill	246—173
1,646,306	10/1927	Milton	246—172
2,626,625	1/1953	Versoy	137—38
2,760,484	8/1956	Ferwerda	137—38 X
3,127,958	4/1964	Szostak	137—38 X

EUGENE G. BOTZ, *Primary Examiner.*