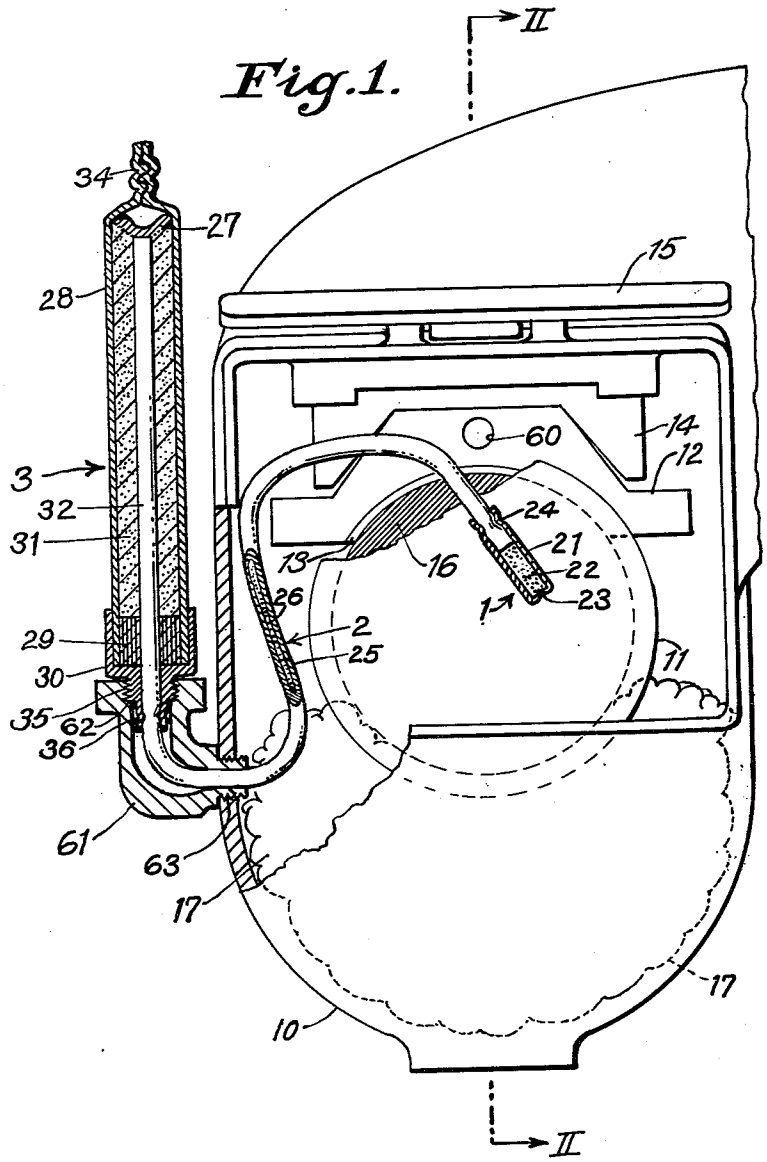
Nov. 6, 1962 C. O. WILLIAMS 3,062,176

SIGNAL DEVICE

Filed March 1, 1960 2 Sheets-Sheet 1

Fig. 1.



INVENTOR:
Charles O. Williams
BY
John F. Williams
Lionel S. Rose
ATTORNEYS

Nov. 6, 1962 C. O. WILLIAMS 3,062,176

SIGNAL DEVICE

Filed March 1, 1960 2 Sheets-Sheet 2

Fig. 3.

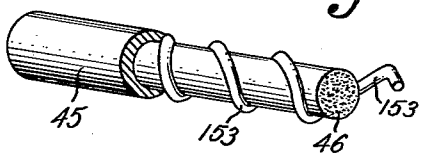


Fig. 2.

INVENTOR:
Charles O. Williams
BY
John D. Wilkins
Lowell E. Hoff
ATTORNEYS

United States Patent Office 3,062,176 Patented Nov. 6, 1962

3,062,176

SIGNAL DEVICE

Charles O. Williams, Alton, Ill., assignor to Olin Mathieson Chemical Corporation, East Alton, Ill., a corporation of Virginia

Filed Mar. 1, 1960, Ser. No. 12,017
10 Claims. (Cl. 116—104)

This invention relates to a thermal tell-tale device operable at a predetermined temperature to indicate the existence or approach of an unsafe or defective condition in a structure, and more particularly to a pyrotechnic signal device operable when an overheated condition is reached in an axle bearing structure, such as when a "hot box" occurs in the wheel bearing structure of a railway car or the like.

Hot boxes and journal failures are one of the most serious problems faced in the operation of railroads. Although this is an old problem, in recent years the problem has been accentuated because of the higher sustained speeds and heavier loads made possible with diesel locomotives.

Heretofore, a number of safety devices have been suggested in the prior art for operation as hot box indicators, but because of the disadvantage attending them, such devices have not been used extensively. Some prior art devices involve complicated assembly of grids, lids and attachments, striking levers, expansion members, propellent cartridges and projectiles and firing pins, which make replacement such a complicated and expensive procedure as to either interfere with the operating schedule of a train or to be prohibitive. Others involve blocks of fuel arranged to become flammable and burn along side the journal box in such a way as to add to the overheated condition indicated. Others are designed to emit characteristic odors upon overheating. Still others produce an indicating flame or spray of paint in such a way as to make the hot box condition a fire hazard as well as to indicate the existence of the hot box. Still others involve fusible plugs for releasing signal liquids and suffer from the disadvantage of unreliability and premature operation of the fusible plug.

Therefore, one object of this invention is to provide a relatively simple, but reliable "hot box" indicator capable of emitting a visual signal in the event the temperature of the bearing in the journal box closure rises beyond a safe operating maximum, but long before breakdown occurs.

Another object is to provide a relatively inexpensive expendable device of this type and which can be readily replaced with a minimum of delay by another in the event of actuation of the one installed.

A still further object is to provide a pyrotechnic or gas pressure generating cartridge hot box indicator device of improved sensitivity and accuracy of actuation at a predetermined temperature.

A still further object is to provide such a device to be initiated by as direct as possible an application of the heat with a minimum of interposed operating links which may themselves either break down, fail to act properly, or to detract from accuracy and reliability of the result sought.

Still another object is to provide such an indicator device utilizing compositions so formulated as to not only initiate the device, but to also carry on its operation to produce reaction products sufficiently luminous to be observable in the dark, or also being suitably colored so as to be readily observable in the light.

Other objects and advantages will become readily apparent from a description of preferred embodiments of this invention as shown in the drawing wherein:

FIG. 1 is a fragmentary side view showing part of a railway car wheel truck at one of the journal boxes with

the hinged lid lifted to show the bearing parts partly in section with the journal partly broken away together with one embodiment of the device and installation of this invention shown partly in section as installed on the box, except for its capsule which is left exposed and sectioned to show it better;

FIG. 2 is a vertical section taken on a line corresponding to section II—II of FIGURE 1, but illustrating another embodiment different from the embodiment of FIGURE 1 at least in that the arrangement is associated with the lid and preferred in certain respects; and

FIG. 3 is an enlarged perspective view partly in section showing a fragment of another form of the fuse for coiling.

The device of this invention has utility especially in connection with bearings carrying very heavy loads such as the journal bearing structure of a railway car, for example, traveling at high speed for long periods. Each bearing of a railroad car usually comprises a journal box 10, an axle journal 11, a journal bearing 12 provided with a lining 13 of a suitable bearing material such as bronze or babbit metal which seats on the journal, and a bearing wedge 14 between the bearing and the top of the box. The journal box is normally closed by a hinged lid 15. The journal bearing 12 of this construction usually comprises a brass casting lined with a lead alloy riding on the journal 11 at the end of the axle 16. Lubrication is applied by means of included mass of lubricant saturated cotton cord or other bibulous material 17 which is located in the bottom part of the box so as to press resiliently against the bottom and side of the journal.

In accordance with this invention, there is provided a relatively simple device of a convenient size for replaceable mounting in association with the journal box of a bearing and characterized by containing compositions not only capable of detecting an excessive rise in bearing temperature but of also setting off and producing a most effective pyrotechnic signal. It is of such construction that one part is adapted to sense an overheated condition at the axle journal itself with comparative accuracy and reliability, another part is adapted to transmit an impulse in response to the condition detected by the first part, and still another part annunciates the existence of this condition by pyrotechnically emitting for at least a predetermined interval a bright signal fire accompanied by smoke, each of a color designed to be readily seen either by day or night, respectively. The sensor includes a capsule which contains a specific igniter composition, the ignition temperature of which is carefully controlled as set forth hereinafter by proportioning a given set of ingredients of the composition so that the resulting composition is ignited at or above a suitable permissible maximum temperature of bearing operation below the temperature known to be accompanied by a "hot box." The sensor then lights a safety fuse cord which safely carries the flame from next to the bearing to a quick match material at the end of a fusee cartridge mounted on the outside of the bearing whereupon the combustion mixture of the fusee is set off to accomplish the desired purpose of indicating the presence of a hot box so that the overheated condition may become known and treated before serious damage to the bearing surfaces has occurred. While detection occurs in the bearing box or housing the signal is carried through the housing to the exterior where it is magnified for easy visual detection without impairing the bearing closure, which impairment may result not only in loss of lubricant, but also in creating a fire and permitting it to escape and cause further havoc.

A signal for indicating excessive bearing temperature ought to become operative at a comparatively low temperature to be of value as a safeguard because any signal which responds only after there has been excessive over

heating and the occurrence of a fire may actually add to the hazard. Early warning is an advantage since when bearing failure starts clearance of the parts decreases on account of expansion and the rise of temperature is accelerated.

For the purpose of this invention it was found that for a suitable duration of signal of about 10 minutes, if the signal is initiated when a temperature of from about 250° F. to about 300° F. is reached in the bearing block adjacent the bearing surface, a sufficiently early and sufficiently long warning can be given to allow the operating crew to observe the warning given and then to permit the speed of the machinery to be reduced or the train to be halted before bearing seizure and/or a fire occurs. The concept of this invention thus is based not only upon the particular structural arrangement provided, but also upon the compositions involved in the sensor, the fuse and the fusee portions of the device.

One suitable initiater mixture found provides an ignition temperature of approximately 280° F. and burns at a flame temperature of approximately 2900° F. to ignite the combustible train in the safety fuse cord. The constituents of this mix are as follows:

	Percent
Dinol	about 20
Potassium chlorate	do 60
Charcoal	do 15
Nitro-starch	do 5

The mixture in the form of a paste is inserted in the open end of a tubular cap of suitable metal such as copper, its suitable alloys, aluminum and its suitable alloys. The mixture is then dried. The cap is then crimped over the end of a piece of safety fuse in such a manner that ignition of the mixture directs the flame against one of the open ends of the fuse which is thereby ignited.

Ignition sensitivity at higher or lower critical temperatures may be obtained by selecting other ignition compositions suitable for the purpose.

The transmission or fuse means for connecting the temperature sensitive igniter to the signal generator takes the form of "safety fuse" which is distinguishable from other types of fuse cords in that it burns at a relatively slow rate of from about 30–40 seconds per foot and the burning is contained within a suitable fuse envelope until the flame reaches the end of the fuse where it emerges as a characteristic "end spit" and readily ignites a suitable match composition.

A suitable fuse construction for this invention involves a central flammable core of black powder composition or the like about which there is built up a flexible and protective covering including an inner layer of yarn containing considerable air space and treated so as to render the yarn flame resistant. The outside of the fuse is a water and oil proof coating or cover including one or more of treated paper, lead, foil, an elastomer, plastic, lacquer, wax or other suitable material. The fuse cover may be a laminate, coated or impregnated with suitable flame suppressing material and capable of resisting oil and water. In order that the fuse cord be formed in any desirable shape such as that of a coil and remain in this shape independently of other support means, it is preferred that the fuse be quite flexible. To facilitate installation, the fuse cord is made in a flexible coil form. For this purpose, the cord preferably may include a stiffener such as a central wire carrying a rather fluffy coating of cotton yarn which may also be rendered relatively flame proof. In any event, the fuse cord contains a suitable powder train and encloses sufficient space and voids to take up the products of combustion of the fuse train without development of excessive pressure. For this purpose the fuse composition may be a relatively gasless powder mixture, such as one including a mixture of lead-selenium powder. In any event, the structure of the fuse is such as to provide a fully enclosed casing for a slow burning relatively gasless medium so that the flame may not burst the closed system and escape to set fire to the lubricant in the journal box.

The ignition capsule, fuse cord and fusee cartridge constitute a closed system open only for the emission of the signal. This is assembled as an article of manufacture adapted for easy installation and replacement. The article may be installed at a threaded hole either in the journal box or in the lid. To change direction a fitting can be used as part of the device as shown in FIGURE 1.

The fuse, preferably of a type capable of being bent to remain in desired form such as in coiled form to keep it out of the way after installation, propagates the flame to a pellet of quick match composition located in a fusee cartridge adjacent the other end of the fuse train and at the top or starting end of a charge of any suitable signal fuel in the cartridge which is thus set off by the safety fuse train to burn with a bright light and also preferably with a large volume of smoke which is rendered luminescent by night to enhance the detectability of the signal by night as well as by day.

The fusee cartridge is charged with a sufficient amount of a suitable color and/or smoke producing slow burning composition. One especially suitable composition, for example, includes magnesium, zinc oxide and ammonium perchlorate, ignitable by means of a pellet composed of black powder, potassium nitrate, and silicon mixed with a binder of nitro-cellulose lacquer, all as set forth in copending application of Jean A. M. Brock, Serial No. 729,526 January 7, 1959, now U.S. Patent No. 2,939,780, granted June 7, 1960. This is included in amounts sufficient to provide a characteristic bright white light and white smoke in large volume for a desired duration, which may be anywhere from about 5 to about 20 minutes, if necessary, but usually for an interval of not more than about 7–10 minutes, long enough to stop the machinery and to permit immediate access to the bearing.

Other fusee compositions may be employed to obtain a signal of the desired color, magnitude and/or duration. In any event, the fusee takes the form of a cartridge with a base adapted for easy mounting on the outside of the bearing. The preferred form of base is a metallic cup screw threaded as a lamp base, for example, to permit easy replacement of the device through a threaded access opening as well as to provide concomitant sealing of the access opening to an enclosed bearing structure.

The device shown in FIGURE 1 is shown partially installed on the side of the journal box with the aid of a threaded fitting **61**. It includes a sensor capsule **1** shown for better illustration out of the cavity, but in a full installation it is to be inserted with a snug heat conductive fit in a bearing cavity **60** in bearing block **12**. The capsule is crimped about one end of the fuse **2** which extends from the capsule to one end of the fusee cartridge **3** mounted with the aid of the fitting on the outside of the box **10** so that the cartridge can extend out to the side of the railroad car in a desired direction and its signal can be emitted where it can be readily seen. The capsule consists of the heat conductive metal shell **21** loaded with the thermally sensitive igniter mix **22**. Where bearing cavity **60** runs all the way through the journal bearing, the closed end **23** of the shell may be weakened in any suitable fashion as by thinning to permit venting through the cavity upon actuation of the igniter. The capsule is crimped at **24** to seal around the casing **25** of the fuse which encloses the powder train **26**. This train links the capsule charge and the match pellet **27** at the ignition end of the fusee cartridge **3**.

The cartridge comprises a convolutely wound paper tube **28** closed at one end, except for a central orifice, by a wound tubular plug of paper **29** which together with the end of the tube is mounted under compression in a suitable metallic cup forming a mounting base **30** for the cartridge forming there a sturdy water tight closure. The tube is charged with pyrotechnic composition **31**

about one end portion 32 of the fuse 2 which extends through the base and orificed plug 29 to adjacent the opposite end of the cartridge in operative association with the match pellet 27. The tube is closed in any suitable fashion as by crimping or turning the end thereof inwardly to form the end closure 34 which is a continuation of the paper tube and, like it, is of a combustible and water proof character.

The base 30 is provided with a thread 35 for mounting in a threaded hole 62 in the fitting 61, which is mounted on the box at the threaded opening 63. The base has a nipple at 36 crimped about the fuse.

The length of fuse 2, exclusive of the end 32, is made sufficient to extend from the cartridge 3 to the bearing cavity 60 without excessive surplus, but with enough surplus to permit the fuse to be bent to a shape which will hold it out of the way when it becomes necessary to service the grease-saturated material 17 in the journal box.

The embodiment shown in FIGURE 2 is especially adapted for mounting in the hinged lid 15 of the journal box in a threaded hole 64, preferably in the upper right hand corner of the lid. The device includes, as before, the sensor capsule 1, a flexible fuse coil 41, and a fusee cartridge 43.

The capsule comprises a shell 40 which contains an igniter mix 42 and is crimped at 44 to the casing 45 of the fuse. To adapt the fuse for assuming the coil form, the fuse encloses not only a suitable powder train 46 for linking the capsule ignition charge and the match filler 47 mounted at the starting end of the cartridge 43, but also a flexible wire 53 which may take the form of a central core or of a surrounding inner coil 153 about the train 46 and within the casing 45 (see FIG. 3). The fuse cord makes a helical spring and will draw itself up into a compact coil form to take up the least space up out of the way of an inspector or oiler while its flexibility permits the lid to be lifted without upsetting the emplacement of the safety device. The inner end of the fuse casing 45 has perforations or slits 49.

As before, the cartridge comprises a paper tube 48 containing at one end a tubular plug 59 of any suitable compressible material, which together with the end of the tube is consolidated in a metallic cup 50 forming there a mounting base as well as a closure. A pyrotechnic composition 51 is compacted between the surrounding tube and the contained end 52 of the fuse which extends through the base or cup 50 and its orificed plug 59 to the opposite end of the cartridge for setting off the match filler 47. At this end the tube is provided with a top wad 54 and crimped to form the combustible end seal. The base is provided with a nipple at 56 which is not only crimped about the fuse, but also externally threaded at the intermediate enlargement 55 for mounting in the lid.

This embodiment has the advantage of being mountable in a separable part of the journal box without need for a fitting for positioning. It also has the advantage of being adaptable to a greater variety of bearings and being mountable in a readily observable position with the least change in the present railway car bearing box.

It will be readily understood by those skilled in the art that the foregoing is illustrative of embodiments now believed preferred, and that various changes and modifications may be made without departing from the spirit and scope of this invention as set forth in the appended claims.

What is claimed is:

1. A signal device for a structure located in one area isolated from another area by a wall of separation and with receptacle means in said one area having a recess in at least close proximity in thermal transmitting relationship with said structure, said device comprising a capsule dimensioned for insertion and detachable retention in said recess and containing an ignitor composition ignitable in response to a rise of temperature of said structure above a predetermined critical temperature, a cartridge having spaced ends and containing a combustible charge between said ends of the cartridge, said charge upon ignition at one of said ends is being adapted to burn toward said other end and emit from said one end a pyrotechnic signal in said other area, means at the other end of said cartridge for detachably mounting said cartridge in said other area on said wall at a distance remote from said capsule, and a hollow fuse cord having open ends and a connection permanently at one end of said cord to said capsule and having a connection permanently between said cord ends to the other end of said cartridge at said mounting means, said cord extending over at least said distance and in said cartridge to adjacent said one cartridge end, said cord including a core material ignitable by said composition and capable upon ignition of igniting said charge at said one end of the cartridge, said composition, material and charge being in successive ignition relationship, while said capsule, cord, mounting means and connections are adapted to seal said composition, material and charge with respect to said one area.

2. The device of claim 1 wherein the igniter composition in the capsule consists of about 20% dinol, about 60% potassium chlorate, about 15% charcoal and about 5% nitro-starch.

3. The device of claim 1 wherein the cartridge is elongated and the charge is a slow-burning fusee charge extending throughout substantially the entire length of said cartridge, said cartridge having a hollow metal base at an end thereof forming the means for mounting the cartridge, and an end of the fuse cord extends through said base and throughout substantially all of said length, said cord in said charge being orificed remote from said base where said cartridge includes a readily ignitable match mixture.

4. The device of claim 5 wherein the base has a reduced nipple screw threaded for mounting the cartridge on the wall of separation between the areas.

5. A signal installation comprising a railway car axle journal box having an enclosing wall and an access hole through said wall, said wall enveloping inside said box a bearing member having a bearing surface and forming a first mounting means with a recess in said member in combination with a second mounting means on said wall at said hole, and a replaceable device consisting of an igniter capsule sized to be carried in said first mounting means recess in thermally conductive relationship with said bearing member in close proximity with said bearing surface thereof, an elongated pyrotechnic signal means having opposite ends, one said end being mounted on said box by said second mounting means to extend the opposite end outwardly from said box, said signal means carrying a combustible pyrotechnic charge disposed outside of said box, and a safety fuse having opposite ends and between said fuse ends extending through said hole and carrying a fuse material enclosed in said fuse, said fuse extending between its ends from a sealed connection with said signal means to a sealed connection with said capsule, said capsule containing a thermally responsive igniter composition in fully enclosed relationship and ignitable at a predetermined maximum temperature from about 250° F. to about 300° F., said fuse material being connected operatively in sealed relationship at one fuse end to said igniter composition and at the other fuse end to said pyrotechnic charge, said fuse and capsule being of a size adapted to be received through said access hole into said box, said igniter composition, fuse material and pyrotechnic charge constituting a responsive train for respectively initiating an ignition in said capsule in response to an excessive rise in temperature in said member not in excess of the temperature at which bearing failure commences thereby setting off said fuse material transmitting said ignition out of said box through said fuse and hole to said signal means for thereby lighting said

pyrotechnic charge adjacent said one end and visibly annunciating said rise by the emission of smoke and flame for a predetermined duration, said initiation, transmission and annunciation occurring in isolation with respect to the inside of said box before the occurrence of excessive overheating of said bearing.

6. The installation of claim 5 wherein the igniter composition consists of about 20% dinol, about 60% potassium chlorate, about 15% charcoal and about 5% nitrostarch having an ignition temperature of about 280° F.

7. A signal device installation comprising a railway car axial journal box having a wall and mounted thereon a lid having a hole through said lid, said wall and lid enclosing a recessed bearing member in said box, said member having a bearing surface and a reces, all in combination with a device comprising a pyrotechnic signal cartridge with apertured threaded means for mounting substantially all of said cartridge threadedly at said hole, said cartridge mounted extending outwardly from said box, an igniter capsule adapted to be mounted in the recess of the bearing in close thermally conductive relationship with said surface, and a safety fuse, said fuse and capsule being dimensioned for insertion through said hole, said capsule being dimensioned for insertion and detachable retention in said recess, said fuse having opposite ends and being connected in sealed relationship at one of said ends to said capsule and being connected between said ends to said cartridge at said apertured cartridge mounting means in sealed relationship, said igniter, fuse and cartridge including respectively an igniter composition, a fuse composition, and a pyrotechnic composition, which together constitute a responsive train in a system closed off from the inside of said box for respectively (*a*) initiating a pyrotechnic response to the detection of an elevated predetermined temperature indicative of an excessive rise in the bearing temperature not in excess of a critical temperature at which failure of said member commences thereby setting off said fuse composition, (*b*) transmitting said response through said fuse and hole out of said box for lighting said pyrotechnic composition, and (*c*) producing a bright and smoky signal fire outside said box, said response and fire occurring in isolation with respect to said member and the inside of said box.

8. The device of claim 1 wherein the fuse cord is longer than the distance and forms a resilient coil extendable between the connections.

9. The installation of claim 7 wherein the fuse includes a resilient stiffening member extending at least between the connections to adapt said means to maintain a coil form.

10. A thermal tell-tale device comprising

(*a*) an elongated tube of combustible material containing a length of slow-burning pyrotechnic charge between the tube ends and having a metal base at one of said ends for detachably mounting said tube extending in one direction away from said base at a distance from a remote structure to be protected, said tube having a readily vented combustible closure at the other tube end, said base having an aperture therethrough,

(*b*) a fire-resistant safety fuse cord having a pair of extremities and a fuse train passing through said cord and aperture, said cord extending internally in the opposite direction from one of said extremities adjacent said other tube end and closure for ignition of said charge through said tube and base to the other cord extremity extending externally of said tube a length disposing said other extremity adjacent said structure,

(*c*) said base being sealed at said aperture about said cord and joined to said cord intermediate said extremities, and

(*d*) a tubular capsule being sealed about said other extremity and joined to said cord, said capsule being adapted for conductive mounting adjacent said structure and containing a thermally responsive ignition composition ignitable upon excessive heating of said structure and rise to a predetermined temperature less than the maximum safe operating temperature of said structure for igniting said train for igniting said charge to burn with the emission of a visible signal from said tube to enable detection of said heating so that said structure temperature can be brought under control before permanent damage from overheating occurs, and said device protecting said structure from said ignition and burning.

References Cited in the file of this patent

UNITED STATES PATENTS

1,309,916	Smidley	July 15, 1919
2,556,042	Rodgers	June 5, 1951
2,851,984	Verhunce	Sept. 16, 1958
2,897,775	Thesen	Aug. 4, 1959

FOREIGN PATENTS

83,933	Austria	May 10, 1921
250,221	Italy	Sept. 22, 1926