Jan. 10, 1967 L. A. J. DUBOSQ ETAL 3,298,010

WARNING AND SUPERVISING APPARATUS WITH VERBAL WARNINGS

Filed Sept. 23, 1963 4 Sheets-Sheet 1

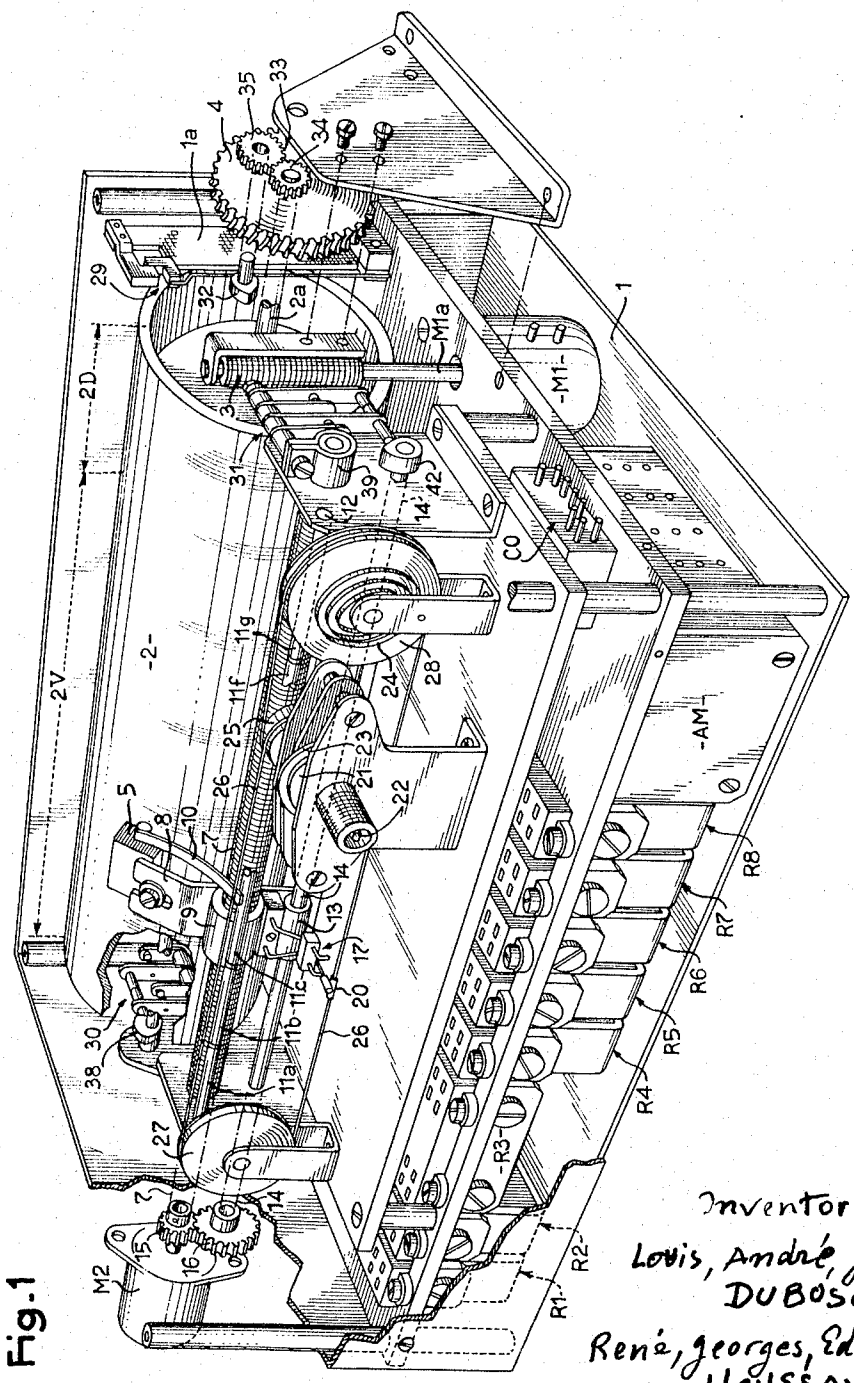

Fig. 1

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WARNING AND SUPERVISING APPARATUS WITH VERBAL WARNINGS

Filed Sept. 23, 1963 4 Sheets-Sheet 2

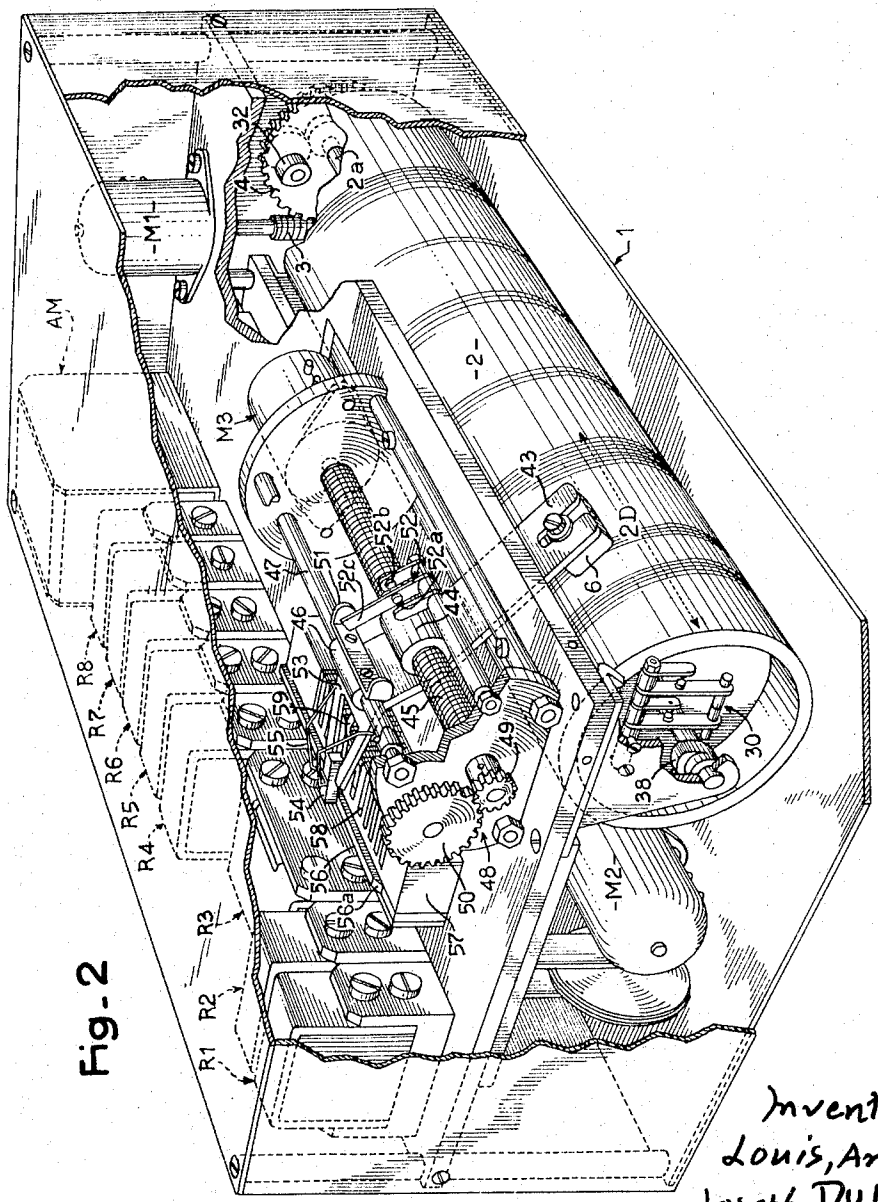

Fig. 2

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WARNING AND SUPERVISING APPARATUS WITH VERBAL WARNINGS

Filed Sept. 23, 1963 4 Sheets-Sheet 3

Fig. 3

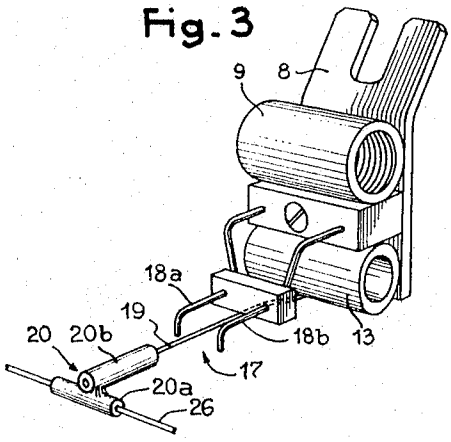


Fig. 4

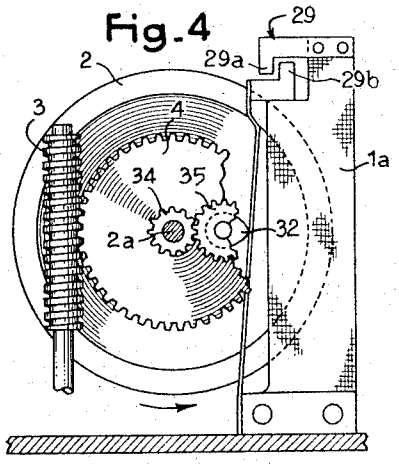


Fig. 5

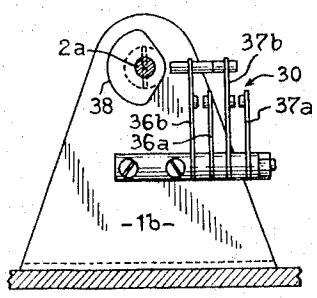


Fig. 6

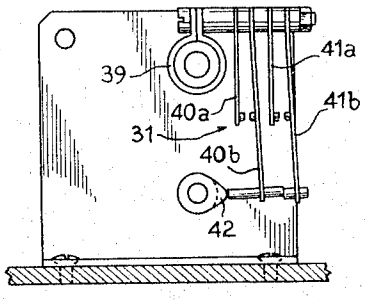
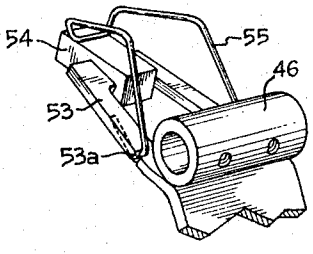


Fig. 7



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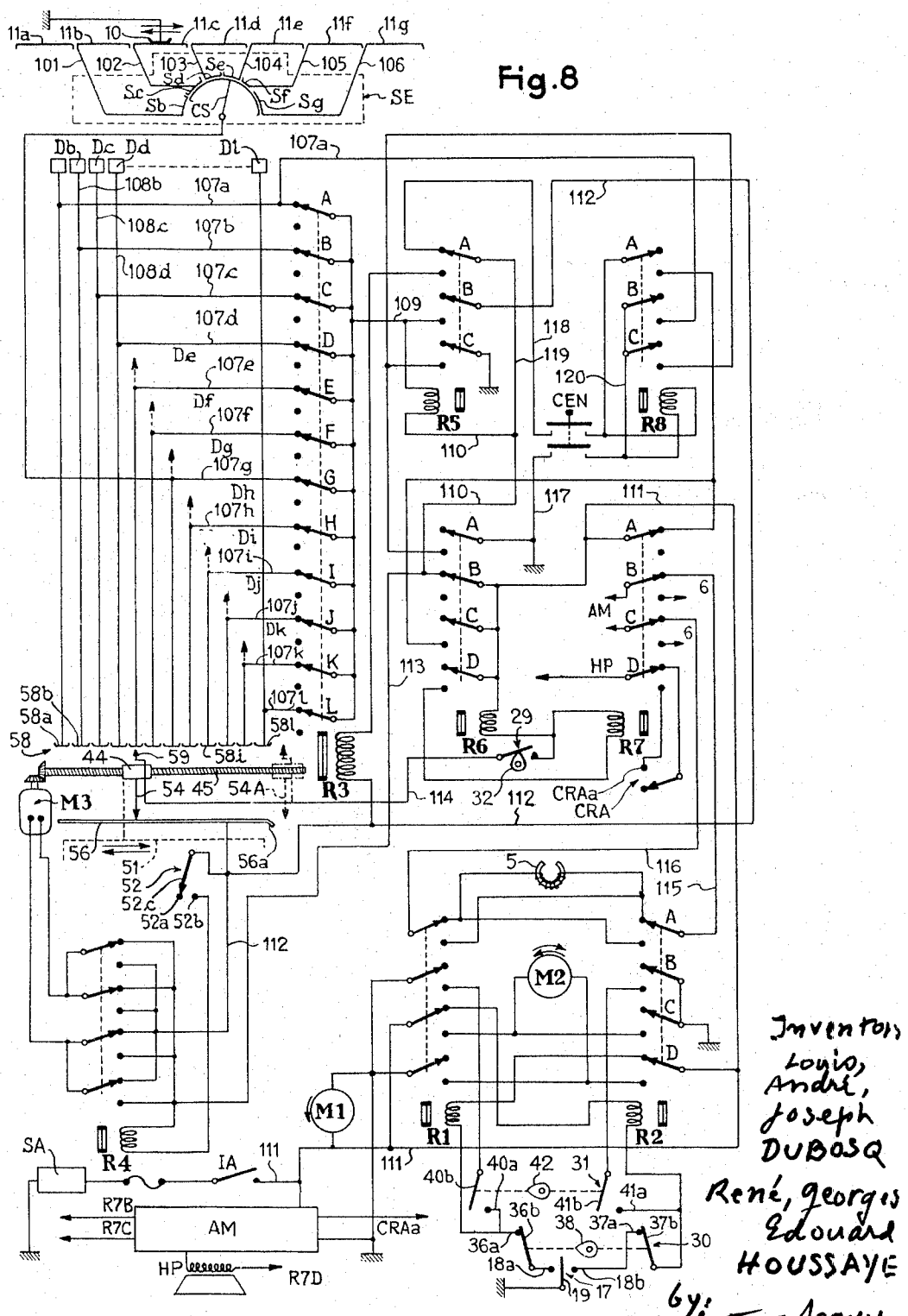
WARNING AND SUPERVISING APPARATUS WITH VERBAL WARNINGS

Filed Sept. 23, 1963 4 Sheets-Sheet 4

Fig.8



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United States Patent Office

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WARNING AND SUPERVISING APPARATUS WITH VERBAL WARNINGS

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15 Claims. (Cl. 340—221)

The present invention relates to a warning apparatus adapted to permanently supervise the operation of a machine and applicable, in particular but not exclusively, to an automobile vehicle.

The object of the invention is to provide a permanent supervising apparatus which satisfies mainly the following requirements:

(a) When in service, the apparatus must constantly furnish information in the form of announcements emitted in the spoken language relating to the various operational characteristics of the machine; these announcements could concern either the normal operation of the machine or certain operational defects, when they occur.

(b) The announcements of a defect must be made at any useful moment without the intervention of the controller or driver as soon as the defect occurs, whereas those of the characteristics concerning the normal operation can be emitted only under the control of the driver, but, in any case, the announcements of the defects must have priority over the announcements concerning normal operation.

(c) If the apparatus is adapted for example, to an automobile vehicle, the normal operational characteristics can consist in announcements indicating the speed of the vehicle, whereas the announcements of the defects can relate to various operational defects of the engine (a limit temperature exceeded, oil or water dropping below the minimum level, etc.) or of the vehicle itself (brake liquid dropping below the minimum level, fuel dropping below the minimum level in the fuel tank, rupture of an electric circuit, etc.); the apparatus must therefore in this case furnish automatically, or when required, announcements concerning the speed of the vehicle and, on priority, automatically announcements concerning operational defects.

(d) The apparatus must be capable of being utilized at the same time as a radio receiver set, the announcements concerning the speed being in this case interrupted but on condition that in the event that a defect occurs the sound emission of the radio receiver set is automatically interrupted and the warning apparatus is automatically switched on in such manner that the defect which occurs is immediately announced.

The warning and supervising apparatus according to the invention which satisfies these requirements comprises in combination, on the one hand, a device detecting various values relating to a parameter of normal operation of the machine, on the other hand, devices detecting certain possible operation defects of the machine, said apparatus further comprising, a sound emitting device comprising recordings of spoken announcements relating to said variations in the parameter of normal operation and spoken warnings each relating to the appearance of one of said operational defects of the machine, said apparatus also comprising means connected to said detectors and to said sound emitting device so as to bring into action said sound emitting device so as to cause it to select and emit automatically the appropriate announcements of normal operation or, if desired, the warnings relating to the operational defects of the machine and means for giving priority to said warnings over said announcements.

If the machine is a vehicle, said parameter of normal operation is preferably the speed.

Further features and advantages of the invention will be apparent from the ensuing description with reference to the accompanying drawings to which the invention is in no way limited.

In the drawings relating to an embodiment applied to a vehicle:

FIG. 1 is an assembly view in perspective of mainly the upper face of the apparatus;

FIG. 2 is an assembly view, in perspective of mainly the lower face of the apparatus;

FIGS. 3–7 are detail views of various electrical devices of the apparatus, and

FIG. 8 is an electric diagram of the apparatus.

According to the illustrated embodiment, the various main parts are mounted on a metal chassis **1**, namely:

A rotary magnetic recording cylinder **2** having a horizontal spindle **2***a*.

Three electric motors M_1, M_2 (FIG. 1), M_3 (FIG. 2), of low power, named hereinafter cylinder motor, speeds motor, and defects motor respectively. These motors are part of control means for causing the reproducing means to reproduce recordings on the cylinder **2**, as will be explained hereinafter.

An assembly of relays R_1–R_8.

An amplifier AM.

A connector CO having multiple plugs.

The cylinder **2** carries magnetic recordings of spoken texts relating to the speed or operational defects of the vehicle. For the sake of clarity, the first-mentioned text will be named hereinafter "announcements" and second-mentioned texts "warnings."

These recordings occupy two zones on the cylinder: the first zone, **2V**, which is 160 mm. long, relates to the speeds; the other, **2D**, which is 35 mm. long, relates to the defects, these dimensions being given merely by way of examples by which the scope of the invention is not limited. This cylinder can have such diameter and be driven at such speed that the peripheral linear speed is of the order of 9.5 cm./second.

The tracks of these recordings have the shape of circular, plane, and not helical spirals as is usually the case with magnetic or other recordings on rotary cylinders. Each announcement recording occupies angularly at the most 180°, the remaining 180° being reserved for the displacement of the reading or reproducing head, as will be understood hereinafter. The tracks are separated by spaces of 1 mm., bearing in mind the width of the track itself, the pitch of the tracks is therefore 2 mm. These tracks start at announcements relating to speeds increasing in steps of two km./h. between 40 and 160 km./h. for example.

The zone **2D** is divided into twelve equal portions each carrying a recording track of a warning relating to a single type of defect. These tracks are also plane and can have an extent of 360°. The apparatus consequently has the possibility of emitting twelve different warnings. However, two of these tracks are preferably reserved for special purposes which will be mentioned hereinafter, the remaining ten tracks being available for use in the emissions of warnings which can therefore relate to ten different defects.

The rotary cylinder **2** is driven in rotation about its spindle **2***a*, which is fixed, by the motor M_1, through a speed reducing gear train comprising a worm **3** keyed on the shaft M_{1a} of the motor and a worm wheel **4** rigid with the cylinder and meshed with the worm **3**. This por-

tion of FIG. 1 has been shown in an exploded view for the sake of clarity.

On either side of the cylinder, and in front of each of the two zones 2V and 2D, respectively, there are movable, in a direction parallel with the spindle 2*a* of the cylinder, a speed reproducing head 5 (FIG. 1) and a defect reproducing head 6 (FIG. 2).

The head 5 is driven in translation in a direction parallel with the spindle 2*a* by a rotary screw 7 parallel with the spindle, this screw being driven in rotation by the motor M_2. For this purpose, the reproducing head is mounted on an arm 8 rigid with a nut 9 in the form of a tapped sleeve screwthreadedly engaged on the screw 7.

This reproducing head 5 supports and drives an elastic arm 10 which bears at its end on a series of sleeves 11*a*–11*g* which are insulated from each other and mounted on a fixed rod 12 parallel with the spindle 2*a*. The end of the arm 8 carries a sleeve 13 which slides along a shaft 14 parallel with the spindle 2*a*, this arm being driven in rotation by a gear train 15–16 driven by the motor M_2 and having a gear ratio of 1:4.

The head 5 is positioned in front of the various speed tracks by means of a positioning device constituting a veritable servo-motor and comprising, on the one hand, a reverser switch 17 (FIG. 3) having two "fixed" contacts 18*a*, 18*b* rigid with the movable nut 9 driving the head 5, these two contacts being fixed relative to this nut and a "moving" contact 19, constituted by a very light flexible strip or blade capable of being moved into contact with either one of the two fixed contacts, these contacts being connected, as mentioned hereinafter, in such manner as to cause the motor M_2 to rotate in one direction or the other.

The moving contact 19 is actuated by an index 20 whose position is fixed by a "linear counting" device or first device having a rotary magnet 21 in the shape of a disc which is driven in rotation at a speed proportional to that of the vehicle by means of a flexible shaft (not shown) which is connected at 22, to the spindle of the magnet and at its other end, to the output shaft of the gear box.

The disc drives by induction a disc 23 of aluminium in opposition to the action of a resistant torque created by an elastic element such as a spiral spring 24. For this purpose, the aluminium disc drives a pulley 25 round which extends an endless wire 26 which is held taut between two pulleys 27, 28 and carries the index 20.

This index comprises (FIG. 3) a tube portion 20*a* which is coaxial with the wire and welded to the latter and tube portion 20*b* welded to the portion 20*a* and perpendicular to the wire and in which can be introduced the end of the moving contact 19 so as to be driven by this index.

The apparatus further comprises a pair of "interruption" contacts 29 (FIGS. 1 and 4) and a block of "positioning" contacts 30 (FIGS. 1 and 5) and a block of "indexing" contacts 31 (FIGS. 1 and 6).

The pair of interruption contacts 29 (FIG. 4) mounted on an element 1*a* of the chassis comprises a fixed contact 29*a* and an elastic movable contact 29*b* controlled by a cam 32 actuated by an epicyclic gear train 33 having a sun gear 34 keyed on the fixed shaft 2*a* of the cylinder and a planet gear 35 pivotally mounted on the gear 4 and on the shaft of which is mounted the cam 32. The gear train is so calculated that the cam 32 effects one revolution for four rotations of the cylinder and this cam has such shape that it cuts off the circuit of the pair of contacts 29 for a short instant for each revolution of this cam when the latter moves into the position shown in FIG. 4. The block of positioning contacts 30 (FIG. 5) mounted on an element 1*b* of the chassis comprises two fixed contacts 36*a* and 37*a* and two movable contacts 36*b*, 37*b*; these two pairs, which are normally open, are capable of being closed by the action of a cam 38 mounted on the shaft 2*a* of the cylinder, this cam being so shaped as to maintain these two pairs of contacts closed during one half of each rotation of the cylinder and open during the other half.

Lastly, the block of indexing contacts 31 (FIG. 6) carried by a collar 39 comprises two pairs of contacts 40*a*, 40*b* and 41*a*, 41*b* which are normally closed and whose movable contacts 40*b*, 41*b* are actuated by a cam 42 mounted on the end of the rotary shaft 14, which, as mentioned hereinbefore, is driven at a quarter of the speed of the screw 7.

The reproducing or reading head 5, the fixed contacts 18*a*, 18*b*, the movable contact 19, the various pairs of contacts described hereinbefore and the insulated sleeves 11*a*–11*g* are connected in the manner shown in the diagram of FIG. 8.

Movable in front of the zone 2D, is the defects reproducing head 6 mentioned hereinbefore. This head is carried by an arm 43 driven by a tapped sleeve or nut 44 mounted on a rotary screw 45, directly driven in rotation by the motor M_3. The driving of the arm 43 by the sleeve 44 is effected by means of a lug (not visible) fixed to the sleeve and extending into an opening formed in the arm, so that this arm is capable of oscillating in a vertical plane, the arm being connected to a smooth sleeve 46 or carriage which slides on a shaft 47 parallel with the screw 45 and driven in rotation by the motor M_3 through the medium of a gear train 48 which is a speed-reducer having a gear 49 mounted on the end of the screw 45 and a gear 50 mounted on the end of the shaft 47, the rotation of this shaft having for purpose solely to facilitate the sliding of the sleeve 46. Fixed to this sleeve 46 is a fork 51 controlling a reversing switch 52 comprising fixed contacts 52*a*, 52*b* and a movable contact 52*c*. This reversing switch is connected (FIG. 8) in such a manner as to control the direction of rotation of the motor M_3 through the medium of the relay R4.

The sleeve 46 also carries a forked arm 53 of aluminium carrying an electric brush 54 pivoted to the end of the arm. The head 6 is urged toward the surface of the cylinder by the action of a spring wire 55 whose two branches are hooked in recesses 53*a* formed in the arm 53 and whose end bears against the brush (FIG. 7). This brush bears against a conductive bar 56 mounted on an insulating block 57. This bar 56 has a portion 56*a* of less height so that when the brush 54 is in front of this portion 56*a* the contact between these two elements is interrupted.

The insulating block 57 also comprises a series of fixed studs in the form of blades constituting a row 58 of contacts 58*a*, 58*b* (FIG. 8) on which the end of an elastic brush 59 rubs, this brush being constituted by a conductive blade fixed at its other end to the sleeve 46, and insulated from the latter. This blade is electrically connected to the break switch 29 controlled by the cam 32 (FIG. 4).

A number of the elements mentioned hereinbefore are to be found in the electric diagram of the apparatus (FIG. 8) with the same reference characters. Some of the movable contacts (blades) of the relays are represented in the diagram by the following letters ABC . . . and are designated hereinafter by the reference of the relay followed by the corresponding letter. For example, R_3A designates the blade A of the relay R_3. The relays R_1–R_8 are represented in the state of rest. The defects head 6, not shown in this diagram, is connected to the state-of-rest contacts (carrying the indication "toward 6") of the relay R_7.

The amplifier AM supplies the moving coil of a loud-speaker HP. When the apparatus is installed on a vehicle supplied with radio receiver set this loud-speaker can be that of the set. In this case, the loud-speaker can be connected either to the radio set or to the amplifier AM by the action of the relay R_7. The apparatus also comprises a normal switch CRA which permits obtaining either the complete operation of the apparatus with

announcements and possible warnings, or the listening in to the radio with the automatic passage, on a priority basis, of the warnings.

The apparatus is also adapted to give the user a warning when the vehicle exceeds a maximum limit speed the value of which is selected by the user by means of a selector SE mounted on the instrument panel and constituted by a series of fixed studs S*b*–S*g* and a selecting slider CS, these fixed studs being respectively connected to the sleeves **11***b*–**11***g* by a series of conductors **101**–**106** extending between the instrument panel and the apparatus, the slider CS being itself connected to the apparatus by another conductor **107***g*, these connections between the instrument panel and the apparatus being obtained in a detachable manner by means of the multiple-pin connector CG (FIG. 1). The warning of excessive speed is recorded on a special track selected from among the twelve defects tracks, the fact of exceeding the speed selected by the selector CS being considered as a defect and causing operation of the apparatus as in the case of a defect, as will be described hereinafter.

The apparatus is fed by a D.C. supplying source SA of 12 volts, the negative pole of which is earthed. This source can be for example constituted by the battery of the vehicle and it is connected to the apparatus by a manual supply switch IA.

The apparatus works in combination with a series of detectors or second devices from which it receives information relating to the presence of operational defects of the machine to be supervised—the vehicle in the presently-described embodiment. In this embodiment the studs of the row **58** are twelve in number **58***a*–**58***l* connected to twelve state of rest contacts of the relay R_3 by conductors **108***a*–**108***l*. The state of rest contact of R_3G is connected by the conductor **107***g* to the selector slider CS as mentioned hereinbefore. The state of rest contact R_3A is connected, through the medium of a conductor **107***a* to a manual "normal state check" push-button CEN; the detector outputs D*b*–D*f* and D*h*–D*l* connected to the remaining state of rest contacts of R_3 can therefore be ten in number at a maximum and are connected by conductors **108** (**108***b*–**108***f* and **108***h*–**108***l*). Only four of the detector outputs have been shown.

It will be understood that the structure of each of the detectors or second devices is appropriate to the defect to be detected (temperature, pressure, liquid level etc.) and the information or signal furnished by each detector for indicating the coresponding defect consists in the earthing of one of the conductors **108** (and consequently the corresponding stud of the row **58** and the state of rest contact of R_3).

The electric diagram of the various relays and the connections between components are indicated in the diagram (FIG. 8). The enumeration of the connections will therefore be limited to the connections **101**–**106**, **107***a*–**107***l* and **108***a*–**108***l* mentioned hereinbefore and to some other connection which are designated by numerical reference characters for the sake of clarity.

To facilitate the reading of the diagram, it will be mentioned that the relays R_1–R_4 and R_7–R_8 perform the following functions:

R_1 and R_2 control the reversing of the direction of rotation of the motor M_2, depending on the position of the slider **17**, controlled by linear speed counter **21**–**28**.

R_3 is a relay having twelve switches used in its state of rest which, when it is excited, breaks the circuits connecting each of the studs of the row of contacts **58** to the excitation coil of the relay R_5.

R_4 reverses the direction of rotation of the motor M_3 controlled by the action of the fork **51**.

R_7 brings the loud-speaker into circuit with either the radio set or the amplifier of the apparatus and also has for purpose to select the speeds head **5** or the defects head **6**.

R_8 is used for controlling the normal state by means of the push button CEN in the manner explained hereinafter.

The function of the relays R_5–R_6 will be explained hereinafter.

The conductive bar **56** which is normally insulated is earthed by the brush **54** when the latter is in contact with this bar.

Thus, to summarize, the motors M_1, M_2 and M_3 and their associated actuating and transmission means described hereinbefore constitute control means which cause the reproducing means, namely the reproducing heads **5** and **6**, to cooperate with and reproduce a single one of said recordings in zones 2V and 2D respectively of the cylinder **2**. The relay R_7 and its associated switches R_7A, R_7B, R_7C and R_7D act as selecting means ensuring priority of the transmission of the defects warnings over the transmission of the vehicle speed announcements or of a radio receiver if the switch CRA connects the radio receiver circuit to the speaker H.

The apparatus according to the invention operates in the following manner:

Let it be assumed that the apparatus is in the operative position, that is, that it is connected to the selector SE of the instrument panel and that it is fed by the supply source SA.

Supposing that no defect is to be announced, the contacts of the various relays are in the position shown in the diagram. The hand switch CRA is in the closed position assuming that the whole of the apparatus is desired to be used.

The magnet **21** is driven by the vehicle at a speed substantially proportional to the speed of the latter, and drives the wire **26** in opposition to the action of the spring **28**; as a result, the movable contact **19** is driven and comes in contact with one of the fixed contacts **18***a* and **18***b*. In the event that the speed increases, the movable contact comes into action with the fixed contact **18***b* and causes the excitation of the relay R_2 and the driving of the motor M_2 in the direction which tends to shift the head **5** toward the recording tracks in the direction of increasing values of the speeds; in the case of a decreasing speed, the motor is driven in the opposite direction and the head is shifted toward the decreasing values of the announcements of the speeds. The cylinder, which continuously rotates owing to the fact that the supply circuit is closed, drives the positioning cam **38** which closes the pairs of contacts **36***a*, **36***b* and **37***a*, **37***b* during 180° of the rotation of the cylinder. If it is assumed that **18***b* is closed, the relay R_2 is excited and the motor M_2 starts up in a given direction and closes the indexing circuit by the action of the cam **42**, which, after having effected one rotation (that is, after four rotations of the screw **7**) corresponding to an advance of the head equal to one pitch of the recording, opens the pairs of contacts **40***a*, **40***b* and **41***a*, **41***b* in interrupting the excitation of the relay R_2 and consequently stopping the motor M_2. As a result, the head is locked in front of the track corresponding to the speed of the vehicle at that moment. The reading or reproduction of the corresponding recording is therefore repeated so long as the movable contact **19** remains in equilibrium between the two fixed contacts **18***a*, **18***b*. If the speed increases or decreases from this position the movable contact comes in contact with one of the two fixed contacts. The cycle of operation described is repeated either with the relay R_2 or with the relay R_1 until a new position of equilibrium arises.

The diagram shows that in the course of the displacement of the head **5** there is no possibility of reading the recording, the head being out of circuit so long as one or the other of the relays R_1 or R_2 is excited. On the other hand, this possibility arises as soon as the head is once more stopped. It is also clear that a safety arrangement exists which prevents the simultaneous excitation of the relays, the excitation of one of these relays

R_2 for example, interrupting by the blade R_2D the circuit through which R_1 could be excited in the event that the contact **18***a* would also be earthed, an arrangement symmetrical with respect to the foregoing being provided for preventing the excitation of R_2 when R_1 is excited.

Reading of the defects

Assuming that no defect is to be announced, the motor M_3 is stationary, the brush **54** being in front of the recessed part **56***a* of the conductive bar **56** (position **54**A shown in dotted line in the diagram).

If it is assumed that a defect arises and is detected by one of the ten detectors reserved for the detection of the defects proper D*b*–D*f* or D*h*–D*l*, for example D*b*, the result is that the corresponding fixed stud, R_3B, is earthed by this detector. The relay R_5 is so excited, the negative polarity being applied to the coil of R_5 by the conductor **109** and the positive polarity being applied by the conductor **110**, the blade R_6B, the conductor **111** and the supply switch IA.

Further, a negative voltage is applied through the medium of the blade R_5B and the conductor **112** to the device **52** reversing the motor M_3 to which the positive polarity is always applied through the medium of **110**, **113**; the circuit of the motor M_3 is thus temporarily closed, moreover, the bar **56** is brought to a negative voltage. As the screw **45** is driven in rotation, the brush **54** comes in contact with the conductive bar **56** and thus maintains closed the negative circuit and feeds the motor (even if R_5B passes to the state of rest position). The brush **59** consequently explores successively the twelve studs of the row **58**. When this brush arrives in front of the stud **58***b*, which is assumed to be earthed by the detector D*b*, the relay R_6 is excited, a permanent positive voltage being provided by the conductor **111**, and the circuit being closed through the conductor **114**. In being excited, R_6 feeds positive voltage, through R_6D, to relay R_7, which is excited and acts as control means which select the defects head **6** in preference to the speeds head **5** by shifting the blades R_7B and R_7C from their state of rest contacts to their operative contacts in thus breaking the circuits **115**, **116** which connect the speeds head **5** to the amplifier AM and connecting the defects head **6** to the amplifier.

Further, the excitation of R_6 interrupts at R_6B the excitation of R_5 through **111**–**110** and also interrupts the supply to the motor M_3 through **111**–**113**.

The defects reproducing or reading head **6** is consequently held stationary in front of the defect track corresponding to the detected defect.

As the cylinder is still rotating, the reading of the defect occurs and is repeated for each rotation of the cylinder; the recording of this announcement can occupy, as mentioned hereinbefore, 360° of a track but occupies only a single track.

It is obviously necessary that the head **6** cannot remain constantly in position in front of the same recording since otherwise if other defects occurred during this time, they would not be announced.

The apparatus comprises a cancelling device which permits after at the most, four successive repetitions of the same warning "cancelling" this defect, that is rendering this defect inoperative for the apparatus in permitting the latter to pursue the investigation of other defects, emitting once again a series of warnings relating to this defect in the event that no other defect occurs, so that in the event of a plurality of defects occurring simultaneously each of these defects is announced at the most four times and the exploration of all the defects is carried out nonetheless in a complete manner.

This "cancellation of the defect" is obtained by means of the "interruption cam" **32** which, once every four rotations of the cylinder, breaks the negative conductor **114** common to the coils of the relays R_6 and R_7 and thus re-establishes the supply circuit of the motor M_3 through R_6B and the possibility of exciting the coil of the relay R_5 by a possible detection of another defect.

At the end of the exploring travel or sweep of the brush **59** over the studs **58** in one direction, the fork **51** tips the arm of the switch **52** which reverses the direction of operation of the motor M_3 and the exploration is pursued in the opposite direction and returns the brush to its position of rest.

In the event that no other defect occurs but that the defect already detected remains, this defect once more sets off the aforementioned cycle when the brush **59** once more passes over the corresponding stud (**58***b* in the selected example).

The push-button CEN permits creating a false defect on condition that no other real defect exists in the circuit. In closing the contact CEN, the coil of R_8 is inserted between the negative conductor **117** and the conductor **118** which is connected to the positive conductor **110** through the blade R_5A and the conductor **119**. If this blade in the state of rest R_8 is excited and earths the conductor **120**; this "defect" is sent by the conductor **107***a* to the state of rest contact of R_3A in the same way as in this case of an information transmitted by one of the other conductors **107***b*–**107***l*.

The relay R_8 is maintained in the state of self-excitation through R_6A and R_7A in the state of rest. This self-excitation can consequently only be maintained if R_6 is not excited by the action of a real defect. In this way, a checking of the normal operation of the vehicle is obtained.

The warnings relating to excessive speed are obtained by means of the device constituted by the insulated sleeves **11***a*–**11***g* which are connected to the fixed studs **8***b*–**8***g* of the selecting switch SE whose slider CS is connected to the stud R_3G. Its action is therefore the same as that of the detectors the earthing being obtained by the brush or rubbing element **10** which moves in synchronism with the speeds head and rubs against the sleeve, which corresponds to the entrance of the region predetermined by the slider CS.

The procedure which occurs in the case of defects, takes place in the same manner in the case of this excessive speed whose recording is, it will be recalled, one of the twelve recordings of the defects zone; this recording would therefore be read and emitted in the form of a warning and under the same conditions as the other warnings of defects.

In the event that the apparatus is used on an automobile vehicle provided with a radio set, the switch CRA having two positions permits substituting the listening element of the radio on board for the speed readings or vice versa. However, as soon as a signal of the defect type occurs, the relay R_7 isolates the receiver and effects through R_7D the connection of the loud-speaker to the amplifier of the apparatus in thus insuring in a permanent manner the signalisation of the defects.

Although specific embodiments of the invention have been described, many modifications and changes may be made therein without departing from the scope of the invention as defined in the appended claims.

In particular, the number of tracks can vary in accordance with the destination of the apparatus; the dimensions and speed of the cylinder, the pitch of the recordings, the ratios of the gear trains, the embodiments of the contacts and other details of construction can vary without departing from the scope of the invention.

Certain elements, and in particular the elements actuated manually (contacts CO, contacts CRA, press-buttons CEN which are shown in the electric diagram) can be mounted outside the main unit of the apparatus shown in FIGS. 1 and 2, and connected to this unit only by conductors. The source of power, if it is a battery, can be incorporated, or not, in this unit. The apparatus can be provided with a case of appropriate form and supported by any suitable means.

Having now described our invention what we claim as new and desire to secure by Letters Patent is:

1. Apparatus for giving sound indications of the operational characteristics of a machine, said apparatus comprising, a first device for measuring a magnitude providing information concerning a parameter of normal non-defective operation of said machine, second detecting devices each responsive to a defective condition of operation of said machine, a sound emitting device comprising first recordings of spoken announcements concerning said magnitude and second recordings of spoken warnings each relating to the appearance of one of said operational defects, a first reproducing head cooperative with the first recordings, first control means associated with the first reproducing head to cause it to cooperate with and reproduce only one of said first recordings at a time in accordance with a signal from the first device, a second reproducing head cooperative with said second recordings, second control means associated with the second reproducing head to cause it to cooperate with and reproduce only one of said second recordings at a time in accordance with a signal from any one of the second devices, amplifying circuit means connecting the first and second reproducing heads to a speaker, the first device, the first control means, the first reproducing head and the amplifying circuit means being electrically interconnected and constituting a first channel, each of the second devices, the second control means, the second reproducing head and the amplifying circuit means being electrically interconnected and constituting a number of second channels corresponding to the number of second devices, the second devices having assigned thereto priority of importance over the first device, and selecting means interconnecting the first channel and second channels so as to be actuated upon operation of any one of the second devices and render the first device inoperative during operation of any one of the second devices.

2. Apparatus for giving sound indications of the operational characteristics of a vehicle, said apparatus comprising, a first device for measuring the speed of said vehicle, second detecting devices each responsive to a defective condition of operation of said vehicle, a sound emitting device comprising first recordings of spoken announcements concerning said speed and second recordings of spoken warnings each relating to the appearance of one of said operational defects, a first reproducing head cooperative with the first recordings, first control means associated with the first reproducing head to cause it to cooperate with and reproduce only one of said first recordings at a time in accordance with a signal from the first device, a second reproducing head cooperative with said second recordings, second control means associated with the second reproducing head to cause it to cooperate with and reproduce only one of said second recordings at a time in accordance with a signal from any one of the second devices, amplifying circuit means connecting the first and second reproducing heads to a speaker, the first device, the first control means, the first reproducing head and the amplifying circuit means being electrically interconnected and constituting a first channel, each of the second devices, the second control means, the second reproducing head and the amplifying circuit means being electrically interconnected and constituting a number of second channels corresponding to the number of second devices, the second devices having assigned thereto priority of importance over the first device, and selecting means interconnecting the first channel and second channels so as to be actuated upon operation of any one of the second devices and render the first device inoperative during operation of any one of the second devices.

3. Apparatus as claimed in claim 2, wherein the amplifying circuit means comprise an amplifier, a first circuit connecting the first reproducing head to the amplifier and a second circuit connecting the second reproducing head to the amplifier, the selecting means comprising switch means inserted in the first and second circuits for ensuring that the first circuit is open and the second circuit closed during operation of any one of the second devices.

4. Apparatus as claimed in claim 3, further comprising a radio receiver having a speaker constituting the first-mentioned speaker, and switch means for connecting the speaker selectively to the radio receiver and to said amplifier, said selecting means further comprising switch means for automatically connecting the speaker to the amplifier of the apparatus and disconnecting it from the radio receiver during operation of any one of the second devices.

5. Apparatus for giving sound indications of the operational characteristics of a vehicle, said apparatus comprising a first device for measuring the speed of the vehicle and having a variable signal output; second detecting devices each responsive to a defective condition of operation of the vehicle, each detecting device having a signal output; a sound emitting device comprising a rotatable cylinder, drive means for driving the cylinder in rotation, a series of first recordings of spoken announcements concerning increasing increments of said speed in a first zone of the cylinder, a series of second recordings of spoken warnings each relating to the appearance of one of said operational defects in a second zone of the cylinder, a speeds reproducing head cooperative with the first recordings, a defects reproducing head cooperative with the second recordings, first control means including a speeds motor and a transmission connecting the speeds motor to the speeds head for shifting the head over the series of first recordings and causing it to co-operate with and reproduce only one of the first recordings at a time in accordance with a signal from the signal output of the first device, second control means including a defects motor and a transmission connecting the defects motor to the defects head for shifting the defects head over the second recordings and causing it to cooperate with and reproduce a single one of the second recordings at a time in accordance with a signal received from any one of the signal outputs of the second devices, amplifying circuit means connecting the speeds head and defects head to a speaker, the first device, the speeds head, the first control means and the amplifying circuit means constituting a first channel circuit means, the second devices, the defects head, the second control means and the amplifying circuit means constituting a number of second channel circuit means corresponding to the number of second devices, switch means inserted in the first channel circuit means, and selecting means connected to the second channel circuit means and associated with said switch means to be actuated by the second channel circuit means upon operation of any one of the second devices and to open the first channel circuit means and render the first device inoperative.

6. Apparatus as claimed in claim 5, wherein the first device is a speedometer, the speeds motor has a supply circuit and switch means inserted in the supply circuit to change the direction of rotation of the speeds motor, and means operatively connecting the speedometer to the switch means in the speeds motor supply circuit whereby the speeds motor and speeds head are driven in one direction for increasing speeds and in the opposite direction for decreasing speeds of the vehicle.

7. Apparatus as claimed in claim 6, wherein each of the first recordings extends around no more than half the periphery of the cylinder in a plane part-circular track, the remainder of the periphery being reserved for shifting the speeds head from one first recording to the next first recording, the apparatus further comprises a cam operatively connected to the cylinder to rotate with the cylinder and second switch means inserted in said supply circuit of the speeds motor, the cam being associated with the second switch means to open said supply circuit and stop operation of the speeds motor during a semi-rotation of the cylinder and thus permit a reproduction by the

speeds head of any one of the first recordings and close said supply circuit and allow operation of the speeds motor during the remaining semi-rotation of the cylinder for shifting the speeds head from one of said first recordings to the next first recording.

8. Apparatus as claimed in claim 7, wherein said transmission connecting the speeds motor to the speeds head is a screw-and-nut system, the first recordings being in axially adjacent relation on the cylinder with a given pitch between each first recording, the screw having a lead equal to one quarter of said given pitch, the apparatus further comprising a cam operatively connected to said screw to be rotated at a speed equal to one quarter of the speed of rotation of said screw, and normally-closed switch means inserted in said supply circuit for controlling operation of the speeds motor, the cam being associated with the normally-closed switch means to open the normally-closed switch means once in each complete rotation of the cam and thus position the speeds head in front of that one of the first recordings which corresponds to the speed measured by the speedometer.

9. Apparatus as claimed in claim 5, wherein the second recordings extend around no more than the entire periphery of the cylinder in the form of a plane parallel tracks axially spaced apart at a given pitch, said transmission connecting the defects motor to the defects head comprising a screw-and-nut system, the screw of said system being connected to the defects motor and the nut of said system being operatively connected to the defects head.

10. Apparatus as claimed in claim 9, wherein the second control means comprise a defects-exploring device including a series of studs electrically insulated from each other and spaced apart at said given pitch of the second recordings and respectively connected to the signal outputs of the second devices, a carriage structure connected to the nut of said screw-and-nut system to move in synchronism with said nut, a brush mounted on the carriage structure to move over and explore the studs in succession as the defects head moves over the second recordings, a source of current for the defects motor, normally-open circuit means for connecting the source of current to the defects motor, reversing switch means inserted in said circuit means and cooperating with said carriage structure to automatically reverse the direction of travel of the defects head at two end-of-travel points spaced apart a distance substantially corresponding to the axial extent of the series of second recordings on the cylinder, relay means associated with said normally-open circuit means to close the normally-open circuit means, first energizing circuit means connecting all the signal outputs of the second devices to the relay means so that a signal from a signal output due to a response of the corresponding one of the second devices to defective operation of the vehicle closes said normally-open circuit means and starts up the defects motor, second relay means associated with said normally-open circuit means for the opening thereof subsequent to the closing thereof by the first relay means, normally-open second energizing circuit means for connecting the studs to the second relay means, the second energizing circuit means having inserted therein said brush and being closed by the contact of the brush with any one of the studs so that contact of the brush with a stud connected to any one of the second devices which responds to a defective operation of the vehicle energizes the second relay means and stops the defects head in front of that one of the second recordings corresponding to the responding second device, whereby a reproduction of the warning relating to the corresponding defective operation is effected.

11. Apparatus as claimed in claim 10, further comprising defects cancelling means associated with the second relay means and operatively connected to the cylinder to be rendered operative once in a given number of rotations of the cylinder to render the second relay means in operative and thereby permit a complete exploration of the other studs by the brush.

12. Apparatus as claimed in claim 11, wherein the defects cancelling means comprise a switch in said second energizing circuit and a cam operatively connected to the cylinder through a speed reducer and rotating at one quarter the speed of rotation of the cylinder, the cam cooperating with the switch to open the second energizing circuit once every four rotations of the cylinder and thereby close said normally-open circuit means and start up the defects motor for another exploration of the series of studs by the brush to ascertain if any other of the second devices is responsive to a defective operation of the vehicle, whereby in the event of a plurality of the second devices being responsive to defective operations of the vehicle the corresponding second recordings are reproduced in succession, each warning being repeated four times.

13. Apparatus as claimed in claim 5, further comprising an excessive-speed warning device comprising a series of contact elements electrically insulated from each other and corresponding to increasing increments of speed of the vehicle, a contact member mounted on the speeds head to move therewith and contact each of the contact elements in succession as the speeds head travels over the first recordings, which correspond to warnings of increasing speeds of the vehicle, the contact member having a signal output similar to the signal outputs of the second devices, a further warning recording on said cylinder in said second zone for indicating that the speed of the vehicle is excessive, a selecting element for electrically interconnecting a selected number of adjacent contact elements of said series of contact elements and connecting the selected interconnected contact elements to said second contact means, the interconnected contact elements corresponding to a range of speeds considered excessive, whereby when the vehicle reaches an excessive speed and said contact member contacts said selected interconnected contact elements said second control means cause the defects head to cooperate with and reproduce said further warning recording.

14. Apparatus as claimed in claim 1, further comprising checking means for checking the correct operation of the second channels, the checking means comprising a relay, a push-button for manually energizing the relay and a second relay for maintaining the first-mentioned relay energized so long as the second relay is not itself energized by the detection of a defect by any one of the second devices.

15. In a vehicle having a speedometer and a plurality working parts the operation of which must be constantly checked to ascertain any defective operation; an apparatus for giving sound indications of the speed of the vehicle and sound warnings of any defective operation of said working parts, said apparatus comprising a first device operatively connected to the speedometer to be driven thereby and having a variable signal output varying in accordance with the speed of the vehicle, second detecting devices respectively responsive to defective operation of said working parts and having signal outputs, a sound emitting device comprising a rotatable cylinder, drive means for driving the cylinder in rotation, a series of first recordings of spoken announcements concerning increasing increments of said speed in a first zone of the cylinder, a series of second recordings of spoken warnings each relating to the appearance of one of said operational defects in a second zone of the cylinder, a speeds reproducing head cooperative with the first recordings, a defects reproducing head cooperative with the second recordings, first control means including a speeds motor and a transmission connecting the speeds motor to the speeds head for shifting the head over the series of first recordings and causing it to co-operate with and reproduce only one of the first recordings at a time in accordance with a signal from the signal output of the first device, second control means including a defects motor and a transmission connecting the defects motor to the defects head for shift-

ing the defects head over the second recordings and causing it to cooperate with and reproduce a single one of the second recordings at a time in accordance with a signal received from any one of the signal outputs of the second devices, amplifying circuit means connecting the speeds head and defects head to a speaker, the first device, the speeds head, the first control means and the amplifying circuit means constituting a first channel circuit means, the second devices, the defects head, the second control means and the amplifying circuit means constituting a number of second channel circuit means corresponding to the number of second devices, switch means inserted in the first channel circuit means, and selecting means connected to the second channel circuit means and associated with said switch means to be actuated by the

second channel circuit means upon operation of any one of the second devices and to open the first channel circuit means and render the first device inoperative.

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