

Oct. 23, 1951

C. N. CAHUSAC ET AL

2,572,008

SMOKE DETECTOR AND SIGNAL FOR DIESEL LOCOMOTIVES

Filed June 5, 1946

7 Sheets-Sheet 1

Fig. 1

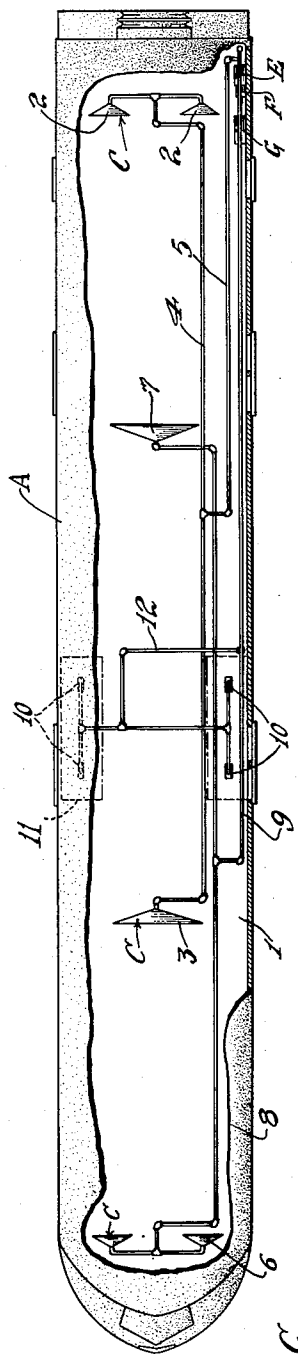


Fig. 2

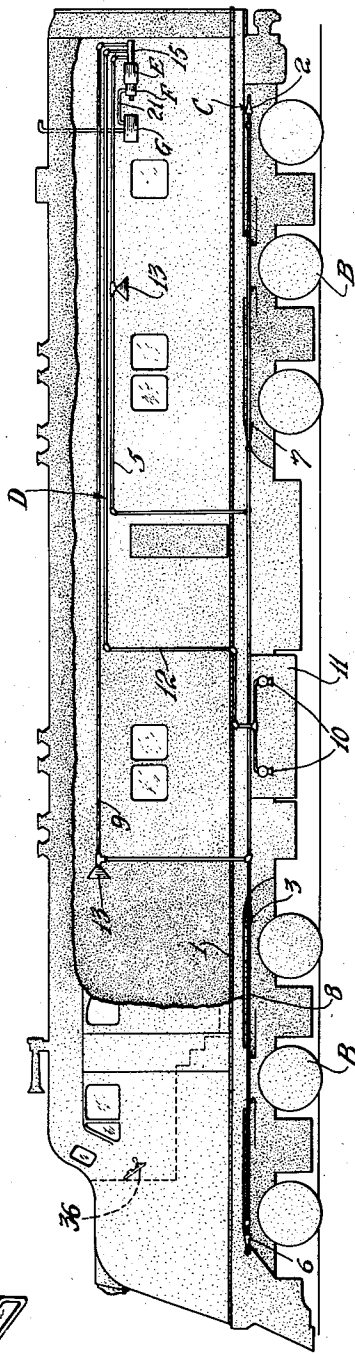
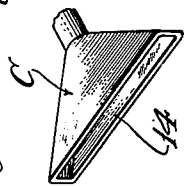


Fig. 3



INVENTORS
Clarence Noel Cahusac,
and Donald A. Diehl,
BY *Harry K. Look*
ATTORNEY

Oct. 23, 1951

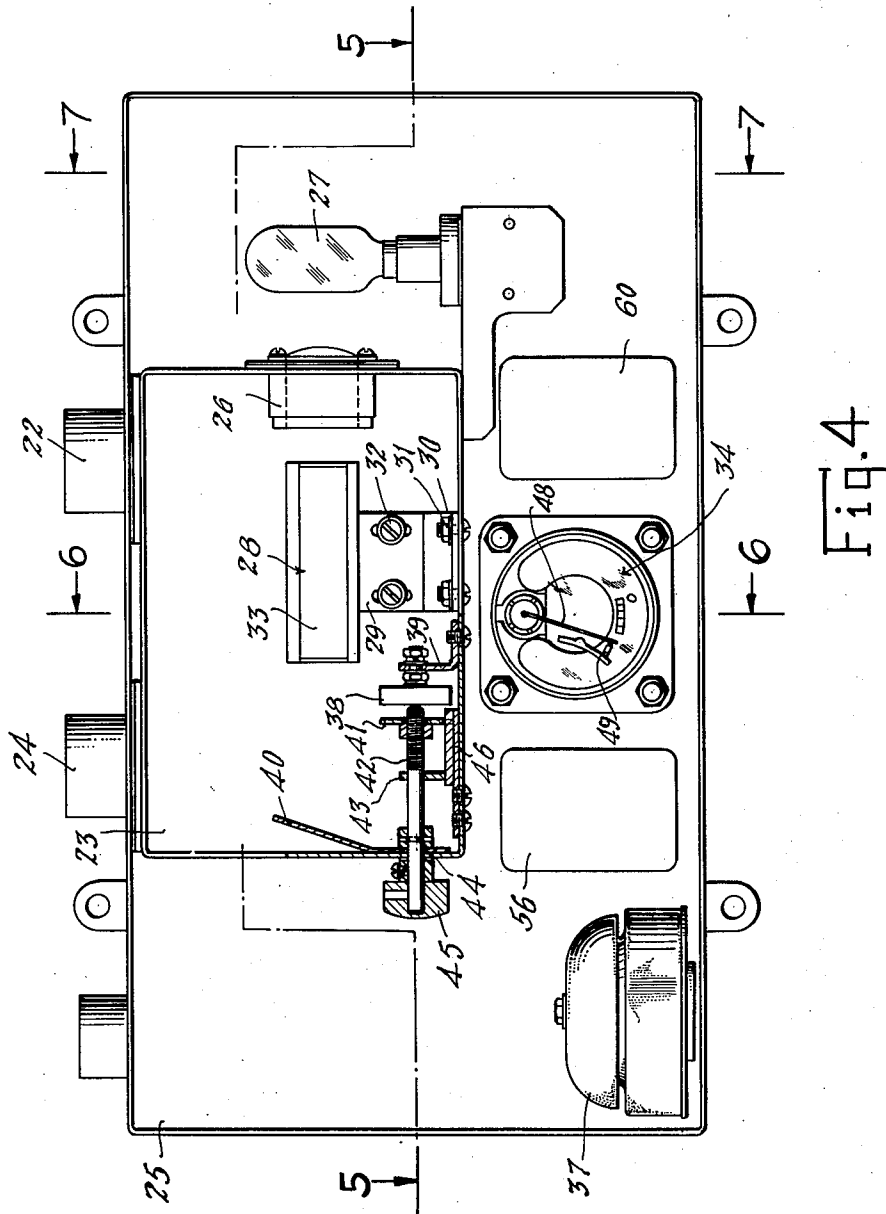
C. N. CAHUSAC ET AL

2,572,008

SMOKE DETECTOR AND SIGNAL FOR DIESEL LOCOMOTIVES

Filed June 5, 1946

7 Sheets-Sheet 2



INVENTORS
Clarence H. Colburn,
and Donald A. Diehl,
BY
Harry B. Cook,
ATTORNEY

Oct. 23, 1951

C. N. CAHUSAC ET AL

2,572,008

SMOKE DETECTOR AND SIGNAL FOR DIESEL LOCOMOTIVES

Filed June 5, 1946

7 Sheets-Sheet 3

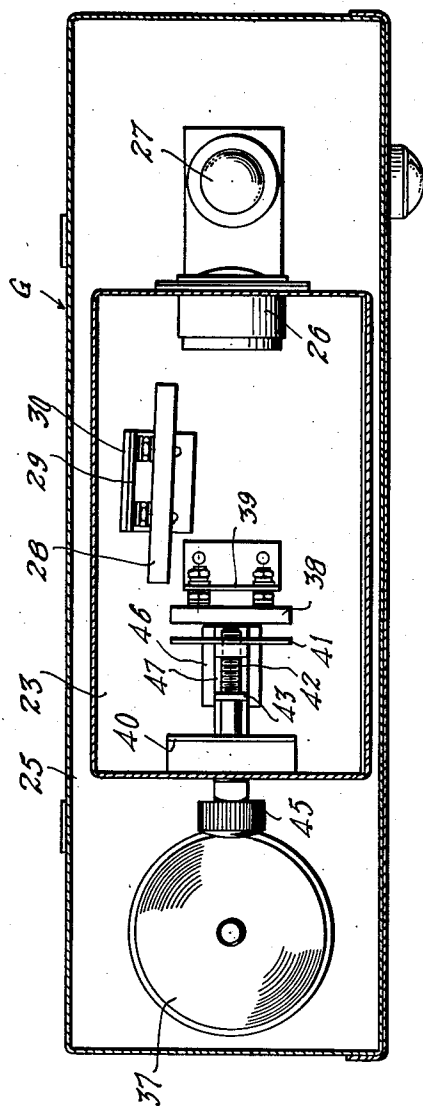


Fig. 5

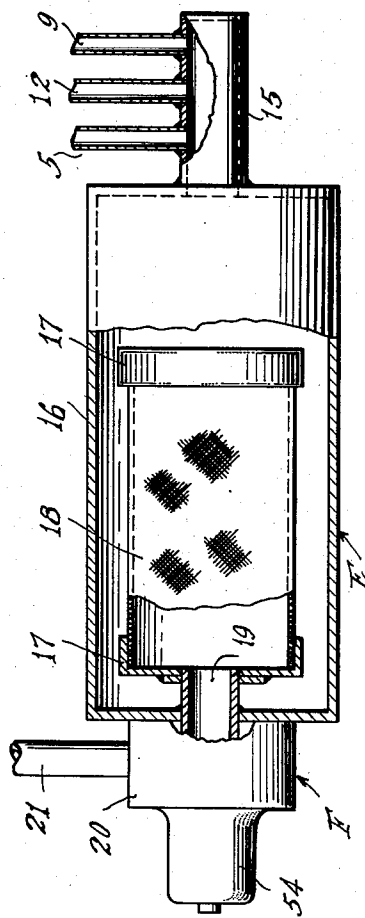


Fig. 8

INVENTORS
Clarence Noel Cahusac
BY ^{and} Donald A. Diehl,
Harry W. Cook,
ATTORNEY

Oct. 23, 1951

C. N. CAHUSAC ET AL

2,572,008

SMOKE DETECTOR AND SIGNAL FOR DIESEL LOCOMOTIVES

Filed June 5, 1946

7 Sheets-Sheet 4

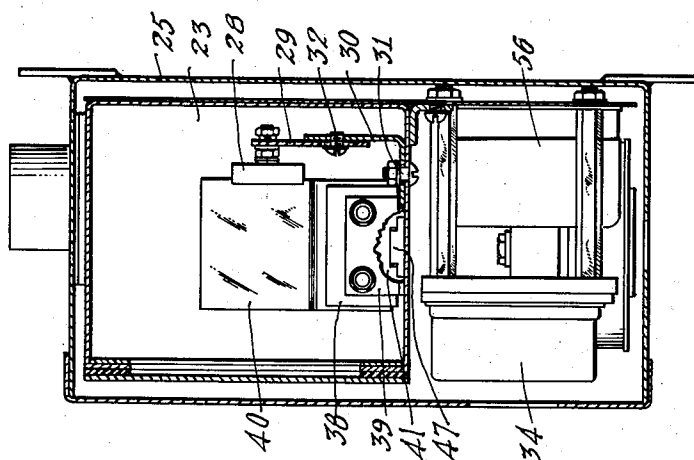


Fig. 6

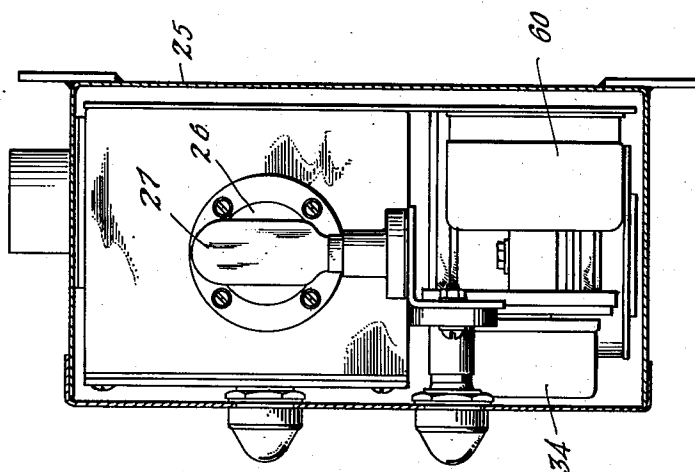


Fig. 7

INVENTORS
Clarence Noel Cahusac
and Donald A. Diehl,
BY *Harry M. Cook*
ATTORNEY

Oct. 23, 1951

C. N. CAHUSAC ET AL

2,572,008

SMOKE DETECTOR AND SIGNAL FOR DIESEL LOCOMOTIVES

Filed June 5, 1946

7 Sheets-Sheet 5

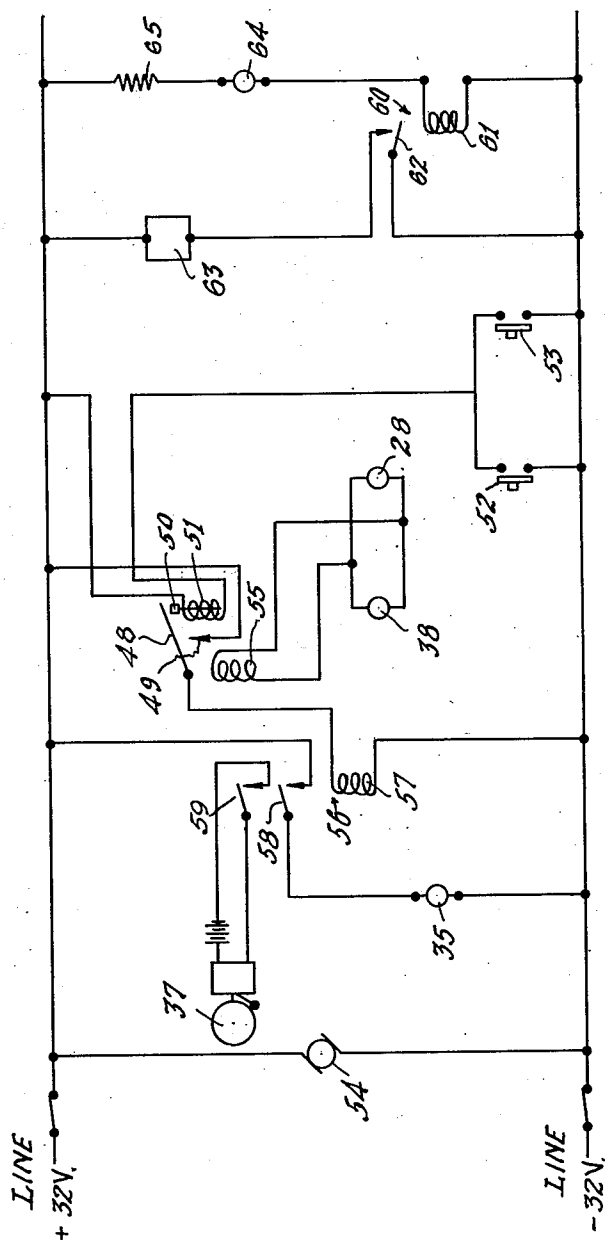


Fig. 9

INVENTORS
Clarence Noel Cahusac
and Donald A. Diehl,
BY Harry M. Hook,
ATTORNEY

Oct. 23, 1951

C. N. CAHUSAC ET AL

2,572,008

SMOKE DETECTOR AND SIGNAL FOR DIESEL LOCOMOTIVES

Filed June 5, 1946

7 Sheets-Sheet 6

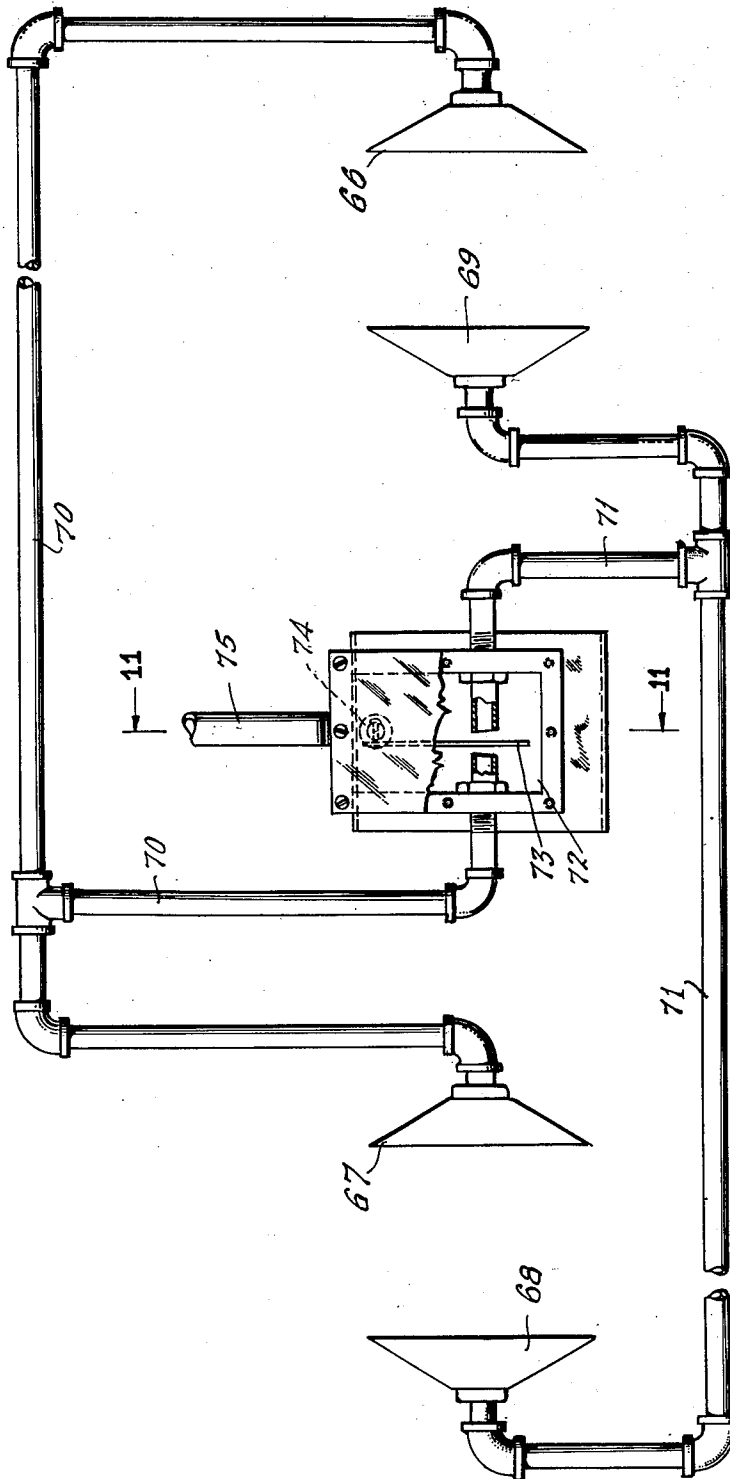


Fig. 10

INVENTORS
Clarence Noel Cahusac
and Donald A. Diehl
BY
Harry M. Cook,
ATTORNEY

Oct. 23, 1951

C. N. CAHUSAC ET AL

2,572,008

SMOKE DETECTOR AND SIGNAL FOR DIESEL LOCOMOTIVES

Filed June 5, 1946

7 Sheets-Sheet 7

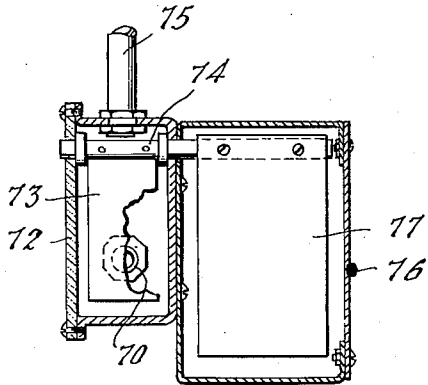


Fig. 11

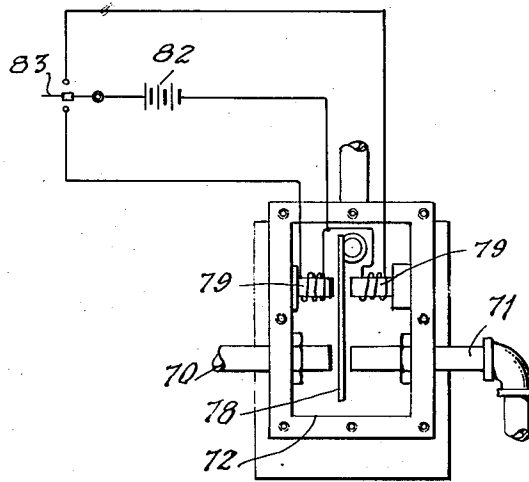


Fig. 12

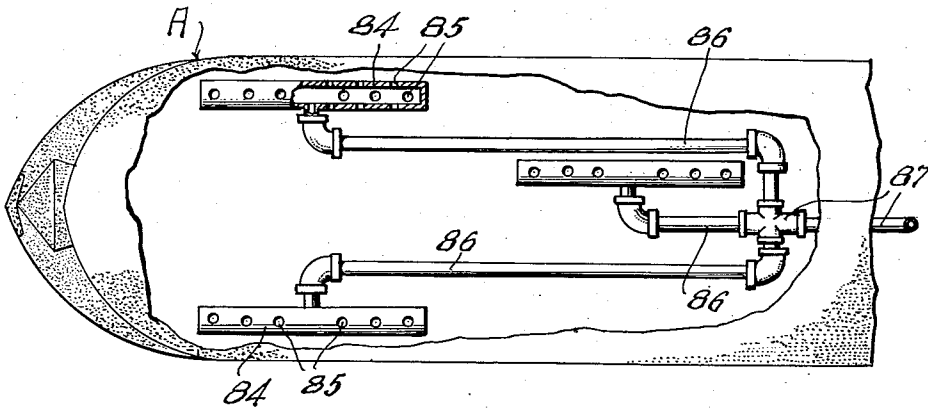


Fig. 13

INVENTORS
Clarence Noel Cahusac
BY *and* Donald A. Diehl,
Harry Pulaski,
ATTORNEY

UNITED STATES PATENT OFFICE

2,572,008

SMOKE DETECTOR AND SIGNAL FOR
DIESEL LOCOMOTIVES

Clarence Noel Cahusac, Newark, and Donald A. Diehl, Arlington, N. J., assignors to C-O-Two Fire Equipment Co., Newark, N. J., a corporation of Delaware

Application June 5, 1946, Serial No. 674,522

5 Claims. (Cl. 116—114)

1

This invention relates in general to apparatus for detecting and announcing the existence, at a point remote from the apparatus, of a fluid having particles of matter suspended therein, such as smoke; and one object of the invention is to provide such apparatus which shall embody a novel and improved construction combination and arrangement of parts that is especially adapted for detecting the presence of smoke in a locomotive driven by diesel engines, particularly smoke below the floor of the locomotive which might be generated by heat from the motors.

The detecting and signaling mechanism is of the general type described and claimed in United States Patent No. 2,301,367, dated November 10, 1942, which comprises means for producing a beam of light, means for conducting a stream of fluid, such as smoke, into said light beam, a photoelectric element of the generative type located with respect to said beam and said fluid stream to receive light rays reflected from suspended matter in said fluid stream, another photoelectric element located to receive light rays transmitted through said fluid stream, means connecting said photoelectric elements in an electric circuit whereby the photoelectric effects of the first-mentioned element and an electrical responsive means, such as a relay or "Sensitrol," in said circuit for controlling the production of an audible or visible signal.

The apparatus constituting the present invention also contemplates novel and improved means for accumulating or collecting the smoke from a point near the source of the fire and conveying the smoke to the detector and signal mechanism so that the latter will produce a warning of the presence of the smoke.

A further object of the invention is to provide means including a novel construction combination and arrangement of parts for collecting or accumulating smoke from points beneath the floor of a locomotive regardless of the direction of travel of the locomotive.

Another object is to provide such smoke-collecting or accumulating apparatus wherein the air currents incident to movement of the locomotive shall be utilized in forcing the smoke from the point of origin to the detector and signal mechanism.

Other objects, advantages and results of the invention will be brought out by the following description in conjunction with the accompanying drawings in which:

Figure 1 is a schematic top plan view of a diesel locomotive having a smoke-accumulating, detecting and signalling apparatus embodying our invention, portions of the locomotive being broken away for clearness in illustration.

2

Figure 2 is a side elevational view of the locomotive and apparatus illustrated in Figure 1 with portions of the locomotive broken away.

Figure 3 is an enlarged perspective view of one of the smoke collectors.

Figure 4 is an enlarged front elevational view of the smoke detector and signal mechanism with the front wall of the casing removed and portions broken away and shown in section.

Figure 5 is a horizontal sectional view on the line 5—5 of Figure 4.

Figure 6 is a transverse vertical sectional view on the line 6—6 of Figure 4.

Figure 7 is a transverse vertical sectional view on the line 7—7 of Figure 4.

Figure 8 is an enlarged front elevational view of the fan or pump for drawing smoke from the collectors to the detector, and the filter for filtering solid particles from the smoke, with the front wall of the casing removed and portions broken away and shown in section.

Figure 9 is a wiring diagram of the detector and signal mechanism.

Figure 10 is a schematic front elevational view of a modification of the smoke-collecting mechanism.

Figure 11 is a transverse sectional view on the line 11—11 of Figure 10.

Figure 12 is a fragmentary view similar to Figure 10 showing a modification of the apparatus illustrated in Figure 10.

Figure 13 is a fragmentary schematic plan view similar to Figure 1, showing a modification of the smoke-collecting apparatus.

Specifically describing the invention, the reference character A designates a locomotive driven by diesel engines which have been omitted for clearness in illustration, the car having the usual wheeled trucks B by which the car is adapted to run on railroad rails.

Beneath the floor 1 of the locomotive, adjacent and above the trucks B, are a plurality of smoke collectors C that are connected by pipes D through a filter E to a fan or pump F which draws the smoke from the collectors C and forces it into a detector mechanism G. The collectors C are so grouped and arranged that they will effectively collect smoke regardless of the direction of movement of the locomotive.

More particularly, there are at the rear end of the locomotive and behind the rear trucks B, a pair of collectors 2 having their open ends facing forwardly, while at the forward end of the locomotive and behind the front trucks B is at least one collector 3 having its open end facing forwardly, so that upon forward motion of the locomotive the collectors 2 and 3 will pick up or collect any smoke that may be present beneath

the locomotive. The collectors 2 and 3 are connected to a common manifold pipe 4 which is in turn connected by a pipe 5 to the inlet of the filter E.

At the forward end of the locomotive and ahead of the forward trucks B, are smoke collectors 6, while at the rear end of the locomotive and ahead of the rear trucks B, is at least one smoke collector 7, said collectors 6 and 7 having their open ends facing rearwardly so that upon backward movement of the locomotive smoke will be collected by all of said collectors. These collectors are connected to a common manifold pipe 8 which is in turn connected by a pipe 9 to the inlet of the filter E.

If desired, other smoke collectors 10 may be arranged in the battery boxes 11 of the locomotive and may be connected by a pipe 12 to the filter E. In some instances, it may also be desirable to provide smoke collectors 13 at various points within the locomotive and connect these collectors to any of the pipes 5, 9 or 12.

The collectors may be of any suitable construction, but preferably are fan-shaped in plan view with wide and narrow open ends 14 as best shown in Figure 3. The pipes 5, 9 and 12 conveniently may be connected to a common manifold inlet pipe 15 for the filter E which is connected to one end of the filter casing 16 within which is arranged any suitable element that may include end pieces 17 connected by a porous filtering medium 18, through which the smoke passes to an outlet 19 that is connected to the inlet of a centrifugal fan 20, the outlet of which is connected by a pipe 21 to the inlet 22 of the smoke detector mechanism. This smoke detector mechanism is shown as comprising a smoke compartment 23 having the inlet 22 and an outlet 24 which may extend to any suitable point, for example upwardly through the roof of the locomotive; and said compartment 23 is enclosed within a main housing 25.

At one end of the compartment 23, is a suitable lens system 26, and in juxtaposition thereto and within the main housing 25 is a light source, such as an incandescent lamp 27, so that rays of light from the lamp will be projected through the lens system 26 in a parallel beam into the compartment 23.

At least one photoelectric element 28 is mounted on a bracket which includes two sections 29 and 30, the latter of which is adjustably connected by a slot-and-screw connection 31 to the bottom wall of the smoke compartment 23, so that the cell 28 may be swung in a horizontal plane relative to the light beam, or moved toward and away from the light beam. The two sections 29 and 30 are adjustably connected as by a screw-and-slot connection 32 so that the cell 28 may be adjusted vertically.

The cell 28 is normally located at one side of the light beam so as to be sensitive to the light rays reflected from the suspended matter in the smoke entering the compartment through the inlet 22, and may be of any suitable type such as the current generating barrier layer type having a large flat rectangular exposed light-sensitive surface 33 whereby the cell is capable of generating sufficient current to operate a "Sensitrol" without amplification of the electricity. Preferably, the light-sensitive surface is exposed in close proximity to the outer boundaries of the light beam and tilted obliquely with respect to said beam, so that said surface is inclined away from the light source as shown in

Figure 5, thus insuring great sensitivity and at the same time reducing the effect of stray light rays on the cell when no smoke is present.

The photoelectric element 28 is connected in circuit with any suitable electrical responsive device, such as a "Sensitrol" relay 34 which may be mounted on the rear wall of the housing 25 and exposed through an opening in the front wall of said housing; and said "Sensitrol" controls another circuit which may include any desired electrically operated device, such as a signal lamp 35 mounted on an instrument control board 36 in the locomotive, or a howler or audible signal 37 that may be located at any suitable point but is shown in the housing 25. The circuit for connecting the "Sensitrol" with a source of electricity, said signals and the photoelectric elements is shown in Figure 9 and will be later described.

Another photoelectric element 38, which may be of the same type as the element 28, is mounted by a bracket 39 on the bottom wall of the smoke compartment 23, with its sensitive side directed away from the light source and toward a reflector 40 that is mounted on one end of the compartment to receive the light beam and reflect some of the light rays therefrom to the cell 38.

To vary the extent of the exposure of the photoelectric element 38 to the reflected light rays, a shutter or baffle plate 41 is located in spaced opposed relation to the light-sensitive surface of said cell and is movable toward and away from said surface by a screw 42 threaded in the shutter and rotatable in bearings 43 and 44, and having one end projecting from the compartment and provided with a finger piece 45. The bearing 43 is mounted on a plate 46 secured to the bottom wall of the compartment 23 and, desirably, said plate has a guide 47 to hold the shutter 41 against rotation and to insure smooth movement thereof.

The photoelectric element 38 is connected in circuit with the photoelectric element 28 and the "Sensitrol" 34 in what is known as an "opposed parallel" arrangement, or so that the photoelectric effects of the said elements are caused to operate in compensating differential or opposing relation; in other words, the electrodes of the element 38 are connected respectively to the opposite electrodes of the element 28 (see Figure 9).

With this construction, initially the photoelectric cell circuit is so adjusted that the relay 34 or other device will assume a normal condition, for example to open the signal circuit when no smoke is present in the compartment 23, and when smoke or other fluid containing suspended matter is caused to flow through said compartment into the beam of light, some of the light rays will be reflected from the solid particles in the stream upon the photoelectric element 28, whereupon the relay or other device 34 will be actuated by the current in the photoelectric cell circuit, for example to close the signal circuit. In this connection, it may be well to point out that the relay 34 has a pointer or contact arm 48 which is responsive to current in the photoelectric cell circuit and normally is spaced from the fixed contact 49, but is actuated into engagement with said contact when the photoelectric cell is energized.

It will be observed that the cell 28 will be continuously somewhat affected by stray light rays from the beam even when no smoke is present in

5

the compartment 28, and the cell will be further affected by slight variations in the intensity or candle power of the light source 27, which without some means to prevent it will result in irregular or unsteady operation of the "Sensitrol" 34. By rotating a screw 42, the shutter 41 may be adjusted to vary the amount of light reflected from the reflector 40, and thus when no smoke is present in the compartment 23, the effect of the light on the cell 28 may be balanced by the effect of the light on the cell 38, whereby a steady and normal setting of the "Sensitrol" pointer 48 may be obtained.

When the relay or "Sensitrol" is energized by electricity generated by the photoelectric cell 28, its pointer or contact arm 48 engages the contact 49 and tends to remain in such contact. The "Sensitrol" is a well-known mechanism and includes means for resetting this contact arm from any desirable remote point and, as schematically shown in Figure 9, the resetting mechanism includes a resetting rod 50 normally spring-influenced away from the movable contact arm 48 and actuated into engagement with said contact arm by a solenoid 51. The solenoid 51 is connected in an electric circuit with normally open reset switches 52 and 53 which may be arranged at any suitable point, for example one in the housing 25 and the other on the instrument panel 36 in the locomotive, the operation being such that when either of the switches 52 or 53 is closed, the coil 51 will be energized to push the resetting rod 50 with a snap action against the contact arm 48 which thereby will be pushed back to its normal position.

While the photoelectric cells, light source, "Sensitrol," signals and motor 54 for driving the fan 20 may be connected in circuit in different ways, a preferred arrangement is shown in Figure 9 of the drawings. Here the coil for operating the "Sensitrol" relay is designated as 55 and is shown as connected in circuit as above described with the two photoelectric cells 28 and 38. The "Sensitrol" relay contacts 48 and 49 control a power relay 56 which includes an electromagnetic coil 57 and relay switches 58 and 59 actuated thereby, the former of which controls the circuit through the signal lamp 35, while the latter may control any external alarm circuit such as a howler or a bell or gong 37.

The circuit also preferably includes a supervisory lamp relay generally designated 60 and including a coil 61 and a switch 62 actuated thereby that is connected in circuit with a trouble buzzer 63. Connected in circuit with the coil 61, are the exciter lamp 27 and a resistance 65.

In operation of the construction so far described, assuming the locomotive is traveling forwardly and no smoke is present in the vicinity of the collectors C, the light beam is projected through the smoke compartment 23, but the photoelectric cells are unaffected because of the absence of smoke, so that all of the signals are inactive. Should smoke arise beneath the locomotive, it will be drawn through the collectors 2 and 3 by the fan F in conjunction with the force of the air currents incident to movement of the locomotive through the filter E and into the smoke compartment 23, whereupon the photoelectric cells will be energized and the various visible and audible signals will be operated. Similarly, if smoke should arise within the locomotive, it will be conducted to the smoke compartment from the collectors 13 so as to cause operation of the signals. After the signals have

6

been noted, the "Sensitrol" may be reset by closing either of the switches 52 and 53.

Should the locomotive be moving rearwardly with smoke beneath the locomotive, the smoke will be picked up by the collectors 6 and 7, and thereupon the signals will be operated as hereinbefore described. Similarly, smoke accumulating in the battery boxes 11 will be conducted to the detector G so as to cause operation of the signals.

In Figures 10 and 11 is illustrated a modification of the system which in general is the same as that heretofore described, but includes a device for reducing the effect of suction on the rearwardly facing collectors when the locomotive is moving forwardly and vice versa. As shown, this system includes the collectors 66 and 67 that correspond to the collectors 2 and 3, and collectors 68 and 69 that correspond to the collectors 6 and 7. The collectors 66 and 67 are connected to the manifold pipe 70 which corresponds to the pipe 4, while the collectors 68 and 69 are connected to a manifold pipe 71 which corresponds to the pipe 8.

The manifold pipes 70 and 71 are connected to a valve casing 72 at opposite sides of a valve plate or vane 73 that is pivotally mounted at one end in the casing 72 on a shaft 74, so that swinging of the vane in either direction will contact with and close the end of one of the pipes 70 or 71. Smoke is conducted into the casing 72 from the collectors and is conducted from said casing to the filter and fan through a pipe 75. The vane or plate 73 is actuated by air currents incident to movement of the locomotive. As shown, the shaft 74 projects from the casing 72 transversely of a tube 76 and has connected thereto one end of a vane 77 so that the latter may swing in said tube in either direction under the influence of air currents generated by movement of the locomotive.

With this construction, when the locomotive is moving in one direction, the vane 77 will actuate the valve plate 73 to close the one of the pipes 70 and 71 through which otherwise suction would be created in the casing 72. In other words, when the locomotive is moving forwardly or to the left in Figure 10, the pipe 71 will be closed to prevent the rearwardly facing collectors from creating suction in the casing 72, while when the locomotive is traveling backwardly, the pipe 70 will be closed to prevent creation of suction on the casing 72 by the forwardly facing collectors.

A modification of the invention is shown in Figure 12, where the vane 77 is omitted and the valve plate 78 is actuated at will to close either of the pipes 70 or 71. As shown an electromagnet 79 is mounted on the casing 80 which corresponds to the casing 72 at each of opposite sides of the valve plate 78 which corresponds to the plate 73, and the coils of said magnets are connected in parallel circuits with a source of electricity 82 and a common switch 83, so that either magnet may be energized to attract and swing the plate 81 into closing relation to either of the pipes 70 or 71. Of course, if desired, the magnets 79 might be used in conjunction with the vane 77 so that at the will of the operator either pipe 70 or 71 could be closed, regardless of the air currents developed as the result of movement of the locomotive.

It will be understood by those skilled in the art that the specific construction and arrangement of the smoke-collecting apparatus may be modified according to the conditions under which

7

the apparatus is to be used, and in some cases it may be preferable to use perforated pipes as the collectors instead of the fan-shaped collectors C hereinbefore described. In Figure 13 of the drawings is illustrated a modified form of smoke-collecting apparatus which comprises a plurality of elongate cylindrical hollow elements 84 that have a plurality of apertures or openings 85, each of which is connected by a pipe 86 to a header pipe 87 which leads to, for example, the manifold inlet pipe 15 or through some other means to the smoke detector. The collectors 84 may be located at desired points, for example as are the collectors 2 and 7, or 3 and 6, and with this form of collector it is not necessary that the collector face in any particular direction.

Moreover, the collectors 84 can be formed of pieces of pipe having plugged ends and the lengths and shapes of the pipes can be varied as desired to accommodate various conditions and different locations in which the apparatus is to be installed. For example, the perforated collector pipes might extend throughout the length of the locomotive and be bent to enter corners or partially enclosed spaces. The subject matter concerning the structure of the smoke detector is claimed and described in C. N. Cahusac and F. B. Allen patent application, Serial No. 74,341, filed February 3, 1949, as a continuation-in-part application of Serial No. 604,892, filed July 13, 1945, now Patent No. 2,464,211.

Various other modifications and changes in the details of construction of the apparatus will occur to those skilled in the art as within the spirit and scope of the invention, and it will also be understood that the apparatus may be utilized in conjunction with other types of vehicles or machines than the diesel locomotive herein specifically mentioned.

Having thus described the invention, what we claim is:

1. A smoke detecting system for use on a vehicle operative alternatively in the forward or in the reverse direction, the vehicle having at least one wheeled truck, the smoke detecting system comprising a smoke detector, a collector at each end of the truck and facing the truck, smoke passage means for connecting each of the smoke collectors to the smoke detector, and smoke passage obstructing means responsive to the movement of the vehicle and adapted to alternatively close the smoke passage means from either collector depending upon the direction of movement of the vehicle and operative to close the passage of the collector facing rearwardly with respect to the direction of movement of the vehicle.

2. A smoke detecting system for use on a vehicle operative alternatively in the forward or in the reverse direction, the vehicle having at least one wheeled truck, the smoke detecting system comprising a smoke detector, a collector at each end of the truck and facing the truck, smoke passage means for connecting each of the smoke collectors to the smoke detector, and a valve responsive to the movement of the vehicle and adapted to alternatively close the smoke passage means from either collector depending upon the direction of movement of the vehicle and operative to close the passage of the collector facing rearwardly with respect to the direction of movement of the vehicle.

3. A smoke detecting system for use on a vehicle operative alternatively in the forward or in the reverse direction, the vehicle having at least one wheeled truck, the system comprising a

8

smoke detector, a collector at each end of the truck and facing the truck, smoke passage means for connecting each of the smoke collectors to the smoke detector, and a vane operated valve normally in an open position and responsive to the movement of the vehicle and adapted to alternatively close the smoke passage means from either collector responsive to air currents induced by and in a direction depending upon the direction of movement of the vehicle, the vane-operated valve adapted to close the passage of the collector facing rearwardly with respect to the direction of movement of the vehicle.

4. A smoke detecting system for use on a vehicle operative alternatively in the forward or in the reverse direction, the vehicle having at least one wheeled truck, the system comprising a smoke detector, a collector at each end of the truck and facing the truck, smoke passage means for connecting each of the smoke collectors to the smoke detector, a valve casing having a pair of opposed inlets each in fluid communication with a collector and an outlet in fluid communication with the smoke detector, and a vane-operated valve member in the valve casing and adapted to alternatively close one or the other of the pair of opposed inlets responsive to the movement of air flowing inwardly through the forwardly facing collector and adapted to close the inlet from the rearwardly facing collector depending upon the direction of movement of the vehicle.

5. A smoke detecting system for use on a vehicle operative alternatively in the forward or in the reverse direction, the vehicle having at least one wheeled truck, the system comprising a smoke detector, a collector at each end of the truck and facing the truck, smoke passage means for connecting each of the smoke collectors to the smoke detector, a valve casing having a pair of opposed inlets each in fluid communication with a collector, and an outlet in fluid communication with the smoke detector, and a thin flat pivotally supported member positioned between the inlets and adapted to be swung alternatively to close one or the other of the inlets depending upon the direction of the vehicle so as to close the inlet of the rearwardly facing collector, whereby only the forwardly facing collector with respect to the movement of the vehicle will be in fluid communication with the smoke detector.

CLARENCE NOEL CAHUSAC.
DONALD A. DIEHL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,154,128	Rich	Sept. 21, 1915
1,296,499	Fether	Mar. 4, 1919
1,343,911	Freygang et al.	June 22, 1920
1,755,834	Marr et al.	Apr. 22, 1930
1,828,894	Freygang	Oct. 27, 1931
1,923,349	Wolverton	Aug. 22, 1933
2,033,466	Grant	Mar. 10, 1936
2,118,836	Carter	May 31, 1938
2,301,367	Cahusac et al.	Nov. 10, 1942
2,361,924	Boynton	Nov. 7, 1944
2,408,660	Lannge	Oct. 1, 1946

FOREIGN PATENTS

Number	Country	Date
25,266	Great Britain	Nov. 9, 1906
442,112	Germany	Mar. 23, 1927