H. E. CADE & W. F. COCHRANE.

ELECTRICAL OPERATING AND INDICATING MEANS.

APPLICATION FILED JUNE 17, 1914.

1,167,045. Patented Jan. 4, 1916.

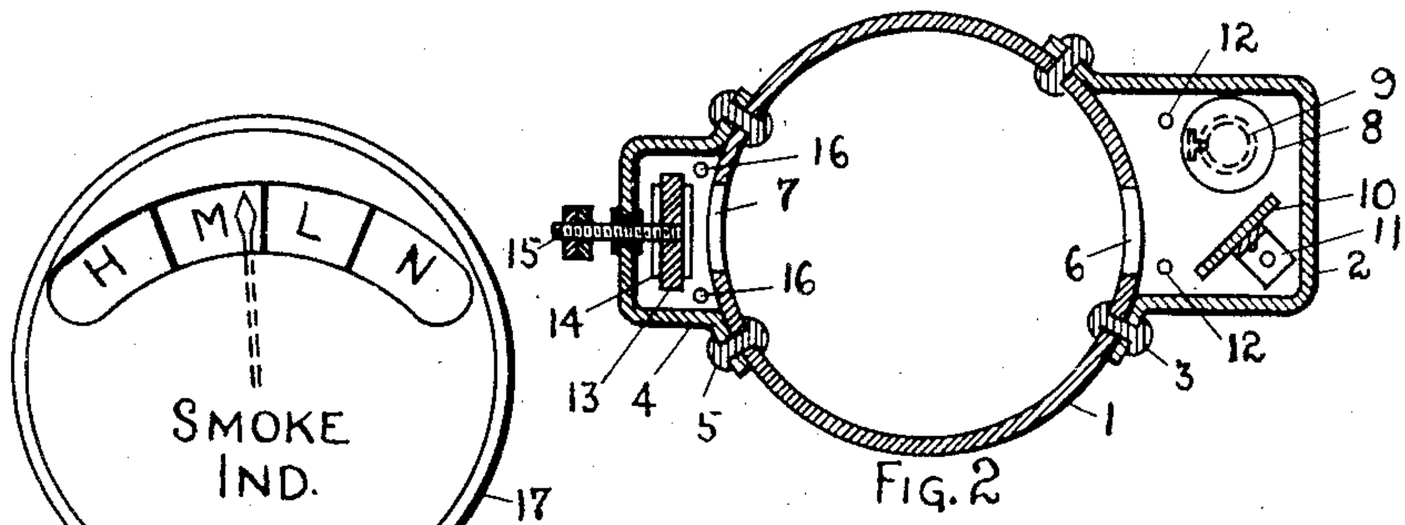
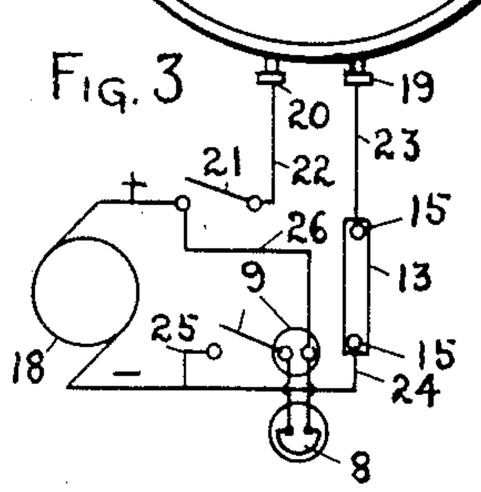


Fig. 3

Fig. 2



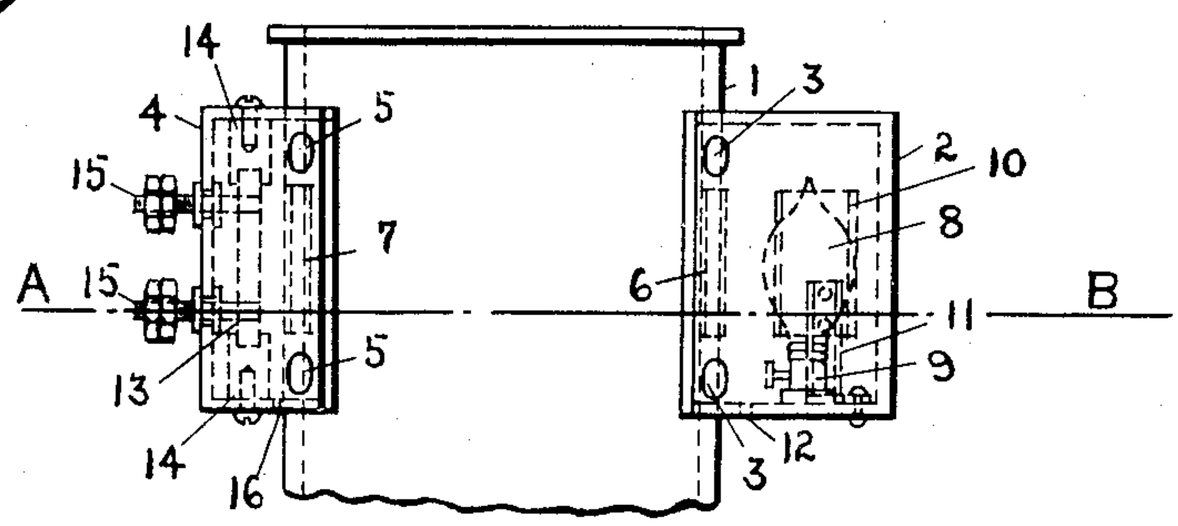


Fig. 1

Witnesses
James L Smyth
Ernest C. Schmidt.

Inventor's
Howard E. Cade
William F. Cochrane.
By
Howard E. Cade, Attorney

UNITED STATES PATENT OFFICE.

HOWARD E. CADE, OF PENCOYD, AND WILLIAM F. COCHRANE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS TO PIONEER SMOKE INDICATOR COMPANY, OF WILMINGTON, DELAWARE, A CORPORATION OF DELAWARE.

ELECTRICAL OPERATING AND INDICATING MEANS.

1,167,045. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed June 17, 1914. Serial No. 845,548.

To all whom it may concern:

Be it known that we, HOWARD E. CADE and WILLIAM F. COCHRANE, citizens of the United States, and residing, respectively, in Pencoyd, in the county of Montgomery, and in Philadelphia, in the county of Philadelphia, and both in the State of Pennsylvania, have jointly invented certain new and useful Improvements in Electrical Operating and Indicating Means, of which the following is a specification.

Our invention relates to the application and use of the electrical properties of the metal selenium under varying light intensities, said metal having the peculiar characteristic of varying its ohmic resistance under varying light intensities and of applying this characteristic to the improvements heretofore mentioned.

Primarily our invention contemplates novel and practical means for directly indicating the density of vapor or smoke passing through a stack or flue. That is to say, it is proposed to utilize the properties of the selenium cell to vary the electrical resistance in circuits having included therein an indicator located preferably remotely from the stack, so that as the smoke or vapor passing therethrough varies light rays directed upon the cell, the resistance of the cell will be increased or diminished, and thereby control the hand of the indicator to give a signal indicating the character of the gas passing through the flue. This is of much practical importance in maintaining proper firing conditions, as is well known, since by the density of smoke, it may be readily determined whether or not the fuel is being properly consumed and the maximum heating efficiency obtained therefrom.

With these objects in view our invention consists in certain novel features of construction and arrangements of parts as will hereinafter more fully be described and pointed out in the claims; reference being had to the accompanying drawings forming part thereof, and in which similar numerals of reference refer to similar parts throughout the several views.

Figure 1 designates a smoke stack and of which it is desired to directly indicate at all times the character or density of the smoke, and fitted with our improved smoke density transmitting means; Fig. 2 designates the section on A B Fig. 1 and showing more clearly the source of light reflected on the selenium cell; and Fig. 3 designates diagrammatically the electrical wiring means for the operation of the smoke indicating means.

Referring to Fig. 1, the numeral 1 designates the stack and to which is rigidly secured boxes 2 and 4 arranged diametrically opposite to each other. Rigidly secured to box 2 is a switch and receptacle 9, said receptacle having inserted in it an incandescent lamp 8. 10 designates a mirror rigidly secured to a support 11, and said support 11 is rigidly secured to box 2. 6 designates an aperture in stack 1. 12 designates apertures in box 2, whose function will be hereinafter more fully described. Rigidly secured to box 4 are insulating holders 14, which hold in containment a selenium cell 13. 15 designates terminals in the selenium cell 13. 7 designates an aperture in the stack 1, and 16 designates apertures in the box 4, and whose functions will hereinafter be more fully described.

Referring to the wiring diagram, Fig. 3, 18 designates the source of electric current supply. 9 designates the switch and receptacle. 8 designates the incandescent lamp. 13 designates the selenium cell, and 21 designates the switch inserted in a circuit to an indicator 17, and which is of the nature of a milliammeter, as understood by those familiar with the electrical arts. Said indicator 17 has its scale so subdivided as to carry legends representative of the character of the smoke:—For instance, the letter H is designatory of heavy smoke, the letter M, medium smoke, the letter L, light smoke, and the letter N, no smoke.

It will be evident to those skilled in electrical arts, that the pointer of the indicator 17 will take up a position on the scale of indicator dependent on the amount of current flowing through the indicator 17.

Numerals 19 and 20 designate terminals of the indicator 17.

It is obvious that if switch 21 is closed on the positive side of the source of electric current supply 18, that a current of electricity

will flow through the indicator 17, as follows:—positive line, switch 21, lead 22, terminal 20, indicator 17, terminal 19, lead 23, selenium cell 13, lead 24, to the negative side of the line. It is also obvious that if the switch and receptacle 9 is closed that a current of electricity will flow as follows:—positive line, lead 26, incandescent lamp 8, switch and receptacle 9, lead 25 to the negative side of the line.

As previously stated, the peculiar characteristic of the metal selenium is its change in ohmic resistance due to changes in light intensity.

Again referring to Fig. 2, it will be evident that light from the incandescent lamp 8 will be thrown on the mirror 10, and said mirror 10 will reflect the light through the aperture 6 diametrically through the stack 1, aperture 7, and on to the selenium cell 13. It will also be evident that as the smoke increases or diminshes in its density that the intensity of the light reflected from the mirror 10 will consequently decrease and increase in its intensity. It will also be evident to those skilled in the arts that the ohmic resistance of the selenium cell 13 will decrease and increase accordingly. It will also be evident that the pointer of the indicator 17 will change its position on the indicator scale upon varying smoke densities and that by suitable calibration and designatory symbols, will indicate at all times the character of the density of the smoke and thereby accomplish the heretofore mentioned object of our said invention.

It will be evident that the draft of the smoke stack will draw additional air up through the apertures 12 and 16 previously mentioned and that this air will be drawn by the draft of the stack through the respective apertures 6 and 7. By drawing the air through the apertures 6 and 7 it will further be evident that soot will be prevented from lodging in the boxes 2 and 4 and interfering with the operation of the system.

It is obvious that other means than selenium can be used to accomplish the objects of our said invention, providing such means has the characteristic of varying its resistance upon changes in light intensities.

We do not wish to limit ourselves to the exact construction and arrangement of parts as shown, as it is obvious that slight departure and changes can be made without departing from the spirit and intent of our said invention.

What we claim as new and desire to secure by Letters Patent is:—

1. An apparatus for indicating the density of smoke including an electric indicator device showing a plurality of indications proportionate to the different density of the smoke, a stack having oppositely located registering openings, a source of light adjacent one of said openings, a device sensitive to varying light rays projected from said source of light, and electrical connections, including a source of electrical energy, between said indicator, cell and source of light.

2. An apparatus for indicating the density of smoke including an electric indicator device showing a plurality of indications proportionate to the different density of the smoke, a stack having oppositely located registering openings, a light projecting device located adjacent one of said openings, a selenium cell located adjacent the other of said openings, and adapted to receive light rays from said light projecting device, and electrical connections, including a source of electrical energy, between said indicator, cell and source of light.

3. An apparatus for indicating the density of smoke including an electric indicator device showing a plurality of indications proportionate to the different density of the smoke, a stack having oppositely located registering openings, a lamp housing adjacent one of said openings and a cell housing located diametrically opposite said lamp housing and over the other opening, a source of light in said lamp housing, a selenium cell in said cell housing, and electrical connections, including a source of electrical energy, between said indicator, cell and source of light.

4. An apparatus for indicating the density of smoke including an electric indicator device showing a plurality of indications proportionate to the different density of the smoke, a stack having oppositely located registering openings, a lamp housing adjacent one of said openings, and a cell housing located diametrically opposite said lamp housing and over the other opening, each of said housings having openings in their bottom wall to provide a draft therein and thereby prevent smoke entering the same, a source of light in said lamp housing, a reflector for projecting light from said lamp through the openings in the stack, a selenium cell adapted to receive light rays projected from said reflector, and electrical connections, including a source of electrical energy, between said indicator, cell, and lamp.

5. An apparatus for indicating the density of smoke including an electric indicator device showing a plurality of indications proportionate to the different density of the smoke, a stack having oppositely located registering openings, a boxing located at one of said openings, a lamp in said boxing, a reflector for projecting light rays from said lamp across the stack to the opposite opening, another boxing located opposite said first boxing and adjacent one of said openings, a selenium cell in said second boxing and located before the opening in the stack to receive light rays projected from

the reflector, and electrical connections including a source of electrical energy, between said indicator, cell, and lamp.

6. An apparatus for indicating the density of smoke including an electric indicator device showing a plurality of indications proportionate to the different density of the smoke, a stack having oppositely located registering openings, a selenium cell located adjacent one of said openings, and a light projecting device located adjacent the other of said openings and including an electric lamp, an electric connection between one terminal of the cell and one terminal of the indicator, a source of electrical energy, an electric connection between the other terminal of said cell and said source of energy, an electrical connection between one terminal of the lamp of the light projecting device and said source of energy, an electrical connection between the other terminal of said lamp and the connection between said source of energy and one terminal of the cell and including an electric switch, and an electrical connection between said source of electric energy and the other terminal of the indicator and also including a switch.

7. An apparatus for indicating the density of smoke, including a stack having openings, a source of light adjacent one of said openings, a device sensitive to varying light rays projected from said source of light, a variable indicator controlled through the light effects on said device, and electrical connections including a source of electrical energy between said indicator, said device sensitive to varying light rays, and the source of light.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

HOWARD E. CADE.
WILLIAM F. COCHRANE.

Witnesses:
JAMES F. SMYTH,
WILLIAM B. ROBINS.