

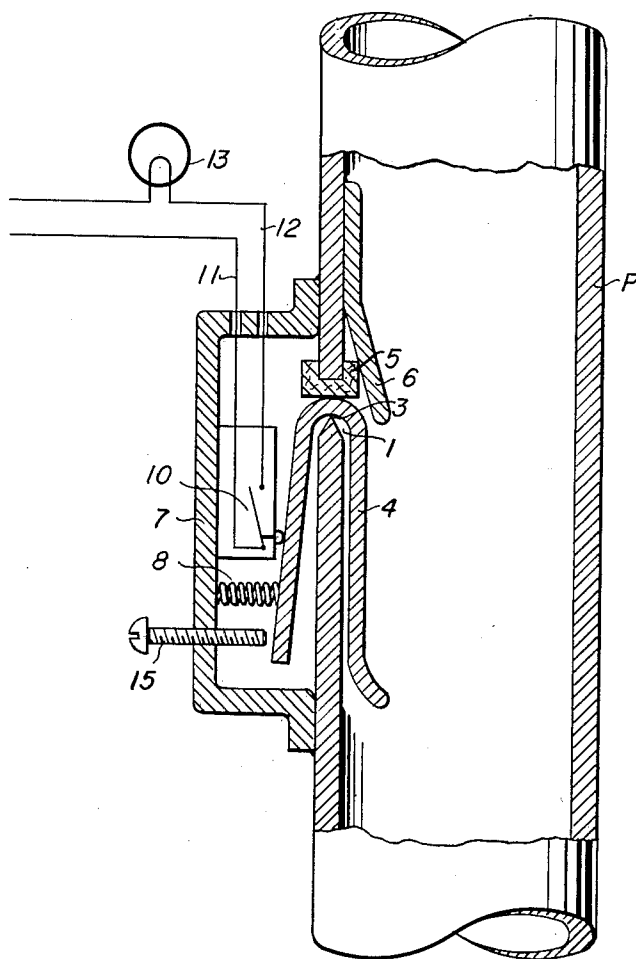
May 15, 1956

L. M. KEEPHART

2,745,920

EMPTY INDICATOR FOR RAW COAL PIPES AND THE LIKE

Filed June 18, 1951



Inventor

LESTER M. KEEPHART

By

George K. Bell
Attorney

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EMPTY INDICATOR FOR RAW COAL PIPES AND THE LIKE

Lester M. Keephart, Chester, Pa.

Application June 18, 1951, Serial No. 232,083

3 Claims. (Cl. 200—61.21)

This invention relates to means for giving an alarm or signal when the coal or like loose material in a so-called "raw coal pipe" falls below a given level therein.

In large coal burning power plants the coal customarily is fed by gravity from a hopper into the top of the pipe and conducted by the latter to a ball mill or other pulverizing apparatus which reduces it to finely divided condition; it is then picked up by a current of high pressure air supplied by a blower and carried to the point at which it is burned. Not infrequently, however, the mass of coal in the hopper forms an arch over the hopper outlet to the pipe and so prevents the coal from feeding normally into the latter. As a consequence after all the coal in the pipe at the time the arch forms has passed into the mill the high pressure air can enter the pipe from below in a blast laden with dense clouds of coal dust which, escaping through seams in the pipe and other confining walls into the plant before the blower can be shut off, contaminate the atmosphere, soil objects on which the dust then settles, and sometimes create fire and explosion hazards.

Raw coal pipes in installations of the character to which reference has been made extend vertically from the elevated hopper to the pulverizing mill and are sometimes eighty feet or more in length and sixteen inches or thereabouts in diameter, the pipe itself thus constituting a coal reservoir of considerable volume; the mill and associated mechanism may therefore continue to be supplied with coal therefrom for some little time after an arch has been formed in the hopper over the upper end of the pipe and prevented passage of coal thereinto. Such arches cannot readily be located by inspection, however, and it has heretofore been difficult to prevent the wide dispersion of coal dust resulting from temporary failure of the coal supply in the manner described despite the fact that when known to exist such arches can usually quickly be destroyed merely by vibrating the pipe and/or hopper with a few blows from a sledge hammer or in other relatively simple manner and the said effects of the stoppage of coal feed from the hopper into the top of the pipe thus obviated.

It is therefore a principal object of my invention to provide automatic means for supplying a signal to indicate normal coal feed through the raw coal pipe has been interrupted with consequent necessity for appropriate action to restore the feed before the residual coal in the pipe is exhausted, although it will of course be evident the invention is useful in other generally similar situations.

A further object is the provision of means responsive to the level of loose material in a vertical or substantially vertical pipe or conduit which are maintained inoperative by the material itself when the quantity in the pipe is at or above a predetermined level but which function to actuate a visual or other suitable signal when the said material falls below that level and are returned to inoperative condition upon restoration thereof.

Other objects, purposes and advantages of the invention will hereafter appear or be understood from the follow-

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ing description of a preferred embodiment of it as somewhat diagrammatically illustrated in the accompanying drawing showing partly in elevation and partly in vertical axial section a portion of a raw coal pipe with the said

embodiment of the invention incorporated therein.

Referring now more particularly to the drawing the pipe P may represent any substantially vertical conduit for material such as coal to be fed by gravity downwardly therethrough, and in accordance with the invention at a convenient point in the wall of the pipe there is provided an aperture 1 at a height such that between it and the lower end of the pipe there will be a reservoir of considerable capacity. The edge of the pipe wall defining the lower edge of the aperture is preferably beveled oppositely inward to form a knife-edge 3 for supporting an inverted substantially V-shaped actuating lever 4 for oscillatory movement relatively to the pipe, a felt or other resilient seal 5 occupying the space between the lever and the upper edge of the aperture to assist in keeping the latter relatively impermeable to the escape of coal dust or air although permitting limited movement of the lever; within the pipe above aperture 1 a fixed angularly projecting baffle or shield 6 tends to exclude the solid material in the pipe from contact with seal 5. On the outer surface of the pipe is secured a housing 7 enclosing the outer arm of the lever, a compression spring 8 interposed between said outer arm and the housing wall urging the lever counterclockwise in the drawing and a self-closing switch 10 adapted to be held open by the lever arm when the latter is swung outward against the bias of spring 8. Leads 11, 12 connect switch 10 in circuit with a source of current (not shown) and a lamp 13 or other indicating or alarm device which may be located at any convenient point at which an alarm signal readily may be received by the operative responsible for restoring normal coal feed following interruption thereof. In the side of housing 7 there is threaded a test screw 15 which may be operated when desired to move the outer arm of the lever inward and thus allow switch 10 to close to test the operability of the system.

When normal feed conditions obtain lever 4 is held by the pressure of the coal or other material in the pipe and against the spring bias in such position as to maintain the switch and hence the circuit through lamp 13 open, the lever offering no appreciable obstruction to the passage of the coal vertically downward through the pipe, and these conditions persist so long as the latter remains filled at least to the level of the lever whether or not the coal is actually feeding through the pipe.

Upon the formation of an arch in the hopper over the inlet to the pipe or occurrence of some other condition preventing passage of coal thereinto the level of the coal in the pipe gradually falls due to withdrawal from its lower end and as this level recedes below lever 4 spring 8 actuates the latter in a counterclockwise direction in the drawing, thereby allowing switch 10 to close and thus energize the alarm circuit to afford visual or audible indication of interruption of feed and inform operatives that suitable measures must be taken to correct the situation before substantial exhaustion of the residual material in the pipe below the lever and ensuing admission of high pressure air to the pipe. Of course as soon as the arch is broken or other feed interrupting condition remedied additional coal passes into the pipe until it is again substantially filled and as the coal level rises above lever 4 the latter is again swung outward to the position, as shown, which it occupies under normal conditions, with consequent interruption of the alarm circuit and cessation of the alarm.

As has been mentioned, lever 4 and associated mechanism should be located far enough above the bottom of the pipe so the alarm will be given while there is still

sufficient residual coal in the pipe to maintain the feed to the pulverizing apparatus for a time adequate to permit the breaking of the arch in the hopper or, in lieu thereof, the shutting off of the blower before substantially all the coal is withdrawn; the minimum distance above the bottom of the pipe at which the lever is disposed will therefore usually primarily be determined by the rate of feed from the pipe.

It now will be apparent that my invention solves in a simple and efficient way an annoying, troublesome and even dangerous problem in the operation of coal feeding and other installations of the character described and further that the apparatus utilized is of non-complicated design and is not liable to get out of order or become damaged under the conditions of use to which it is necessarily subjected, while it may be readily installed in either existing installations or in new ones at a relatively low cost.

I have herein described one embodiment of the invention with considerable particularity as applied to an installation of specific character but it will be understood I do not desire or intend thereby to limit or confine myself in any way as changes and modifications in the form, structure, arrangement and mode of operation of the several parts will readily occur to those skilled in the art and may be made if desired without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, I claim and desire to protect by Letters Patent of the United States:

1. In apparatus affording a signal when the height of a column of loose material falls below a predetermined level, a pipe enclosing the material and having an aperture in its wall defined in part by a substantially horizontal knife edge, an inverted generally V-shaped lever supported on said edge for oscillation relatively to the pipe, the inner arm of the lever extending into and the outer arm extending exteriorly of the pipe, a resilient seal interposed between the lever and the upper edge of the aperture, an electric switch adapted for actuation by the outer arm of the lever, and a spring biasing said outer arm toward the pipe whereby when the level of the material in the pipe is above said inner arm and its pressure thereagainst exceeds the bias of the spring said outer arm is held in switch actuating position.

2. In apparatus affording a signal when the height of a column of loose material falls below a predetermined level, a pipe enclosing the material and having an aperture in its wall defined in part by a substantially horizontal knife edge, an inverted generally V-shaped lever supported on said edge for oscillation relatively to the pipe, the inner arm of the lever extending into and the outer arm extending exteriorly of the pipe, an electric switch adapted for actuation by the outer arm of the lever, and a spring biasing said outer arm toward the pipe whereby when the level of the material in the pipe is above said inner arm and its pressure thereagainst exceeds the bias of the spring said outer arm is held in switch actuating position.

3. In apparatus affording a signal when the height of a column of loose material falls below a predetermined level, a pipe enclosing the material and having an aperture in its wall defined in part by a substantially horizontal knife edge, an inverted generally V-shaped lever supported on said edge for oscillation relatively to the pipe, the inner arm of the lever extending into and the outer arm extending exteriorly of the pipe, a spring biasing said outer arm toward the pipe, said inner arm being adapted for limited movement toward said wall against the bias of the spring when engaged by said material, and a switch cooperative with the outer arm of the lever to make and break an electric circuit upon oscillation of said lever.

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