Nov. 22, 1966 R. W. SPIEGEL 3,286,508

SIGNAL APPARATUS

Filed Feb. 21, 1964 2 Sheets-Sheet 1

Fig. 2

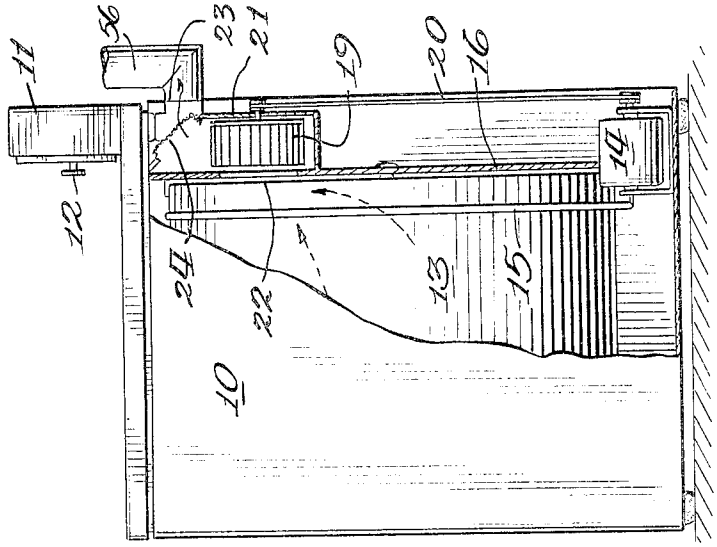


Fig. 1

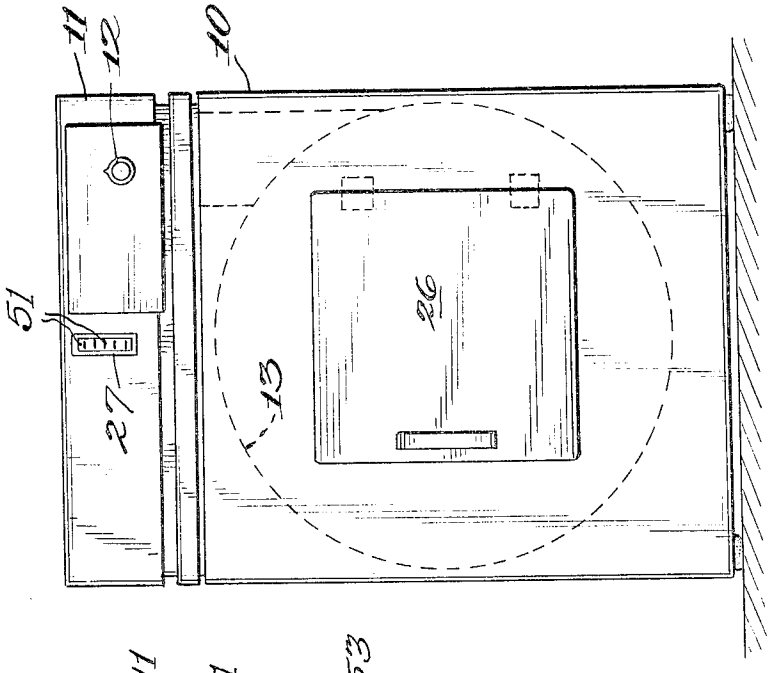
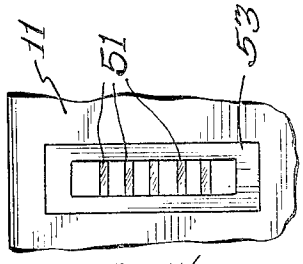


Fig. 5



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Fig. 3

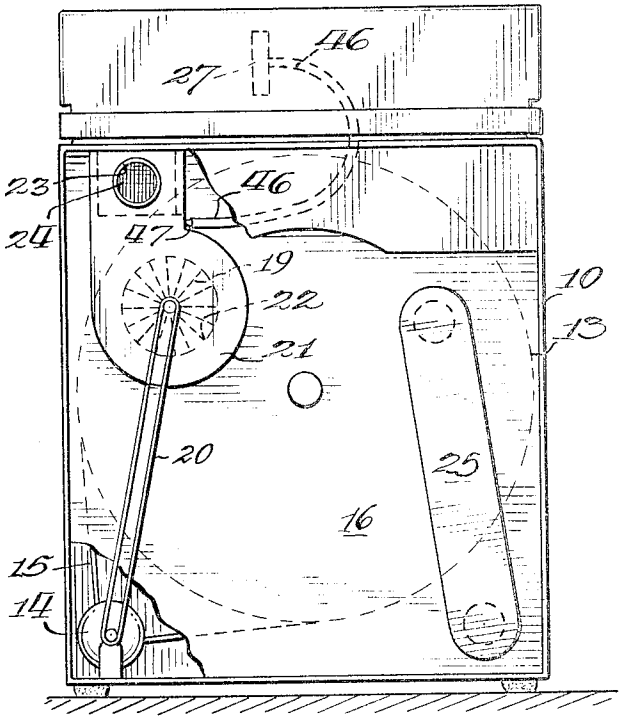


Fig. 6

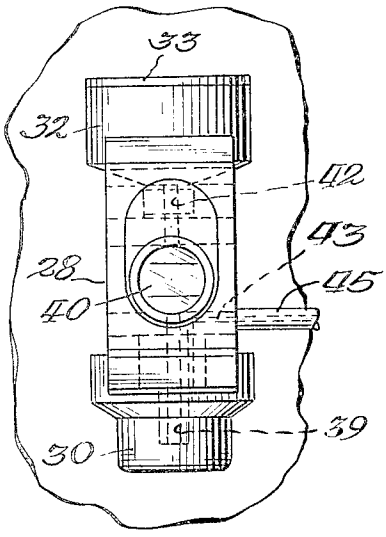
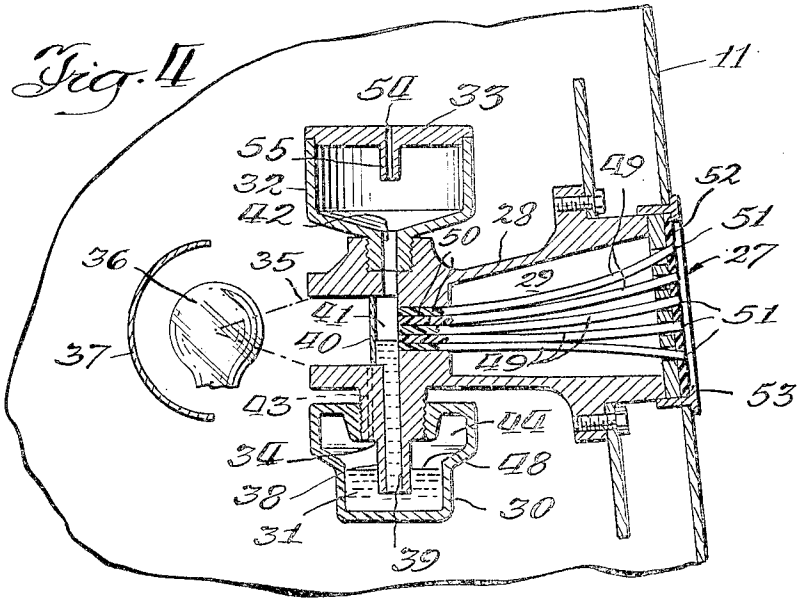


Fig. 4



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SIGNAL APPARATUS

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Filed Feb. 21, 1964, Ser. No. 346,485
9 Claims. (Cl. 73—38)

This invention relates to a signal apparatus, particularly suited for use in a laundry dryer, for signaling changes in fluid pressure.

In many types of equipment it is important to indicate promptly and accurately changes in fluid pressure. An excellent example of such equipment is found in laundry dryers and the like in which drying fluid such as heated air is circulated through the dryer with the drying fluid picking up solid particles such as lint and the like. The drying fluid is then expelled from the dryer through a filter for removing the solid particles including lint and then through a duct means to the exterior. Variations in static pressure upstream from the filter or lint screen caused by solids collecting on the filter will indicate when a dangerous condition has been reached in that insufficient drying fluid or air is flowing through the dryer. The apparatus of this invention provides excellent means for indicating variations in pressure within the equipment.

One of the features of this invention is to provide an improved signal apparatus comprising a light source, means for transmitting light from this source in a plurality of paths observable simultaneously, variable pressure means and means operated by variations in this pressure means for altering the light transmission in these paths successively as a function of pressure variations of the variable pressure means.

Other features and advantages of the invention will be apparent from the following description of one embodiment thereof taken in conjunction with the accompanying drawings. Of the drawings:

FIGURE 1 is a front elevational view of a laundry dryer embodying the invention.

FIGURE 2 is a side elevational view of the dryer with portions broken away.

FIGURE 3 is a rear elevational view of the dryer with the exhaust duct removed and with portions broken away for clarity of illustration.

FIGURE 4 is an enlarged sectional, elevational view showing a detail of a portion of the indicating apparatus of the invention.

FIGURE 5 is a fragmentary elevational view taken from the right-hand side of FIGURE 4.

FIGURE 6 is a fragmentary elevational view taken from the right-hand side of FIGURE 4 but omitting the light conducting strips and the cover plate.

In the embodiment shown in the accompanying drawings the laundry comprises a cabinet 10 of the usual construction having a rear control panel 11 on which is mounted a control knob 12 also of conventional construction. The dryer contains a rotatable drying cylinder or drum 13 which is adapted to be rotated during the drying operation by the usual motor drive 14 and belt 15.

As shown in FIGURE 2, the rear of the cabinet 10 is provided with a vertical bulkhead 16 in front of which the drum 13 is rotated when driven by the belt 15 from the motor 14. At the top of the bulkhead 16 is a rotary blower 19 that is powered from the motor 14 by means of a belt 20. This blower is contained in a chamber 21 so that the inlet of the blower communicates through an opening 22 with the drum 13. The blower exhausts through a rear opening 23 in the cabinet 10 to the atmosphere. Thus the blower chamber 21

forms part of a conduit means for drying fluid and fluid borne solids. In order to entrap solids carried in the drying air stream there is provided a fluid permeable lint filter in the form of a conventional screen 24 in front of the opening 23.

In order to heat the air so as to promote drying, there is provided a conventional heater box and air inlet duct 25.

The dryer as described is conventional and operates in the conventional manner and includes the usual access door 26 to provide access to the rotatable drum 13.

When the screen 24 becomes clogged with entrapped solids so as to interfere with air flow through the drum 13 and thus the drying of the clothes, it is of course necessary that the screen be removed in conventional manner for cleaning. The apparatus of this invention gives a visual indication when such cleaning is necessary. It indicates the relative amount of filter entrapped solids between a solid free state and an undesirably clogged state.

The visible portion of the indicating apparatus 27 is mounted on the front panel 11. As shown most clearly in FIGURES 4, 5 and 6, this apparatus comprises a housing 28 provided with a front chamber 29 and a lower rear storage part or tank 30 adapted to contain a liquid 31.

The tank 30 is on the bottom of the housing 28 and immediately thereabove a receiver part or tank 32 provided with a cover 33. Connecting the two tanks is a conduit 34.

The rear of the apparatus 27 is provided with an opening 35 opposite which is located a visible light source, here shown as an electric light 36 backed up by a reflector 37. The opening 35 defines a light beam of finite transverse dimensions as shown by the broken lines in FIG. 4.

The conduit 34 includes a part 38 of the housing 28 extending downwardly into the liquid 31 and having a vertical internal passage 39. Adjacent the top of the passage 39 and rearwardly thereof is a transparent disk 40 which is spaced from a forward part of the housing 28 to provide a passage portion 41 in front of the disk 40. The top of the housing 28 is provided with another passage portion 42 which communicates with the receiver 32. The passage 39 and the passage portions 41 and 42 are vertically aligned so as to constitute the conduit 34.

As shown in FIGURE 6 the housing 28 is provided with an opening 43 that extends inwardly and downwardly to communicate with the space 44 in the bottom storage tank 30 above the level of the liquid 31 therein. The housing 28 is provided with a stem 45 having an opening communicating with the opening 43.

Leading from the stem 45 is a tube 46 whose other end is connected to a stem 47 which communicates with the housing 21 on the downstream side of the blower 22 but upstream of screen 24, as shown in FIGURE 3. With this arrangement which comprises flow responsive means directly responsive to resistance to fluid flow through filter 24, increasing solids on the filter or screen 24, as it causes increasing air pressure in the housing 21 and the vicinity of the stem 47, will cause increasing air pressure on the surface 48 of the liquid 31 so that the liquid will rise in the passage 39 as indicated in FIGURE 4. The chamber 29 of the housing 28 contains a plurality, here shown as five, of strips 49 of light transmitting material such as Lucite constituting light transmitting means. These strips or members are vertically stacked with their rear ends 50 in contact as shown and their front end 51 spaced apart and exposed through an opening 52 in a cover plate 53.

The liquid **31** is distinctively colored and one such liquid is water colored red. This means that when the liquid has been raised to a level between at least the lowermost light transmitting strip **49** and the transparent disk **40** the light source **36** will project red light through at least this lowermost strip so that it is visible from the front of the control panel **11**. The liquid thereby constitutes light intercepting means progressively movable from exteriorly of the light beam defined by opening **35** to intercept the beam in its transverse dimension and change its appearance.

With this arrangement, as more and more solids are entrapped on the filter **24** the fluid pressure within the space **44** above the liquid **31** becomes increasingly greater. This serves to raise the liquid level in the passage sections **39**, **41** and **42** progressively to above the inner end **50** of first the lowermost strip **49**, then the next, then the next and finally the topmost strip. With this increasing liquid level the strips **49** show red light at the front ends **51**. Thus the strips are arranged to transmit the light beam jointly and to be intercepted in series upon the moving of the intercepting means or liquid to indicate the relative extent of flow resistance through the filter screen **24**. As soon as the observer notes that the topmost strip **49** is colored (or any designated intermediate strip) this will be an indication that the filter **24** should be removed in the customary manner and cleaned. The rear ends **50** of the strips **49** serve to divide the light beam into a plurality of adjacent subbeams also of finite transverse dimensions.

Receiver **32** provides a space for the liquid **31** to be projected into when the air pressure reaches a maximum. The interior of this receiver **32** is vented to the atmosphere through a vent **54** in the cover **33** with the interior part of this vent being defined by an inwardly extending projection **55**. This projection extends a considerable distance inwardly of the cover **33** and provides a safety device so that if in transit the entire housing is reversed so that liquid within the passage flows into the receiver there can be no spillage out through the vent **54**. As can be seen from FIGURE 4, even if the housing **28** is completely inverted only the liquid within the passages **39**, **41** and **42** can spill into the receiver **32**. The maximum depth in the inverted receiver on the cover **33** would be when these passages **39**, **41** and **42** were completely full. The projection **55** is so dimensioned that even under these maximum conditions it would still project upwardly above the level of this maximum amount when the housing **28** was turned completely over or 180° from its position shown in FIGURE 4.

Similarly, the stem **38** containing the passage **39** is so dimensioned that it always extends beneath the liquid level **48** up to at least the time when the upper passage **42** is completely filled with liquid.

By arranging the inner ends **50** of the light transmitting strips **49** against each other and spreading the outer ends **51**, as shown in FIGURE 4, the apparent degree of upward movement of liquid in the passage portion **41** is magnified for ease in observation.

In a specific embodiment of the invention the Lucite strips **49** were one-sixteenth inch thick and the liquid **31** had a specific gravity of 1. In this embodiment of increments pressure increase of about .002 p.s.i. were necessary to cover the inner end of each strip **49** beginning with the lowermost strip and ending with the topmost strip. As this change took place with increasing pressure the strips were changed from white to red to show increasing solids deposition on the filter screen.

As can be seen from the above description of the illustrated embodiment of the invention, the variable pressure indicating apparatus of this invention indicates static pressure in the system between the blower **19** and the screen **24**. As the screen collects lint and other solid matter this static pressure increases. The increasing static pressure causes increasing pressure on the liquid surface **48** (FIGURE 4) to raise the liquid column into the space **41**. Because of the difference in area of the surface **48** and the column in space **41** very small movements of the surface **48** will cause relatively large vertical movements of the fluid column in the passage **39**. Thus the apparatus of this invention is very responsive to changes in fluid pressure and extremely accurate.

It is known that in this type of equipment, such as the laundry dryer illustrated, the air flow must be at not less than a certain minimum rate for proper operation as otherwise the dryer will be damaged. Resistance to this air flow and thus pressure variations are caused not only by the screen **24** but is also caused by internal duct work as well as the external exhaust duct illustrated at **56** in FIGURE 2. This pressure indicating apparatus as described and claimed herein therefore has the additional advantage of being easily adjustable to compensate for these flow losses. Thus after installation of the pressure indicating equipment and testing for proper functioning, the liquid level when there is no obstruction to flow through the screen **24** can be easily regulated by screwing the storage tank **30** up or down on the threaded conduit **34**. This adjusts the position of the tank **30** with relation to the column and thus permits regulating the level of the fluid column in the passage **39** to below the lowermost light transmitting strip **49**. Then, any increase in pressure resulting in raising the liquid column and successively controlling the light in the transmitting strips **49** from the lowermost to the topmost strip is caused primarily solely by increasing static fluid pressure between the blower **19** and the screen **24**.

Having described my invention as related to the embodiment shown in the accompanying drawings, it is my intention that the invention be not limited by any of the details of description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

1. Signal apparatus, comprising: a light source; means for transmitting light from said source in a beam of finite transverse dimensions; means for providing a place of visual observation of said beam; transparent colored means progressively movable from exteriorly of said beam to intercept said beam in said transverse dimensions and thus color the beam progressively for said visual observation at said place; variable pressure means; and means operated by said variable pressure means for thusly moving said colored means progressively with increasing pressure in said variable pressure means, the relative extent of said movement of said colored means and thus of said pressure thereby being indicated by the extent of coloring of said beam in said transverse dimensions.

2. The apparatus of claim **1** wherein said light transmitting means comprises a plurality of separate, adjacent light transmitting means arranged side by side for transmitting said beam simultaneously, said transmitting means thereby being colored in series upon said moving of said colored means.

3. In a laundry dryer having conduit means for conveying drying fluid and fluid borne solids and a fluid permeable filter for entrapping said solids, apparatus for indicating the relative amount of filter entrapped solids between a solid free and an undesirably clogged state, comprising: flow responsive means directly responsive to the resistance to flow of fluid through said filter due to the presence entrapped solids; a visible light source; means for transmitting light from said source in a beam of finite transverse dimensions; light intercepting means progressively movable from exteriorly of said beam to intercept said beam in said transverse dimensions and change its appearance; and means operated by said flow responsive means for moving said light intercepting means progressively with increasing resistance to said flow, the relative

extent of said movement and thus of said flow resistance being indicated by the extent of the intercepting of said beam in said transverse dimensions.

4. The apparatus of claim 3 wherein said light transmitting means comprises a plurality of separate, laterally adjacent light transmitting members arranged to transmit said beam simultaneously and to be intercepted in series upon said moving of said intercepting means to indicate said relative extent of flow resistance.

5. The apparatus of claim 3 wherein said light intercepting means comprises a colored liquid.

6. In a laundry dryer having conduit means including means for conveying drying fluid and fluid borne solids, and a fluid permeable filter for entrapping said solids, apparatus for indicating the relative amount of filter entrapped solids between a solid free and an undesirably clogged state, comprising: means directly responsive to the resistance to flow of fluid through said filter due to the presence of said entrapped solids for exerting a pressure that is directly proportional to said relative amount of entrapped solids; a visible light source; means for transmitting light from said source in a beam of finite transverse dimensions; means for dividing said beam into a plurality of adjacent sub-beams also of finite transverse dimensions; a body of transparent colored liquid; a container for said liquid; and means for utilizing said pressure exerting means to move said liquid from said container to intercept and color said sub-beams in series with increasing amounts of filter entrapped solids.

7. The apparatus of claim 6 wherein said container comprises a storage part for said liquid, a receiver part to receive the moved liquid, and a transparent conveying part between said storage and receiver parts, said conveying part being aligned with said sub-beam means for intercepting light therein.

8. The apparatus of claim 9 wherein said storage part is threadably mounted on said indicating apparatus for said vertical position adjusting.

9. In a laundry dryer having conduit means including means for conveying drying fluid and fluid borne solids, and a fluid permeable filter for entrapping said solids, apparatus for indicating the relative amount of filter entrapped solids between a solid free and an undesirably clogged state, comprising: means directly responsive to the resistance to flow of fluid through said filter due to the presence of said entrapped solids for exerting a pressure that is directly proportional to said relative amount of entrapped solids; a visible light source; means for transmitting light from said source in a beam of finite transverse dimensions; means for dividing said beam into a plurality of adjacent sub-beams also of finite transverse dimensions; a body of transparent colored liquid; a container for said liquid comprising a storage part for said liquid, a receiver part to receive the moved liquid, and a transparent conveying part between said storage and receiver parts, said conveying part being aligned with said sub-beam means for intercepting light therein, the liquid in said container being at a predetermined level; means for adjusting said level by adjusting the level of said storage part; and means for utilizing said pressure exerting means to move said liquid from said container to intercept and color said sub-beams in series with increasing amounts of filter entrapped solids.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,286,508 November 22, 1966

Raymond W. Spiegel

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 68, after "presence" insert -- of said --.

Signed and sealed this 12th day of September 1967.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents