

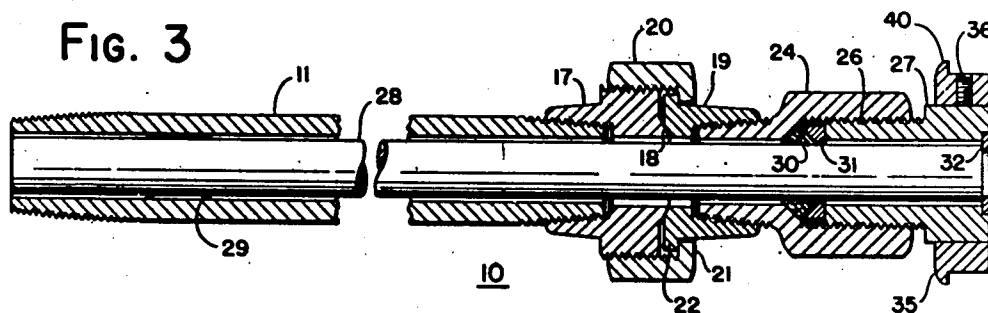
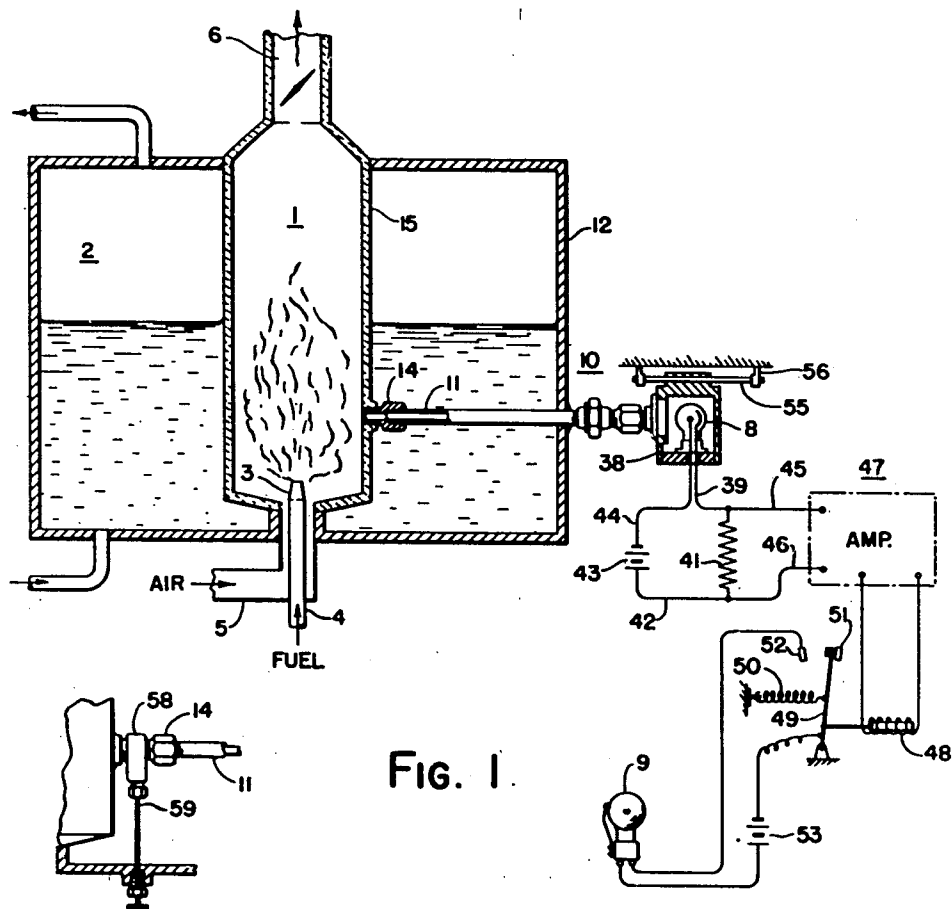
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FLUID-TIGHT LIGHT TRANSMITTING APPARATUS

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FLUID-TIGHT LIGHT TRANSMITTING
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This invention relates to light sensitive systems and more particularly to apparatus for transmitting light from a pressure chamber to a light sensitive device spaced a substantial distance from the chamber.

In order to avoid furnace explosions, a light sensitive device, such as a phototube, is sometimes directed on the flame within the furnace and is connected in a circuit to control the operation of an alarm. As long as ignition is maintained in the furnace, light from the flame reacts on the phototube, causing it to have a low electrical resistance and thereby maintain a flow of current through a relay controlling an alarm circuit. In case of flame failure, light to the phototube is immediately reduced and the resistance of the phototube increases sharply. The flow of current is then reduced so that the relay operates to close or open contacts for giving an alarm. In some cases, the light sensitive device may be directed on a heated object or material within a furnace and be connected in a circuit for controlling the operation of the furnace so as to maintain the temperature of the object or material at a desired value.

Regardless of the type of control circuit employed, it is necessary that the changes in the intensity of the light acting on the phototube be sufficiently great so that the change in current flow through the control circuit will provide the desired operation. It may be impossible in some cases to locate the phototube close enough to the source of light so that the light passing to it will affect its resistance appreciably. It may also be impossible to expose the phototube directly to the light from the source because of pressure differences that must be maintained between them. If the pressure at the light source is very high compared to that at the phototube, and the distance between the source and the phototube is comparatively great, then means must be provided for picking up light rays from the source and concentrating them on the phototube, and the means must be adapted for engagement by sealing means to prevent the escape of pressure. At the same time, the light transmitting or concentrating means must be arranged for removal so that it may be cleaned, when necessary.

An object of my invention is to provide an improved apparatus for transmitting light from a source to a light sensitive device. Another object is to provide improved means for transmitting light between points at different pressures and yet preventing the escape of pressure

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from one point to another. Still another object is to provide improved apparatus for transmitting light from a sealed chamber under high pressure to a light sensitive device located at a substantial distance from the chamber. Yet another object is to provide improved means adapted to be sealed within an opening to a pressure chamber for transmitting light to a light sensitive device, and yet being removable for cleaning when necessary. Other objects will appear in the course of the following description.

In the accompanying drawing there is shown for purposes of illustration, one form which my invention may assume in practice.

15 In this drawing:

Fig. 1 is a schematic diagram showing my invention arranged for transmitting light from a heated chamber to a phototube connected in an alarm control circuit.

20 Fig. 2 is an enlarged sectional view of my improved light transmitting means.

Fig. 3 shows valve means for controlling communication between the heated chamber and the light transmitting means.

25 In Fig. 1 there is shown a chamber 1 arranged concentrically within a chamber 2 and having a burner 3 to which fuel is supplied at high pressure from a conduit 4. Air or gases supporting combustion at the burner is supplied at high pressure from a suitable source, not shown, through a conduit 5 to the lower end of the chamber 1. The products of combustion are discharged through passage means 6 which are adapted to maintain relatively high pressure within the chamber 1. The chamber 2 may contain a cooling liquid, as shown, or it may contain a gaseous fluid at a pressure which is different from that at its exterior or that in the chamber 1. This arrangement is shown because it requires that light from the burner flame be transmitted a considerable distance to a light sensitive device, such as a phototube 8, located at the exterior of the chamber 2 for controlling an alarm 9 in response to changes in the intensity of the light. It also requires that the light transmitting means be sealed against the escape of pressure from the chamber 1 to the chamber 2 and to the atmosphere at the exterior of the chamber 2, and that means be provided for holding it in place against the action of the pressure in chamber 1. It will be appreciated that there may be other arrangements which require means for transmitting light considerable distances without passing through a chamber between the source and the light sensitive device, and in which the pressure at the light

source may be higher, lower, or the same as the pressures at different points along the transmitting means.

As shown in Fig. 1, my improved light transmitting means, generally designated 10, includes a tubular member 11 extending through an opening in the outer wall 12 of the chamber 2 and threaded at its inner end into a coupling 14 secured within an opening in the wall 15 of the chamber 1. The tubular member may be welded within the opening in the wall 12, if desired, to prevent the escape of fluid from the chamber 2 to the atmosphere. Threaded on the outer end of the tubular member, as shown in Fig. 2, is an annular member 17 having a projecting end portion 18 adapted to be received in a recess formed in the end of a coupling member 19. A collar 20 is threaded on the member 17 and has an inwardly projecting flange portion 21 engageable with a flange portion 22 on the member 19 for moving the members 17 and 19 into fluid tight engagement with each other. A coupling member 24 has threaded connection with the member 19 and is provided with an opening threadedly receiving a reduced portion 26 of a member 27. Extending through the tubular member 11 and the members 17, 19, 24 and 27 is a rod 28 made of a transparent material, such as quartz, for transmitting light from a point close to the chamber 1 to a point at the outer end of the member 27. A spring 29 is arranged between the tubular member and the rod for yieldingly supporting the latter in place. Arranged within the member 24 is a packing ring 30, and an annular member 31 engages the outer face of the packing ring and is adapted to be forced by the reduced portion 26 of the member 27 against the packing for effecting a sealing engagement by the latter with the rod 28 and with the member 24. Formed in the end of the member 27 is a recess adapted to receive an annular member 32 engageable by the rod 28 for preventing longitudinal movement of the latter by pressure acting on its inner end. The member 32 may be held in the recess by welding or by any suitable means attached to the member 27. If desired, the member 27 may be provided with an integral portion to take the place of the member 32. Surrounding the member 27 is an annular member 35 held in place as by a screw 36, and the member 35 is adapted to be received within the open end of a chamber forming member 38, as shown in Fig. 1.

The phototube 8 is arranged within the chamber forming member in such a position that the outer end of the rod 28 is located close to it when the member 35 is moved into the chamber until a flange 40 on its periphery engages the face of the member 38 and forms a light tight seal. The light sensitive elements of the phototube are connected in a series circuit including a conductor 39, a resistance 41, a conductor 42, a source of D.-C. power 43, and a conductor 44. The voltage drop across the resistance is applied by conductors 45 and 46 to an amplifier 47, and the output of the amplifier is connected to a relay winding 48 which operates when sufficiently energized to move a contactor 49 against the action of a spring 50 into engagement with a contact 51. When the current through the relay winding is reduced to a point where it can no longer hold the contactor against the spring action, the contactor is moved into engagement with a contact 52 which is connected in a circuit including the alarm 9, a source of power 53, such as a battery, and the contactor 49.

When the intensity of the light in the chamber 1 is high, the resistance of the phototube is low by reason of the light transmitted to it through the rod 28, and the current flow through the resistance 41 produces a voltage drop therein which causes the amplifier to energize the relay winding 48 for holding the contactor in its open position. A failure of the flame within the chamber 1 results in a sharp increase in the resistance of the phototube and a reduction of the voltage drop in the resistance 41 to a point where the amplifier no longer energizes the relay winding for holding the contactor 49 open. The circuit through the alarm is then completed to warn the attendant that attention is needed.

It is desirable that the chamber member 38 be moved away from the outer end of the rod 28 at times so that the operator may either look through the rod or remove it for cleaning its inner end. The member 38 is therefore slideably and pivotally supported on a member 55 carried at its ends by stationary supports 56. When the chamber device is moved clear of the member 35 it may be swung about the member 55 to a position out of line with the light transmitting means 10. To remove the rod 28 for cleaning, the collar 20 is unscrewed from the member 17 so that the rod with the members 24 and 26 still holding the packing clamped thereon, may be removed from the tubular member 11. When the inner end of the rod has been cleaned, it may be reinserted in the tubular member, and the collar 20 screwed on the member 17 until the members 17 and 19 again sealingly engage each other. If it is necessary that the rod be removed for cleaning while the burner 3 is still operating, or when different pressures exist in the chambers 1 and 2, a gate valve 58 may be arranged in the coupling 14, as shown in Fig. 3, and a valve stem 59 may be extended from the valve through the chamber 2 and the wall of the latter to a point where it may be operated manually for opening and closing the valve.

In certain installations it may be that temperature, rather than pressure, is the principal reason for necessarily locating the phototube 8 at some distance from the source of light. For instance, the wall 15 might be the enclosing or shielding wall of a billet heating furnace or of an open hearth furnace and of material thickness. In such cases it is essential that the smallest opening be made through the wall for sighting on the heated metal and, due to the thickness of the wall and the heat within the furnace, it is not possible for the phototube 8 to be located nearer than some considerable distance from the object to be sighted.

While there is described in this application one form which my invention may assume in practice, it will be understood that it may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. Fluid-tight light transmitting apparatus between a light source and a remote point including, in combination, a tubular member connected fluid-tight by one end to the light source, a transparent rod extending through said tubular member and projecting from its other end, spring structure radially disposed about the rod in the annular space formed with the tubular member, a coupling arranged about the projecting end of the rod in fluid-tight engagement with the tubu-

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lar member, and a packing in fluid-tight engagement with the rod by reason of compression by a portion of the coupling.

2. Light transmitting apparatus between a source and a sensitive device including, in combination, a tubular member connected fluid-tight by one end to the light source, a quartz rod extending through the tubular member and projecting from its other end, coupling members surrounding the projecting portion of said rod and holding a packing in fluid-tight engagement therewith, means for connecting one of the coupling members in fluid-tight communication with the tubular member, an abutment structure carried by one of the coupling members engaging the outer end extremity of the rod for preventing its movement against the light sensitive device beyond that end, and a chamber for the light sensitive device receiving the outer end of the coupling members in a close sliding fit for ready disengagement.

3. Apparatus for transmitting light from a pressure chamber to a point spaced through a fluid medium including, in combination, a tubular member extending through the fluid, a manually adjustable valve means secured fluid-tight between a tubular member inner end and the pressure chamber, a transparent rod extending

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through the tubular member and projecting from the outer end thereof, coupling members connected in fluid-tight communication with the outer end of the tubular member, and inwardly projecting retaining means carried by one of the coupling members for preventing outward longitudinal movement of the rod.

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