July 24, 1956 A. L. PITTINGER 2,756,281

EXPLOSION PROOF ACOUSTIC DEVICE

Original Filed May 3, 1949 2 Sheets-Sheet 1

FIG. 1

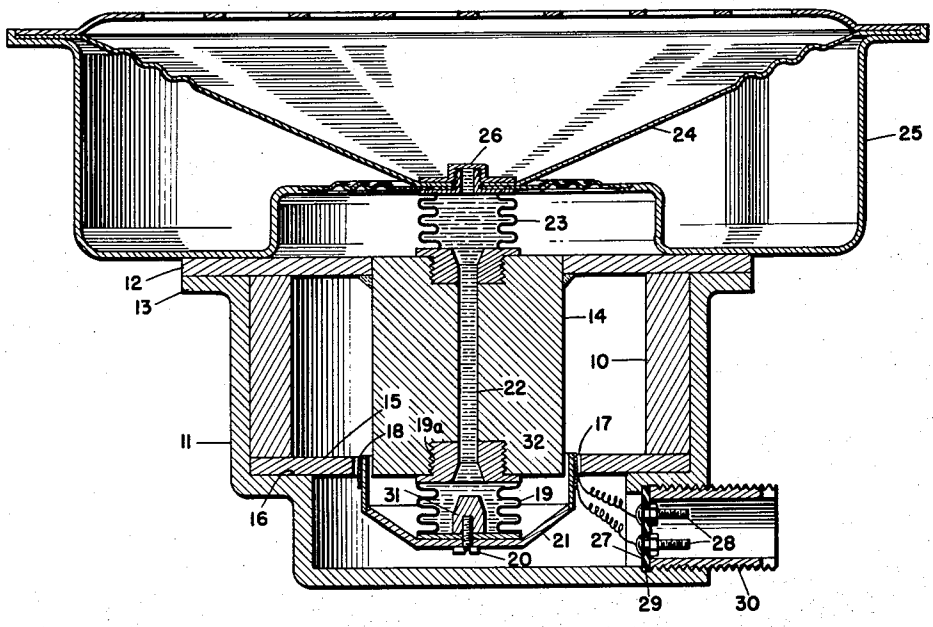
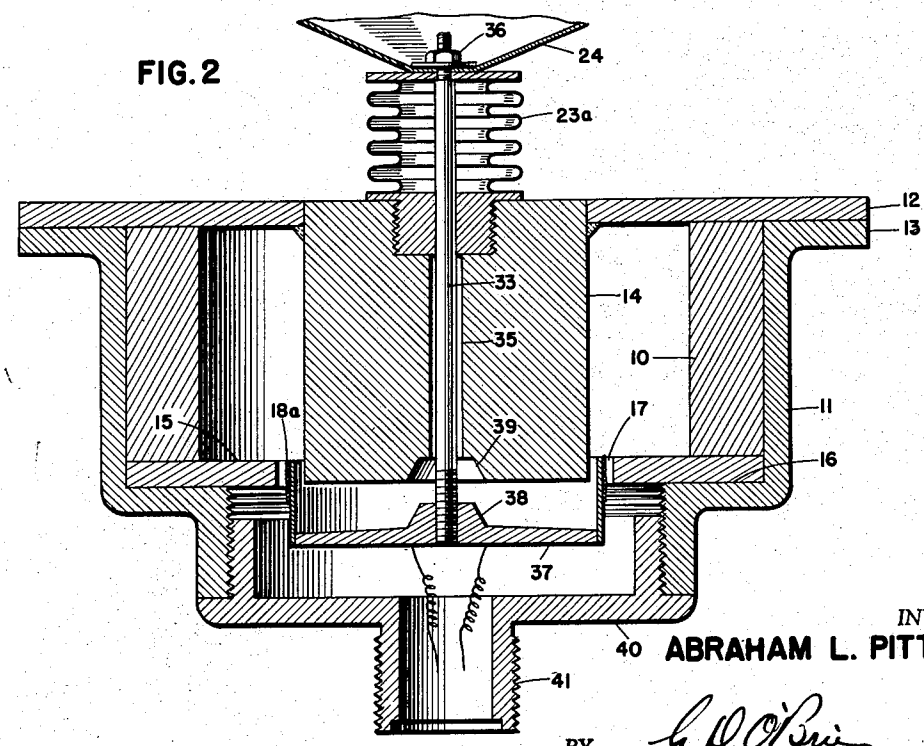


FIG. 2



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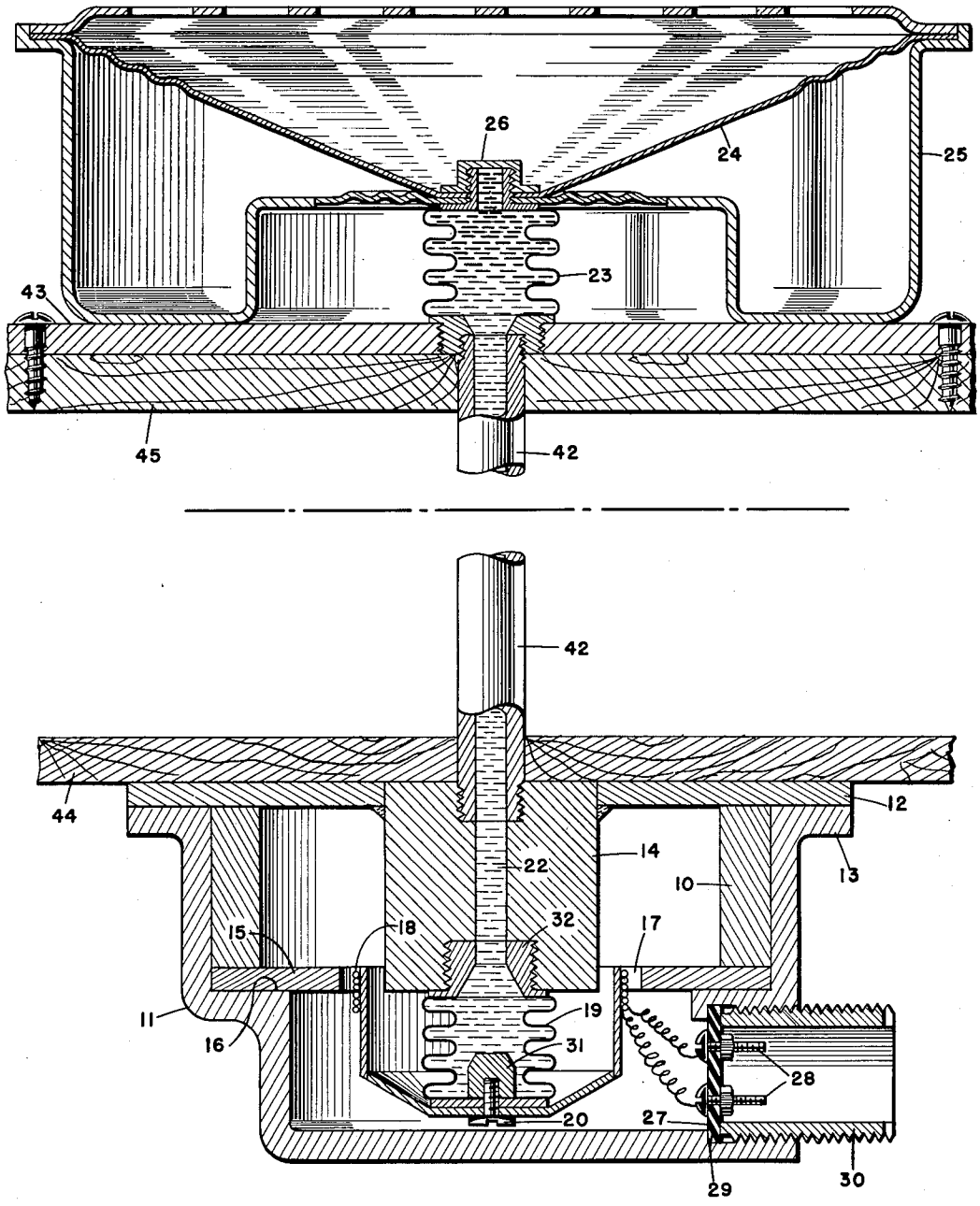


FIG. 3

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EXPLOSION PROOF ACOUSTIC DEVICE

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Original application May 3, 1949, Serial No. 91,207, now Patent No. 2,655,566, dated October 13, 1953. Divided and this application April 21, 1953, Serial No. 350,648

2 Claims. (Cl. 179—115.5)

(Granted under Title 35, U. S. Code (1952), sec. 266)

This invention relates to transducers and more particularly to a new and improved construction thereof. The present invention has particular application to sealed transducers of the explosion proof type for use in hazardous areas. This application is a division of copending application Serial No. 91,207, filed May 3, 1949, now Patent Number 2,655,566.

In the design of apparatus for use in mines, powder magazines and similar installations where the atmosphere may be laden with dangerous gases, dust, vapors or liquids it is important that all electrical elements be shielded so that in the event there is any sparking in the electrical system, the resulting flame will be confined within the electrical instrument and cannot spread to the surrounding atmosphere. The problem of making such installations explosion proof without interfering with the efficiency or operation of such equipment is, of course, an extremely important consideration.

With the advent of public address systems in factories, warehouses, etc., a particular problem has arisen in connection with the design of loudspeakers for such systems especially where the devices are to be used in industries where the aforementioned hazardous conditions are present.

The conventional phenolic diaphragm speakers do not meet the rigid safety requirements for such installations. This is true even through the electrical eelments may be mounted in a closed speaker housing with the peripheral edge of the speaker cone in sealed engagement with the housing to provide an airtight construction. Since the diaphragm must of necessity be of relatively light material, on the order of 3 to 5 thousandths of an inch in thickness, there is always danger that the diaphragm may crack and thus admit gases into the area surrounding the electrical elements. If this should occur any sparks developing in the electrical elements could spread the flame to the surrounding atmosphere and set off an explosion.

The present invention may be used with particular advantage in overcoming the dangers and defects inherent in the conventional loudspeakers for such use and may be installed with complete safety regardless of the fact that the surrounding atmosphere may be laden with gases or substances of an explosive nature.

It is an object of the present invention to provide a sealed transducer.

A second object is to provide a novel linkage between the acoustical and electrical elements of a transducer.

Still another object of the present invention is to combine a sealed construction with a novel linkage adapted to operate through such sealing arrangement.

An additional object is the provision of an explosion proof transducer which may be used with safety under harbardous conditions.

A further object is the provision of means for automatically sealing off a portion of the transducer at the instant an explosion occurs.

These and other objects and attendant advantages will

be readily apparent from the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is an axial sectional view illustrating one embodiment of the present invention;

Fig. 2 is a fragmentary view similar to Fig. 1 illustrating a modified form of the present invention; and

Fig. 3 is a view similar to Figs. 1 and 2 and showing a modification permitting the operating parts to be spaced apart a substantial distance.

Referring now to the drawings wherein like reference characters refer to identical parts the present invention is disclosed in connection with its application to the permanent magnet type of loudspeakers. In the embodiment shown in Figs. 1 and 2 the permanent magnet may comprise cylinder **10** of "Alnico" or other suitable material positioned in the cavity of a nonferrous cup-shaped housing **11** with a soft iron disc **12** contacting the upper end of the cylinder **10** and extending over the open end of the housing **11** to provide a closure therefor. This disc **12** may be suitably secured in sealed relation to a flanged face **13** on housing **11** to prevent the entrance of dirt, gases or moisture into the housing cavity. A soft iron core **14** may be affixed to disc **12** as by welding or other well known means so that the core depends downwardly into the housing cavity and is positioned centrally of the "Alnico" cylinder bore. A second soft iron disc **15** resting on an annular ledge **16** in the lower portion fo the housing and in contact with the lower end of the "Alnico" cylinder has a central aperture to provide a magnetic flux gap **17** adjacent the lower end of core **14** thereby completing the magnetic field.

Referring now especially to Fig. 1 it will be noted that a voice coil **18** is mounted on a flexible bellows **19** with the coil positioned in the flux gap. The bellows may be a "Sylphon" bellows or a flexible diaphragm of the aneroid type and, in the embodiment illustrated, one end of the bellows is secured to the lower end of core **14** as by threaded bushing **19***a* and its other end is secured by screw **20** or other suitable means to voice coil carrying cup **21**. An axial bore **22** extending longitudinally through core **14** connects the hollow interior of the aforementioned bellows with a similar flexible bellows **23** affixed to the upper end of the iron core member. A speaker cone **24** supported at its rim by speaker casing **25** may be attached at its center to the upper bellows unit **23** by a flanged nut **26** as illustrated. As can be seen the hollow interior of the upper and lower flexible bellows members and the bore provide a closed chamber between the voice coil and the speaker cone. This chamber may be filled with a fluid such as a hydraulic oil or a gas and sealed. This fluid then provides the connecting linkage between voice coil **18** and speaker cone **24**. Thus, as the electrical impulses energize the voice coil and impart movement thereto, the fluid in the chamber will transmit the movement to the speaker cone where it is translated into sound waves.

The eelctrical wires connecting the voice coil in circuit with the source of electrical energy may enter the housing through an explosion proof conduit connection including a circular disc **27** of insulating material having a pair of binding posts **28** extending therethrough so that the desired connections can be made to the posts on each side of the disc. This disc may be clamped between an internal ledge **29** in the threaded opening of the housing and the end of a threaded conduit coupling **30** thus providing a seal at the conduit connection.

As illustrated a valve plunger **31** may be mounted so as to project upwardly within the interior of the lower bellows **19**. This valve plunger is in alignment with a valve seat **32** formed in the threaded bushing **19***a*. It will be seen that a fire, spark or explosion occurring within the housing **11** is prevented from escaping through

bore 22 to the outside of the speaker since any pressure developed in the housing from such a cause would tend to compress the bellows and close the valve.

The construction shown in Fig. 2 is similar to that shown in Fig. 1, however, in this instance the voice coil 18 and the speaker cone 24 are linked by a rigid shaft 33 axially movable in bore 35 and extending at each end beyond the core 14.

The upper portion of shaft 33 projects through a flexible bellows 23*a* affixed to the upper end of the soft iron core and is threaded to receive a nut 36 for securing the apex of the speaker cone to the shaft for movement therewith.

A disc shaped coil support 37 threaded onto the lower end of shaft 33 supports voice coil 18*a* in magnetic flux gap 17.

Threaded into the lower end of housing 11 is a substantially cup-shaped closure 40 having a threaded extension 41 adapted to receive a suitable explosion proof conduit coupling (not shown) through which may pass the voice coil leadin wires.

In the embodiment shown in Fig. 2 the safety valve comprises a valve face portion 38 formed integral with disc 37 and movable upwardly to cooperate with the valve seat 39 formed in the lower end of iron core 14.

Thus, should an explosion occur within the housing cavity the resulting flame could not escape to the outside atmosphere for the pressure on the undersurface of support 37 would tend to move valve face 38 into sealing engagement with valve seat 39 closing bore 35.

In some installations it may be desirable to locate the electrical unit of the transducer at a distance from the hazardous atmosphere, as behind a wall of the room where the hazardous conditions are present, or in a room adjacent thereto. Such an arrangement is shown in Fig. 3, where, it will be noted, the sealed housing 11 containing the electrical elements is secured to the outer face of a wall partition 44 and the speaker cone assembly is secured to the outer face of such opposite wall partition 45. The arrangement is similar to the embodiment illustrated in Fig. 1 but includes a fluid conduit 42 of the required length extending through the wall or partition and around corners if necessary to connect the voice coil bellows 19 and the speaker bellows 23.

As shown such a construction may include an auxiliary plate 43 affixed to the wall 41 as by threaded screws to provide a suitable mounting base for the speaker cone housing 25 and flexible bellows 23 as shown.

If housing 11 is located a distance from the speaker cone unit, conduit 42 may consist of two sections of tubing one of the sections being threaded into soft iron core 14 and the other section threadedly connected to flexible bellows 23. The sections may be joined by a suitable coupling (not shown) and a bleed valve may be inserted in the fluid line if desired.

It will be apparent from the foregoing description that the present invention may be used with particular advantage not only in hazardous areas but also wherever the atmospheric conditions are such that dust, dirt or moisture might enter the area surrounding the electrical elements and thus interfere with the efficient operation of the transducer.

Although the embodiment which has been illustrated and described herein relates to the application of the invention to transducers of the permanent magnet type, it is to be understood that it is not intended to limit the invention to that particular type of transducer. For it will be apparent to those skilled in the art that the invention broadly includes a novel linkage arrangement for connecting acoustical and electrical elements and for sealing such constructions.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that numerous modifications or alterations may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

1. In a transducer containing a voice coil, a speaker diaphragm and a magnetic core therebetween, said core having a bore therethrough, a shaft extending through said bore to connect said coil and said diaphragm, a valve face portion carried by said shaft on the coil side of said transducer, and said magnetic core having a valve seat formed therein around the bore on the coil side thereof for cooperation with said valve face portion to seal said bore.

2. In a transducer containing a voice coil, a speaker diaphragm and a magnetic core therebetween, said core having a bore therethrough, a shaft extending through said bore to connect said coil and said diaphragm, a valve face portion carried by said shaft on the coil side of said transducer, a valve seat formed around the bore on the coil side of said magnetic core for cooperation with said valve face portion to seal said bore, and a disc-shaped coil support intgeral with said valve face portion and threadedly engaged to said shaft.

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