July 10, 1951 G. W. HOPKINS 2,559,820

KEYBOARD SEALING MEANS

Filed Oct. 16, 1948

2 Sheets-Sheet 1

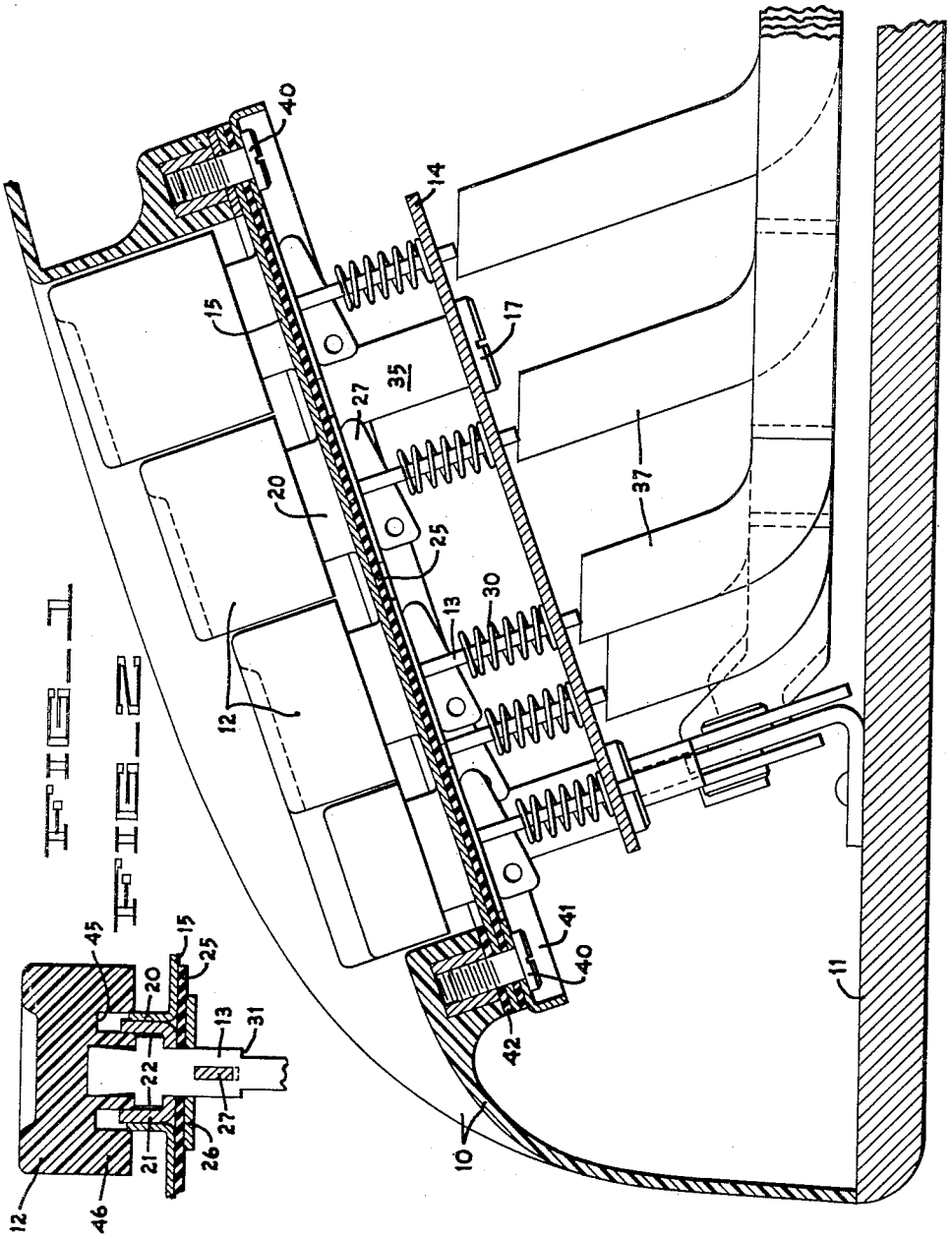

FIG. 1

FIG. 2

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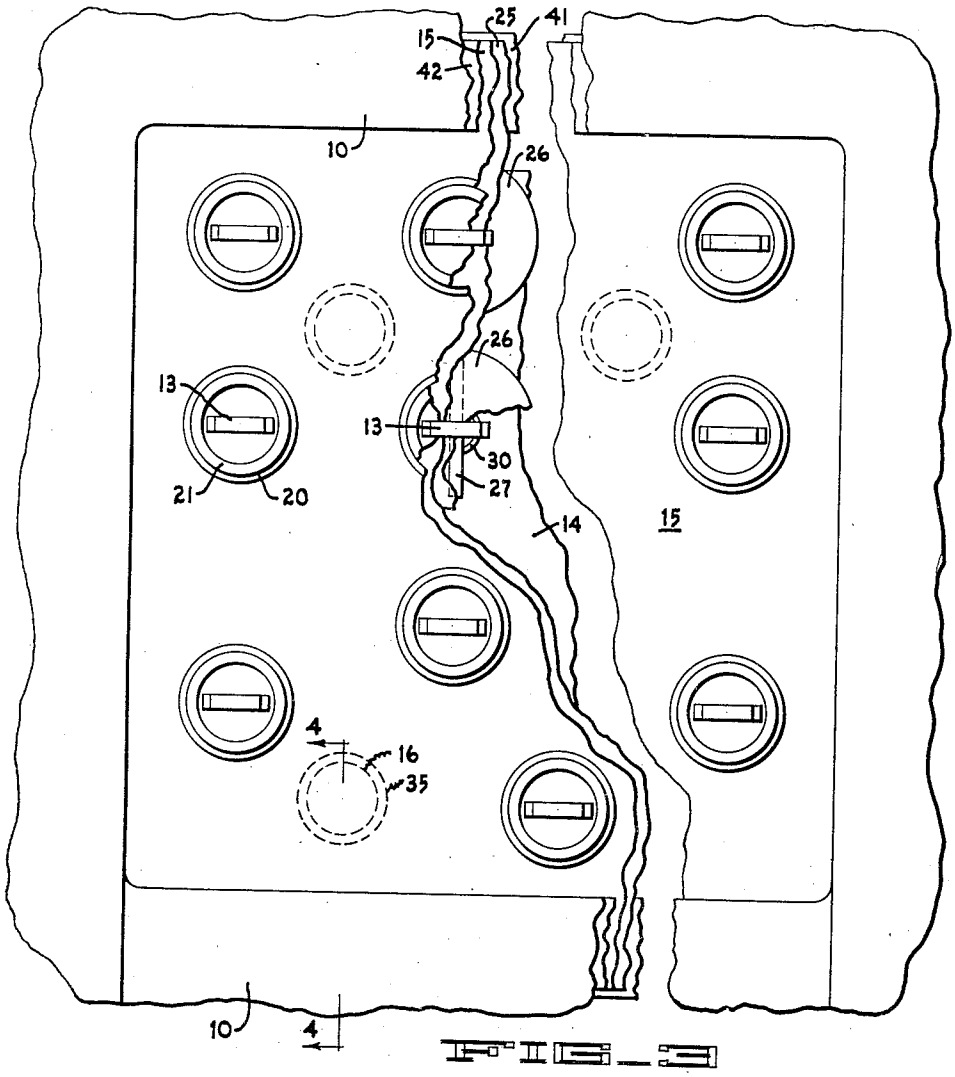
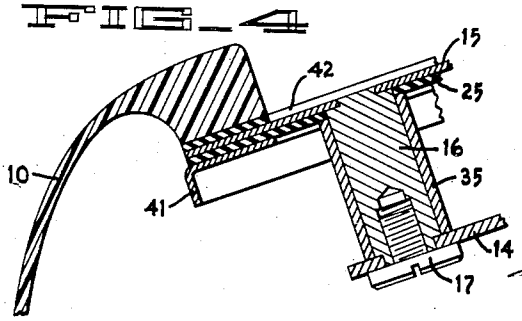


FIG. 3

FIG. 4



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UNITED STATES PATENT OFFICE

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KEYBOARD SEALING MEANS

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4 Claims. (Cl. 235—145)

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This invention relates to a means for providing a substantially air-tight seal around the manipulative elements of a keyboard. More particularly, the invention is concerned with a means for tightly sealing the individual keystems of a group of keys against the passage of gases, liquids, dust, etc.

It is often desirable and sometimes absolutely necessary to protect the delicate mechanisms of certain types of apparatus from the harmful effects of corrosive vapors and gases as well as from water, water vapor and fine particles of dust and dirt. Also, when the mechanism is to be used in places where explosive gases are present and the apparatus is of the type incorporating electric motors and switches which may generate sparks, it is necessary to completely enclose the apparatus within a tightly sealed housing so as to eliminate the danger of an explosion.

It is sometimes quite difficult to seal the mechanism in an air-tight housing and this is particularly true where the mechanism is of the type which must be externally controlled by means of manually settable control members. It was with this problem in mind that the novel means for sealing a group of manually depressible keys, hereinafter to be shown and described, was originated.

Accordingly, it is an object of the present invention to provide a gas-proof and moisture-proof seal for a group of manipulative elements.

Another object of the invention is to provide a novel sealing means for a group of manipulative elements wherein a single sheet of resilient sealing material is utilized to prevent the passage of gas, vapor, dust or other foreign matter past the manipulative elements.

A further object of the invention is to provide a gas and moisture-proof seal for a keyboard in which a resilient diaphragm of gas-proof and moisture-proof material is used to seal off the upper ends of the keystems from the lower ends thereof and additional means is provided for preventing oil or other deleterious material from reaching the sealing gasket and causing deterioration thereof.

Still a further object of the invention is to provide a gas-proof and moisture-proof keyboard in which the individual keys pass through perforations provided in a single sheet of resilient material, the edges of the perforations being firmly pressed against the sides of the keystems by means of a suitable clamping device so as to provide a tight seal around the keystems.

Another object of the invention is to provide a

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sealed type of keyboard in which the individual keystems are guided for sliding movement in a plate provided with a plurality of projecting sleeves which are adapted to receive a mating guide element provided on each of the key stems.

Still another object of the invention is to provide a seal for a keyboard comprising a plate provided with a plurality of upwardly extending guide sleeves for slidably receiving piston-like elements on the keystems and an annular counterbore in the underside of the key caps for receiving the guide sleeves when the keys are depressed.

Other objects and advantages will become apparent from the following description of a preferred embodiment of the invention as illustrated in the accompanying drawings wherein:

Fig. 1 is a longitudinal sectional elevation of a keyboard incorporating the novel means for sealing the same against the entry of gas vapors, moisture, dust and other types of foreign matter.

Fig. 2 is a cross-sectional view taken through one of the keys for the purpose of showing the detailed construction of the key and the seal therefor.

Fig. 3 is a plan view of the keyboard with certain parts broken away so as to more clearly illustrate the construction of the sealing means.

Fig. 4 is a cross-sectional view taken along the line 4—4 in Fig. 3 for the purpose of showing the manner in which the keyboard seal is maintained around the studs which support the bottom plate of the keyboard.

As shown in Fig. 1, the invention is shown applied to a keyboard which is mounted in an opening provided in a housing or casing 10 which is supported on a base 11. The housing 10 and base 11 serve to completely envelop a mechanism (not shown) which is adapted to be controlled by the keys thereby protecting the mechanism from the harmful effects of moisture, dust, etc. The space within the housing 10 and base 11 is also effectively sealed against the entry of explosive gases so as to prevent the possibility of an explosion due to sparking of the motor brushes or electrical contacts used in conjunction with the mechanism contained within the housing. As shown in the drawings, the keyboard consists of a plurality of keycaps 12 secured to the upper ends of keystems 13 which are guided for substantially vertical sliding movement in the keyboard framework. For this purpose the lower end of each keystem is slidable within a suitable aperture provided in a bottom plate 14 of the keyboard, this plate being supported from a top

plate 15 by means of four spacing studs 16 (see Figs. 3 and 4). At its upper end, each of the studs 16 is riveted to the top plate 15 and at its lower end is provided with a tapped hole for receiving the threaded portion of a suitable fastening screw 17. As shown in Fig. 4, the four screws 17 serve to support the bottom plate 14 and hold it in spaced relationship with respect to the top plate 15.

As shown particularly in Figs. 2 and 3, the top plate 15 is provided with a plurality of struck-up sleeves 20, there being one such sleeve for each of the keys 12. These sleeves serve to guide the upper ends of the keystems and also to provide a barrier against the entry of moisture and dirt past the top plate 15. Each of the keystems 13 has mounted thereon a cup-shaped guide element 21 which is apertured to receive the keystem 13. As shown in Fig. 2, each keystem is provided with a pair of laterally projecting lugs 22, the lower edges of which engage with the bottom of the guide element 21 and thereby serve to locate the element on the keystem.

Disposed immediately below the top plate 15 is a sealing gasket 25 formed of a resilient gas-proof and moisture-proof material such as natural rubber, synthetic rubber or any one of the well-known resinous compounds possessing suitable characteristics for this purpose. The gasket 25 is provided with perforations for accommodating each of the keystems 13, the perforations being made slightly smaller than the stems 13 so as to insure a tight fit between the gasket and each of the keystems. Located on each of the keystems immediately below the gasket 25 is a clamping washer 26 which may be held in place by means of a tapered drive key 27 receivable within a rectangular shaped opening provided in each of the keystems 13.

In assembling the keyboard, the cup-shaped element 21 is first slid onto the stem of the key from the bottom thereof so as to assume the position shown in Fig. 2 after which the lower end of the keystem is passed through one of the perforations provided in the gasket 25, and the guide element 21 is slid into one of the sleeves 20 as shown in the figure. The washer 26 is then slid onto the keystems after which the drive key 27 is inserted in the opening provided therefor in the keystem. The drive key is next driven home so as to squeeze the gasket material between the washer and the bottom of the element 21 thereby securing the element 21 to the keystem 13 and effecting an air-tight seal around the stem of the key. As previously pointed out, the perforation in the gasket material 25 is made somewhat smaller than the keystem. Hence, when the washer 26 is forced up toward the element 21 by the drive key, the gasket material will be squeezed in tightly against the stem of the key so as to create a perfect seal at this point.

Each of the keys is normally maintained in its raised position by means of a compression spring 30 which is slid onto the keystem during the assembling operation and is compressed between a shoulder 31 provided on each key stem and the bottom plate 14. The key will thus be elevated by the spring until it is stopped by the engagement of the clamping washer 26 and gasket 25 with the underside of the top plate 15.

The sealing gasket 25 is also provided with four perforations for receiving the four supporting studs 16. These perforations are preferably made somewhat smaller than the studs 16 so as to cause a tight fit between the gasket and the studs. In order to maintain the seal at this point, a sleeve 35 (Fig. 4) is slipped over each of the studs 16, the sleeves being of such a length as to cause the upper end of the sleeves to be pressed firmly against the gasket material when the screws 17 are turned up tight. Thus, the material of the sealing gasket will be pressed tightly into engagement with the top plate 15 so as to afford a tight seal at this point.

As shown in Fig. 1, the lower ends of the keystems 13 are arranged to engage with the upturned ends of a series of levers 37 which serve to control the operating mechanism of the machine housed within the casing 10.

The keyboard is supported within the housing 10 by means of suitable fastening screws 40 which serve to hold a flanged supporting frame 41 in contact with the periphery or rim of the sealing gasket 25 and also serve to draw the top plate 15 of the keyboard tightly up against a sealing gasket 42 which extends around the outside edge of the keyboard. It will thus be seen that the gasket 42 will prevent any gases or moisture from getting inside the housing at the point where the top plate 15 and the housing 10 are joined together.

Referring to Fig. 2 of the drawings, it will be noted that the keycap 12 is provided with an annular counterbore 45 which is of sufficient width to receive the sleeve 20 and the element 21 and is cut to a sufficient depth so as to enable the key to be fully depressed without any interference between the keycap 12 and the sleeve 20. The keycap 12 is thus, in effect, provided with a skirt 46 which extends down around the sleeve 20 and serves as a shield for preventing dirt and moisture from gaining access to the upper surface of the gasket 25 by way of the sliding joint between the guide element 21 and the sleeve 20. The struck-up sleeves 20 also prevent liquids such as oil, water, etc., accidentally spilled on the keyboard, from reaching the gasket 25 and thereby causing deterioration of the same.

It will be noted from the foregoing description that a double seal is effected by the present invention, that is, the sealed diaphragm 25 is protected by the sleeve 20 and counterbore 45 from damage due to the presence of oil or other similar substances which might cause deterioration of the same and also the keyboard is provided with gas-tight seal by means of the gasket 25. Thus, the mechanism contained within the housing 10 will be effectively protected from moisture, vapor, dust, etc., and at the same time the machine will be rendered explosionproof due to the inability of explosive gases to penetrate the seal provided by the gasket 25 and the gasket 42.

I claim:

1. A gas-proof and moisture-proof seal for a reciprocable member comprising a substantially flat sheet of resilient gas-proof and moisture-proof material apertured to receive said member and through which said member projects, a guide plate disposed in parallel relation to said sheet, an outwardly projecting sleeve on said guide plate, a guide element on said member slidable within said sleeve, said element having a sealing surface disposed parallel to and on one side of said sheet, and means clamped against the opposite side of said sheet for pressing said one side of said sheet firmly into contact with said sealing surface so as to provide a gas and moisture-tight seal.

2. A gas-proof and moisture-proof seal for a keyboard comprising a plurality of depressible

keys; a plate having suitable openings for receiving and guiding the upper ends of said keys; and a gas and moisture-proof barrier for said keyboard including a substantially flat sheet of resilient gas-proof and moisture-proof material located beneath said plate and in parallel relation thereto, said sheet being apertured to receive the stem of each of the keys, the stems projecting through the apertures, means on the stem of each key having a sealing face disposed parallel to said sheet and lying immediately above the sheet, and means on the stem of each key for positively pressing said sheet firmly into contact with said sealing face whereby a gas and moisture-proof barrier is provided.

3. A gas-proof and moisture-proof seal for a keyboard comprising a plurality of keys, an upper guide plate having an upwardly projecting sleeve for each of the keys, a keycap on the upper end of each keystem, a skirt on each keycap extending down around said sleeve, a guide element on each keystem slidable within said sleeve, a sealing face on the lower end of each element, said face lying in a plane parallel to the surface of said plate, a substantially flat sheet of resilient gas-proof and moisture-proof material located beneath said plate and in parallel relation thereto, said sheet being apertured to receive the stems of said keys, the stems projecting through the apertures, and means for positively pressing and maintaining that portion of the sheet immediately surrounding the stem of each of the keys into tight contact with the sealing face provided on the guide element so as to provide a gas

and moisture-tight seal around each of the keystems.

4. A moisture and dust-proof keyboard comprising one or more depressible keys, a guide plate having a corresponding number of openings therein for receiving the stem of each of the keys, an upstanding lip formed around the periphery of each opening so as to provide a tubular extension for guiding its related keystem, a cup-shaped guide element on each keystem slidable within the tubular extension for guiding the key in its up and down movements, means for securing each guide element to its associated keystem, a keycap mounted on the upper end of each keystem, and a counterbore in the bottom of each key cap receiving in concentric relation both the associated tubular extension and cup-shaped element, each of said counterbores being bounded on its outside by a skirt on the bottom of the associated keycap extending down around the associated tubular extension for preventing moisture, dust, and other foreign matter from getting beneath the keyboard.

GEORGE W. HOPKINS.

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