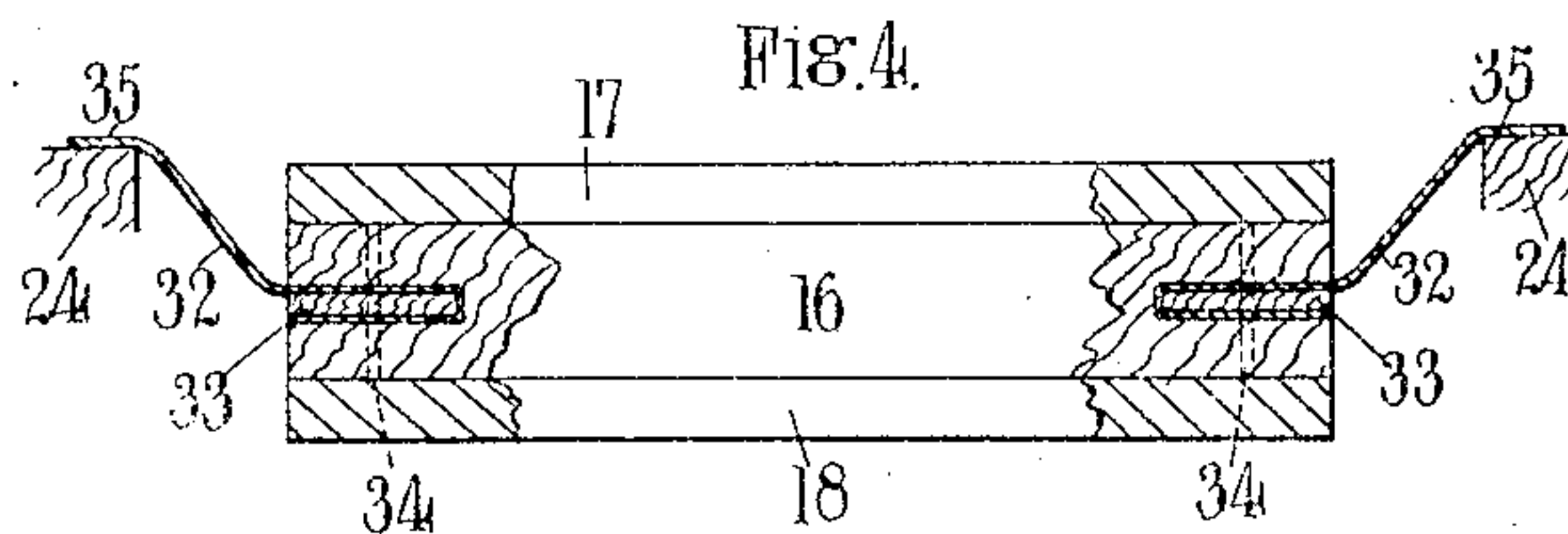
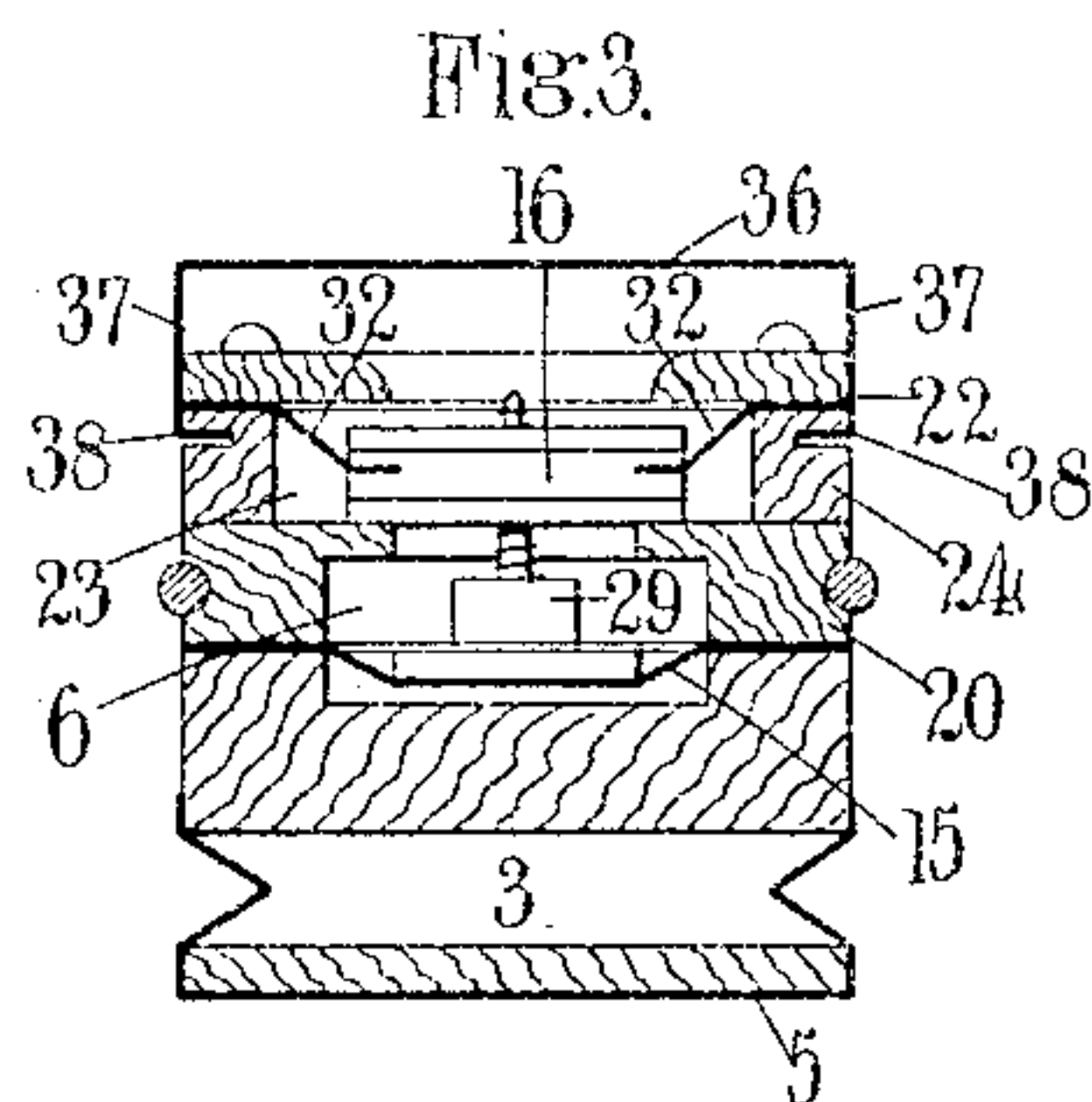
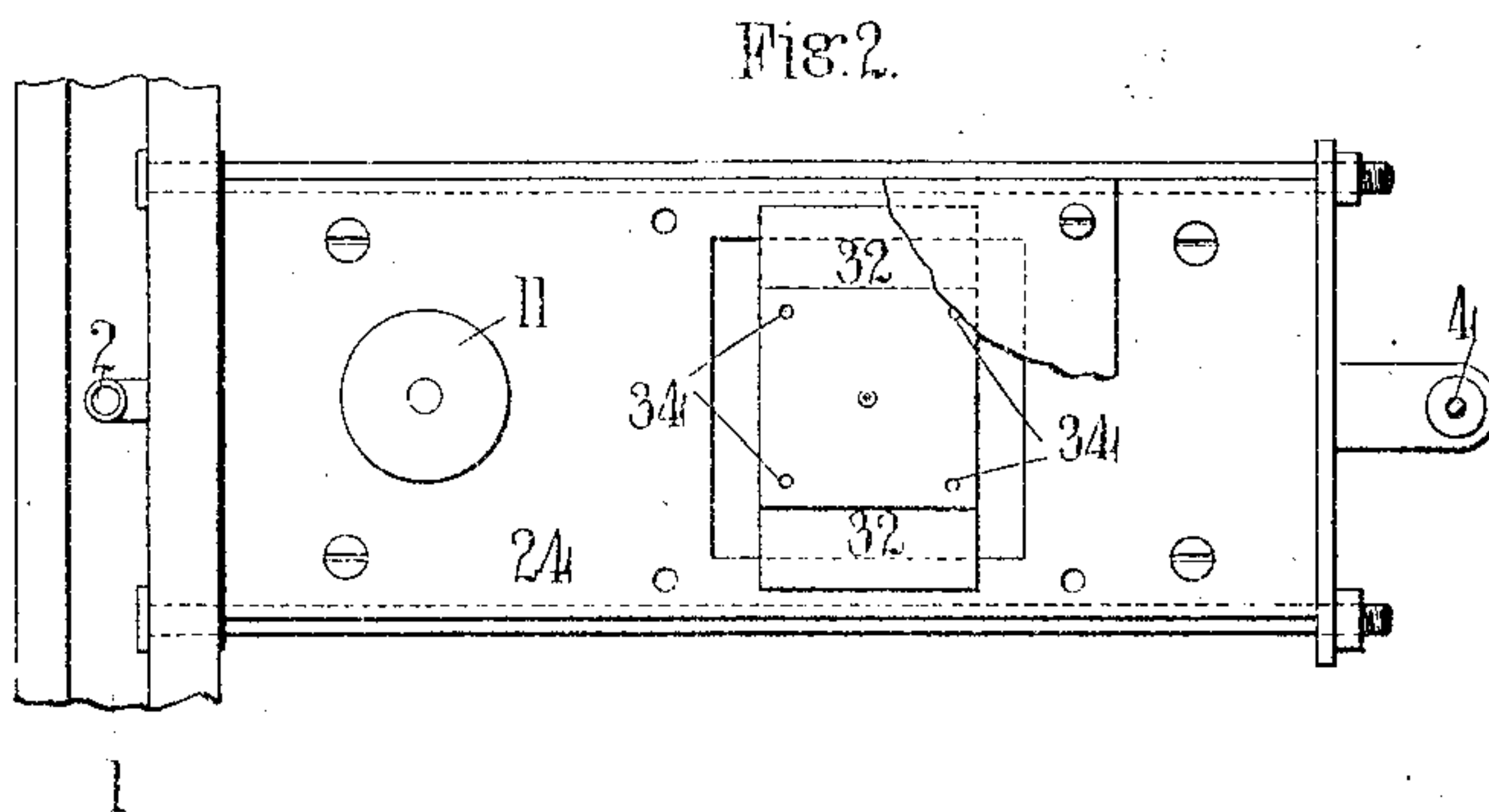
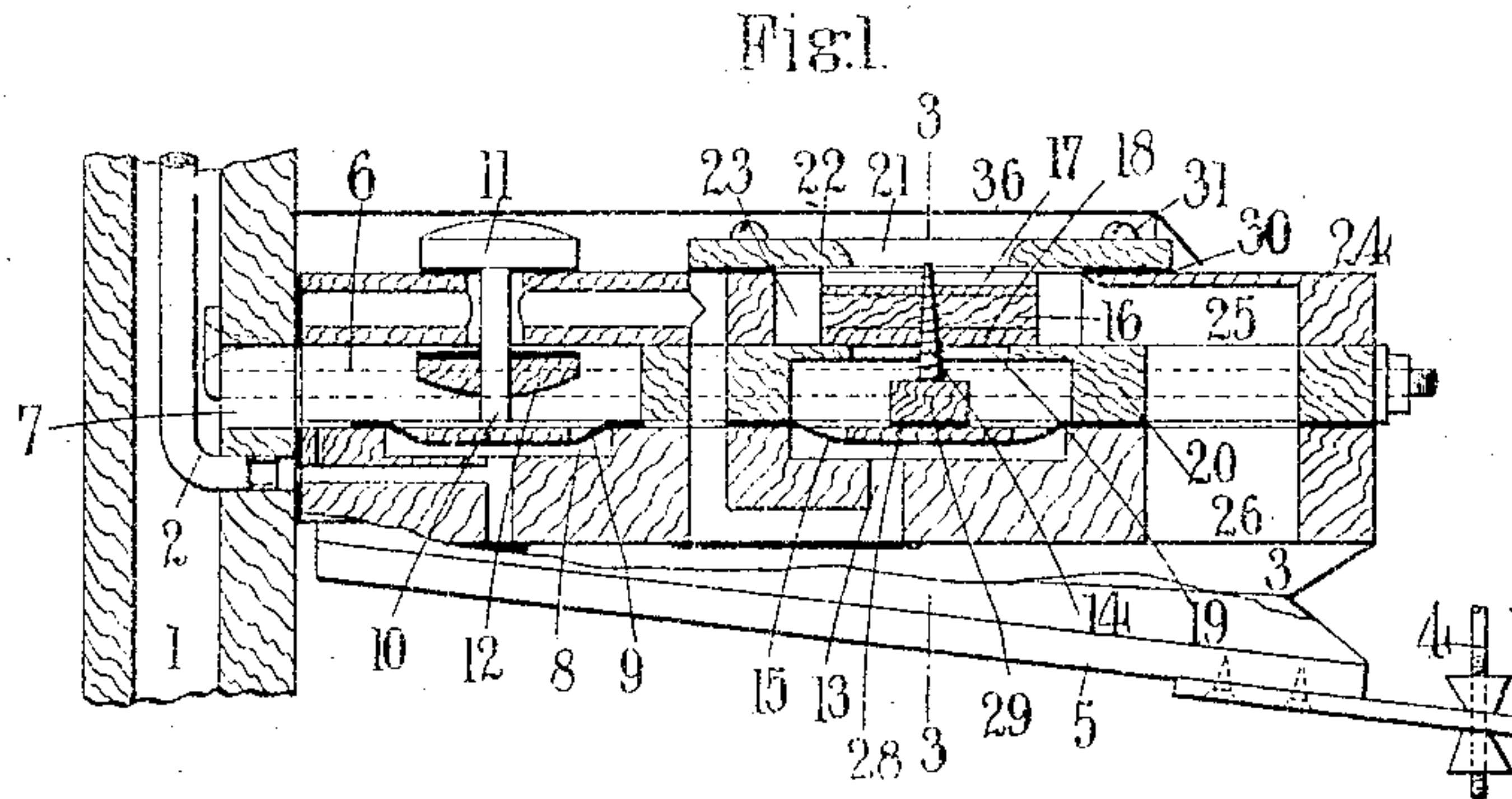


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PNEUMATIC RELAY FOR AUTOMATIC MUSICAL INSTRUMENTS.  
APPLICATION FILED APR. 26, 1909.

944,798.

Patented Dec. 28, 1909.



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# UNITED STATES PATENT OFFICE.

ARTHUR WALTER LONSDALE, OF BEDFORD, ENGLAND.

PNEUMATIC RELAY FOR AUTOMATIC MUSICAL INSTRUMENTS.

944,798.

Specification of Letters Patent. Patented Dec. 28, 1909.

Application filed April 26, 1909. Serial No. 492,175.

*To all whom it may concern:*

Be it known that I, ARTHUR WALTER LONSDALE, a subject of the King of Great Britain, and resident of 22 Woburn road, Bedford, in the county of Bedford, England, a member of the Burma Education Service, have invented certain new and useful Improvements in Pneumatic Relays Particularly Applicable for Use in Automatic Musical Instruments, of which the following is a specification.

This invention relates to improvements in the construction of pneumatic relays, more particularly such as are commonly employed in the "actions" of automatic piano-players and similar musical instruments or adjuncts thereto. As is well known such actions are devices for operating mechanical members whereby the corresponding note is caused to sound or any required impulse is produced, the working of the action being controlled by a pneumatic relay serving to establish or interrupt communication between (on the one hand) one of a series of collapsible elements corresponding to the individual notes or impulses and (on the other hand) a vacuum-chest wherein a substantially constant negative pressure is maintained; each collapsible element normally containing air at atmospheric pressure and being adapted, by the exhaustion consequent on its temporary connection with the common vacuum-chest, to transmit motion to the "prolonge" or equivalent member of the action appertaining to the corresponding note or impulse. The admission of air to, or its exhaustion from, the collapsible element is determined by means of primary and secondary valves both of which are double acting and whereof the latter (which has the larger movement and commands passages of greater area) serves to put the interior of the collapsible element into direct communication with the external atmosphere or with the vacuum-chest alternatively; the primary valve controlling such movement of the secondary valve and being itself controlled in turn by the tune-sheet passing over holes in a tracker board. Reliability and promptitude in action being essential in such apparatus, it is obviously of the utmost importance that the valves should be so constructed and mounted as to be enabled to seat themselves freely and with perfect accuracy in either of the two positions which each is capable of assuming; this requirement being more espe-

cially observable in the case of the secondary valve, inasmuch as this valve is of much larger area and frequently has a longer lift than the primary valve.

It is the object of the present invention to provide a construction and method of mounting especially adapted for application in connection with the secondary valve, whereby risk of defective action will be as far as possible entirely eliminated. To this end the valve is made rectangular, and is prevented from excessive lateral displacement (while being left completely free to seat itself fairly upon the surfaces with which it alternatively makes joint) by opposite lateral edges of the valve being attached to the adjacent sides of the valve chamber by means of a pair of loose flaps of very thin and flexible leather or equivalent material.

For the sake of clearness, the invention will be described with reference to a convenient construction of pneumatic relay as employed in connection with an automatic piano-player, the individual features, as well as the general operation of the apparatus as a whole, being well known with the exception of the construction and mounting of the secondary valve as above stated.

In the accompanying drawings, Figure 1 is a sectional side elevation of the apparatus. Fig. 2 is a top plan view, a portion being broken away. Fig. 3 is a cross section on line 3-3 of Fig. 1, and Fig. 4 is an enlarged view of part of Fig. 3.

Similar reference numerals denote corresponding parts throughout the drawings.

1 represents a portion of the vacuum-chest; 2 one of the small tubes which lead from the respective holes in the tracker-board; 3 the bellows which represent the collapsible element appertaining to the relay; and 4 the rod through which motion is transmitted from the flap-board 5 of the bellows to the prolonge or equivalent part of the mechanical "action" whereby the particular note or impulse is produced.

The pneumatic relay is comprised within the limits of a casing, preferably of rectangular shape as indicated with which the inner end of the vacuum chest makes an airtight joint. The main portion of the interior of the casing constitutes a vacuum-chamber 6 which is in direct and permanent communication with the interior of the vacuum-chest 1 through an aperture 7 in the wall of the



latter; the partial vacuum or negative pressure existing in the chest being consequently maintained uniformly in this chamber.

The primary variable-pressure chamber 8 is in permanent communication with the tracker-tube 2 which opens out through the face of the vacuum-chest 1. When a hole in the tune-sheet registers with the tracker-hole, atmospheric pressure is admitted to the chamber 8 through the tube 2 so that the diaphragm 9 being in consequence distended upward, the valve-stem 10 is raised to its highest position, the lifting and dropping of the primary valve-stem occurring every time a perforation and the succeeding blank portion of the tune-sheet respectively pass over the tracker-hole.

The primary valve is duplex and when in the normal position as shown, the disk 11 closes the upper end of the valve stem hole, while the disk 12 leaves the lower end of the same open and thus maintains communication between the vacuum chamber 6 and the secondary variable-pressure chamber 13. Under these circumstances the diaphragm 15 is in equilibrium as regards the pressures to which its opposite sides are exposed, and is therefore free to sag downward so as to permit the vertical stem 14 of the secondary valve to occupy (under gravity) its lowest position as indicated. When however, the primary valve-stem 10 is raised, the disk 12 closes the lower end of the valve-stem hole while the disk 11 leaves the upper end of the same open and thus admits atmospheric pressure to the chamber 13 so that the diaphragm 15 is distended upward, the valve-stem 14 is raised to its highest position; the lifting and dropping of this secondary valve-stem occurring every time the primary valve-stem 10 is similarly raised and lowered.

The secondary valve is double-acting and consists of a flat piece 16 of wood or equivalent light material whose opposite surfaces are faced as at 17 and 18 with soft leather washers so as, according as the stem is in the normal (*i. e.* the lowered) or in the raised position, to close air-tight an opening 19 in the lower wall 20, or an opening 21 in the upper wall 22 of the valve-chamber 23 formed in the top board 24 of the casing. The chamber 23, which is of considerably larger area than the valve 16 which works in it, is in permanent communication by way of a passage 25, 26 with the interior of the bellows 3. Hence whereas, in the normal position shown, the valve 16 closes the hole 19 and thus, by leaving the hole 21 open, maintains atmospheric pressure within the bellows 3 whose flap-board 5 therefore remains down as does also the rod 4; on the other hand when the valve 16 is raised so as to close the hole 21 and thus, by leaving the hole 19 open, brings about the exhaus-

tion of the bellows 3, the flap-board 5 will be raised by the atmospheric pressure acting against its lower surface and will also raise the rod 4 with the result that the corresponding note or impulse will be produced. This effect will obviously be produced each time a perforation in the tune-sheet passes over the corresponding tracker-hole.

The diaphragm 15 which is of thin and very flexible leather or like material, is preferably strengthened as usual by a central disk of stronger material as at 28 against which the lower end of the valve-spindle 14 bears. In the case of the secondary valve the length of lift is made adjustable, for which purpose the spindle 14 may be constituted by a screw working stiffly through a hole in the valve, the head of the screw being formed by a circular wooden button 29 shod with a disk of felt where it rests upon the diaphragm 15.

The chamber 23 is sunk in the thickness of the top-board 24, its upper wall 22; which is removable so as to afford access to the secondary valve 16, being constituted by a thin board or the like jointed to the outer surface of the top-board 24 by means of a washer 30 of soft leather or equivalent material and secured in place by screws as at 31.

As already stated, the feature of the invention consists in the fact of the secondary valve being so mounted and guided as to be completely free to seat itself fairly upon the surfaces with which it alternatively makes joint. For this purpose the secondary valve is made rectangular (preferably square as shown) and is prevented from excessive lateral displacement (such as would otherwise be permitted in consequence of the relatively great width of the apertures 19 and 21 as compared with the diameter of the valve-stem 14) by opposite lateral edges of the valve being attached to the adjacent sides of the valve chamber 23 by a pair of loose flaps 32 of very thin and flexible leather or equivalent material. Each flap is preferably secured to the valve by the corresponding end portion of the flap being lapped about a thin slip of wood which is then tightly wedged into a saw cut provided for the purpose in the edge of the valve as indicated at 33 in Fig. 4, a pin 34 being driven through the wood body of the valve at each corner to further prevent the thin slip of wood 33 from detaching itself. By this means the quantity of glue required in these joints is reduced to a minimum. The opposite end of each flap may be glued as at 35 to the upper surface of the top-board 24, the thickness of the flap being so slight as not to interfere with the tightness of the joint between the board 24 and the cover 22 of the valve-chamber.

A detachable cover is preferably provided for the protection of the otherwise exposed



portions of the valves and the interior of the relay from dust and insects. This cover 36 is shaped from a piece of sheet metal and carries laterally two U-shaped flanges 37 adapted to slide into position along a pair of grooves or saw cuts 38 in the side of the top section 24 of the casing of the relay and thereby being held conveniently secured.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a pneumatic relay, a valve chamber, a valve member movable therein and having recesses at opposite edges, and flexible flaps each partly wedged in one of said recesses

and each secured at a side of said valve chamber.

2. In a pneumatic relay, a valve chamber, a valve movable therein and having grooves in opposite sides thereof, flexible flaps, each secured to a side of said valve chamber, and each having a part located in one of said grooves wedges securing said parts in said grooves, and pins passing through the member and said wedges.

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Witnesses:

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