M. F. GUTERMUTH.

AUTOMATICALLY ACTING SPRING FLAP VALVE.

APPLICATION FILED JUNE 30, 1908.

978,152. Patented Dec. 13, 1910.

3 SHEETS—SHEET 1.

Fig. 1

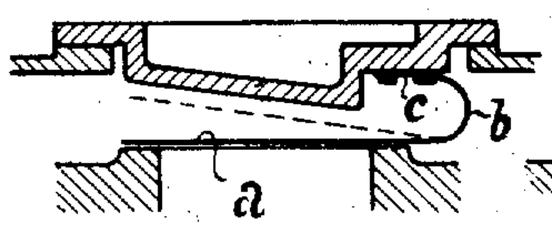


Fig. 2a

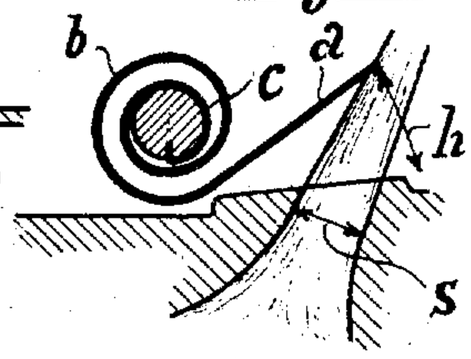


Fig. 2b

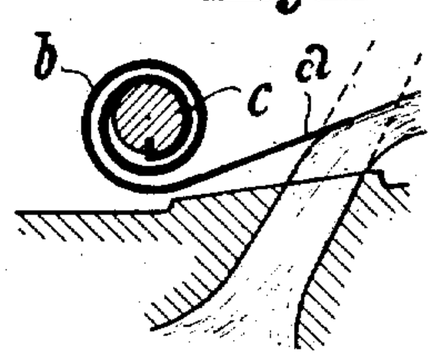


Fig. 3

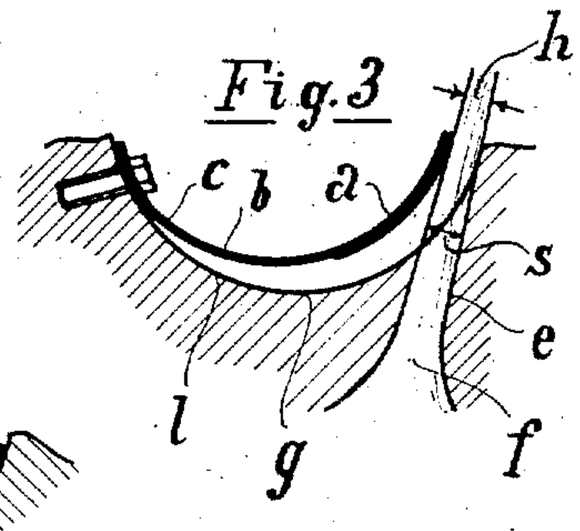


Fig. 4

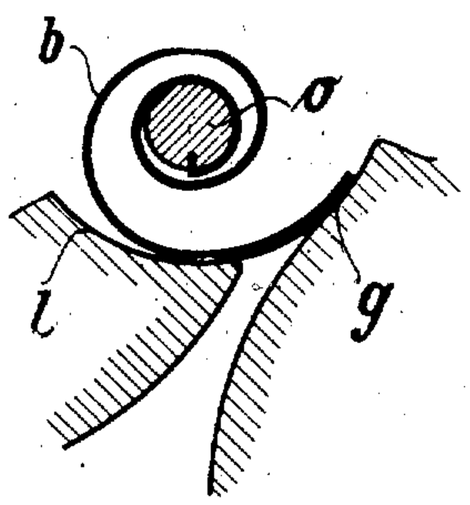


Fig. 6

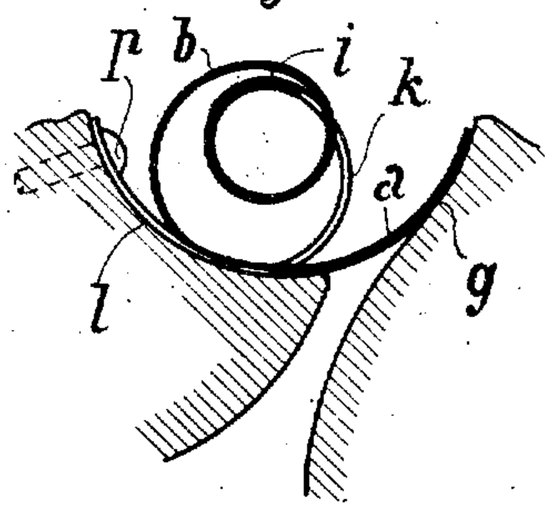


Fig. 5

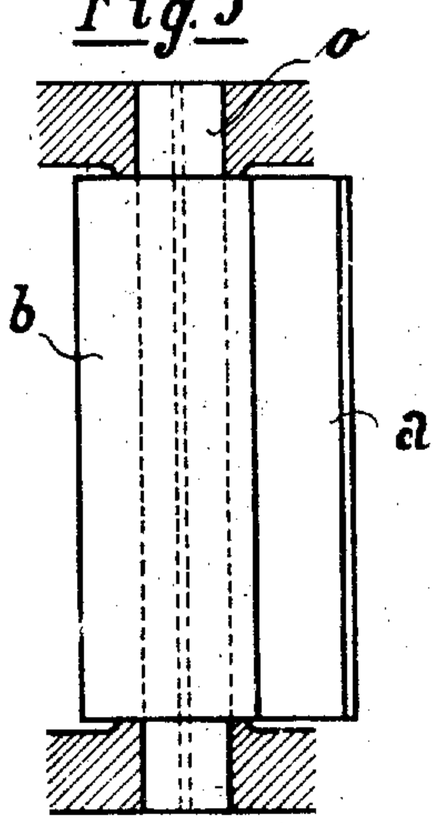


Fig. 7a

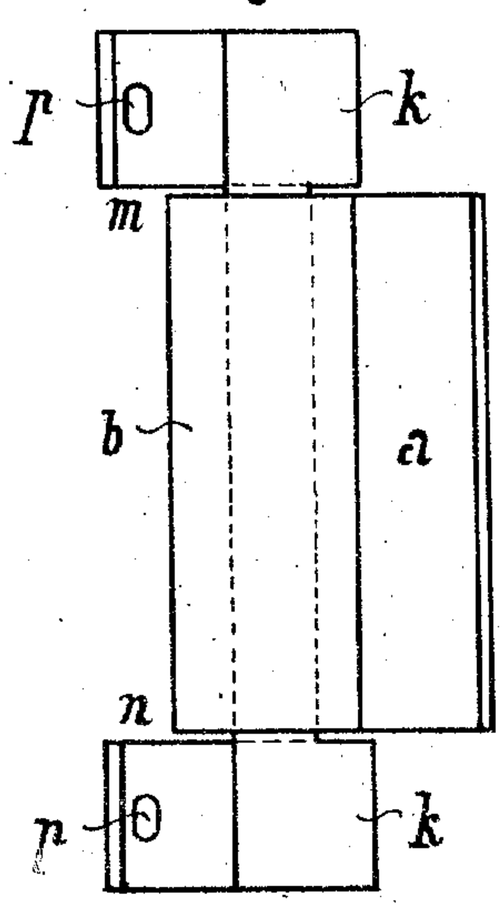
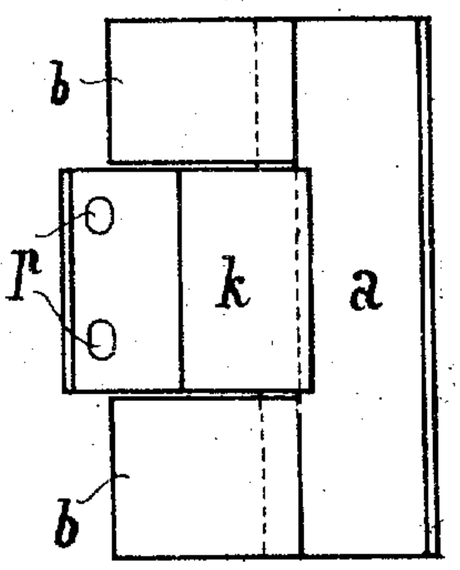


Fig. 7b



Witnesses:

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Inventor:

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by Munn & Co.

M. F. GUTERMUTH.

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3 SHEETS—SHEET 2.

Fig. 8

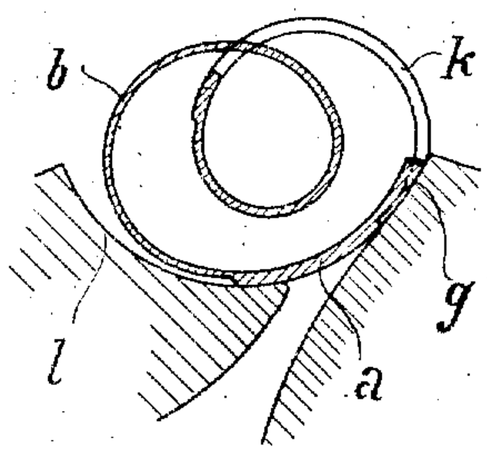


Fig. 10

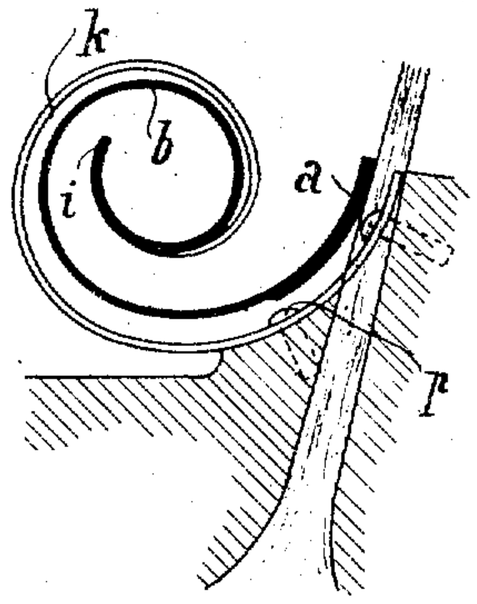


Fig. 12

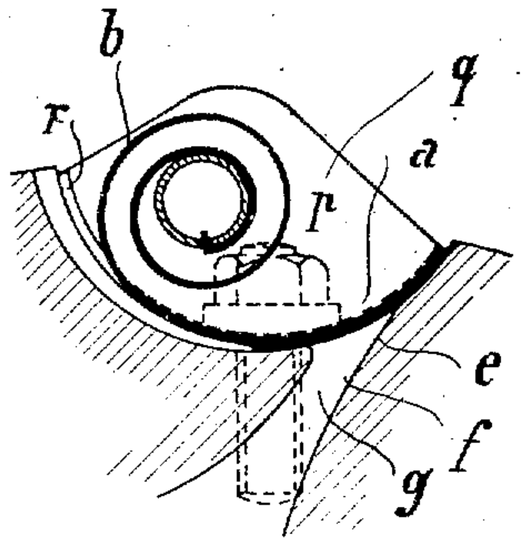


Fig. 9

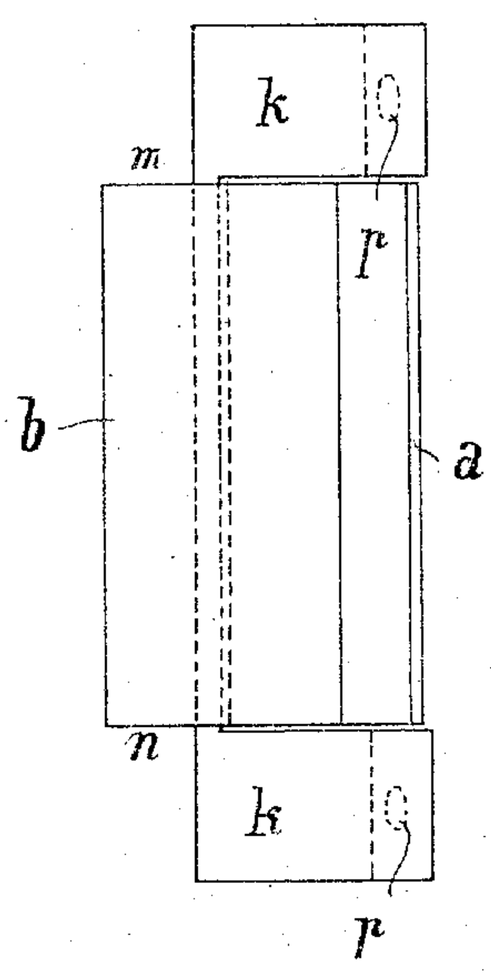


Fig. 11

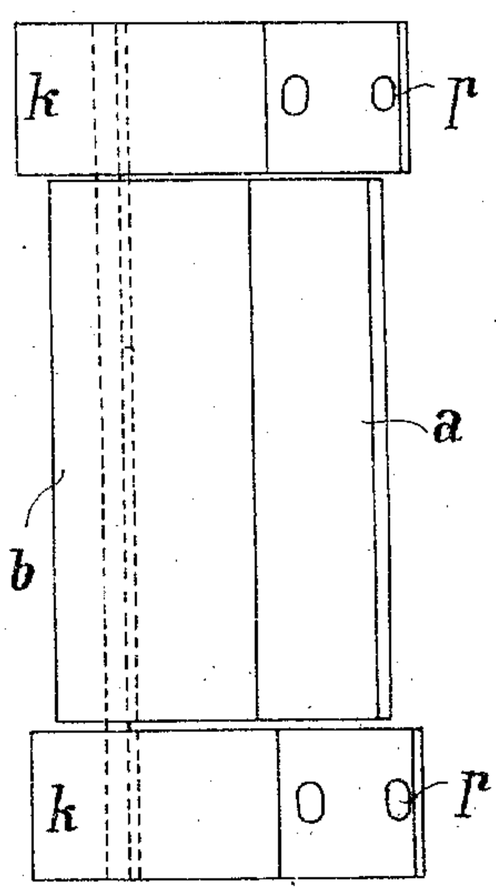
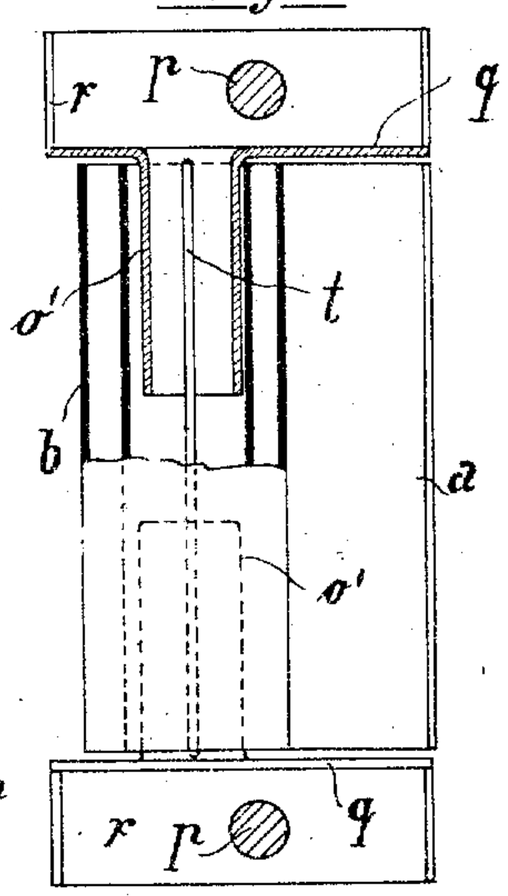


Fig. 13



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3 SHEETS—SHEET 3.

Fig. 14

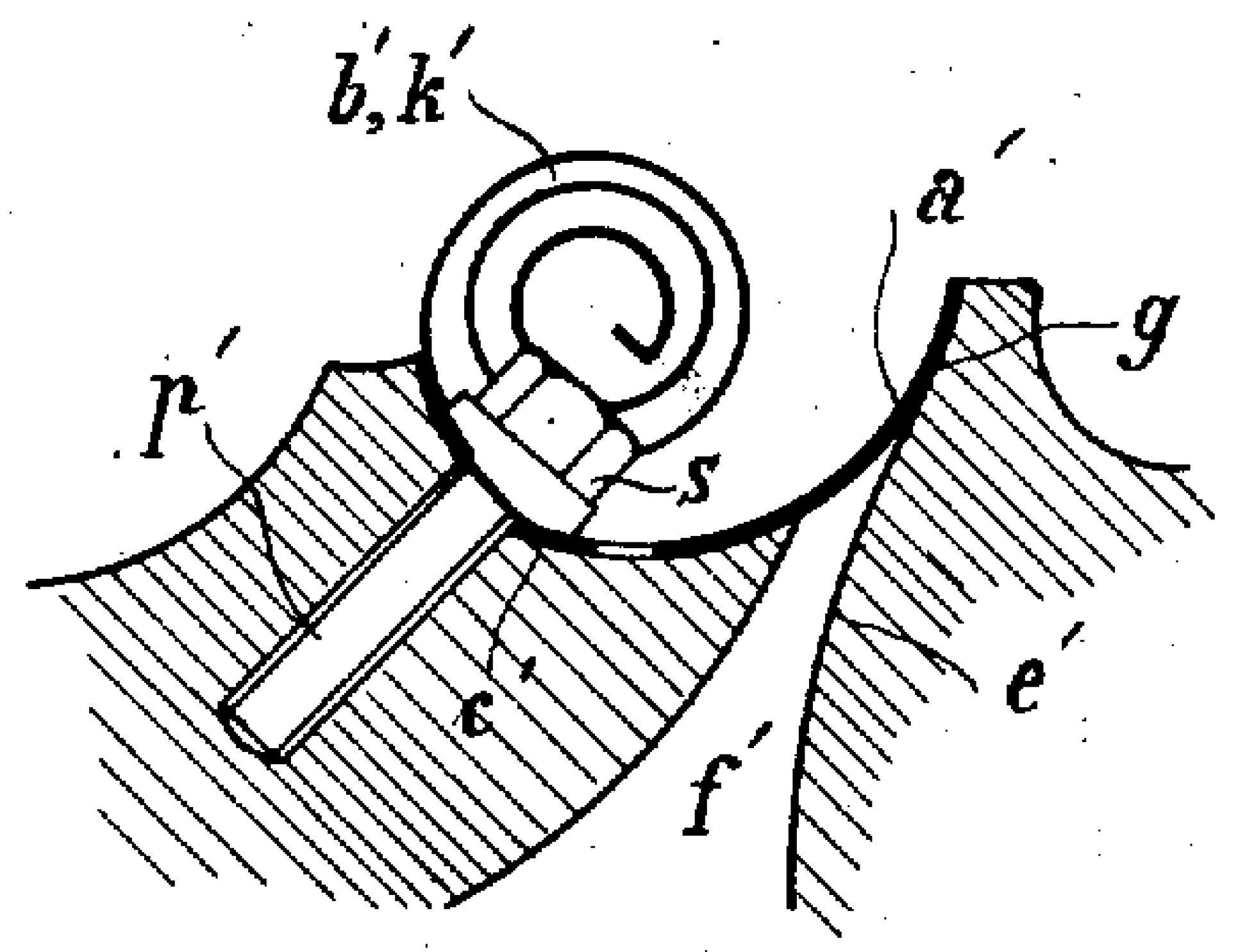
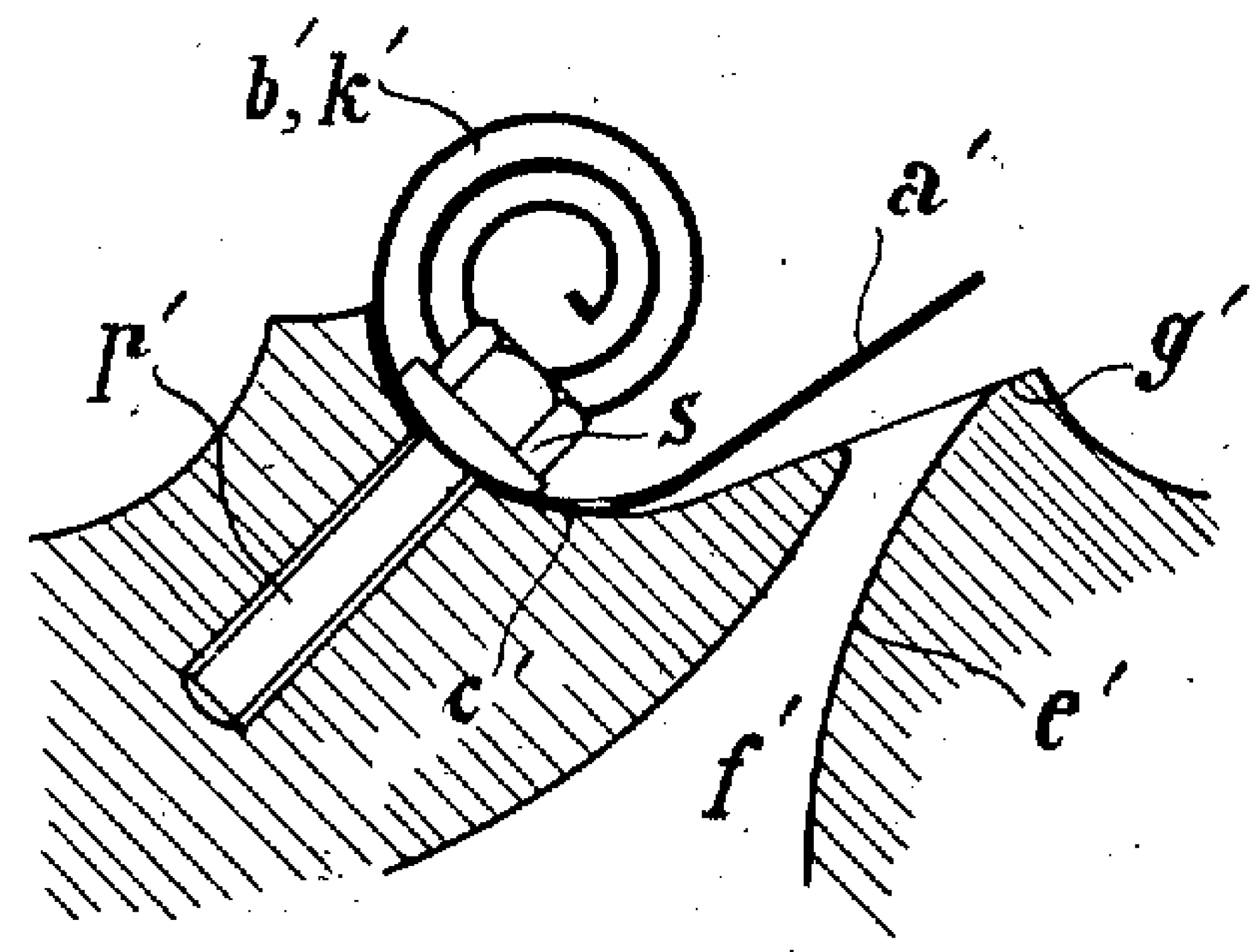


Fig. 15



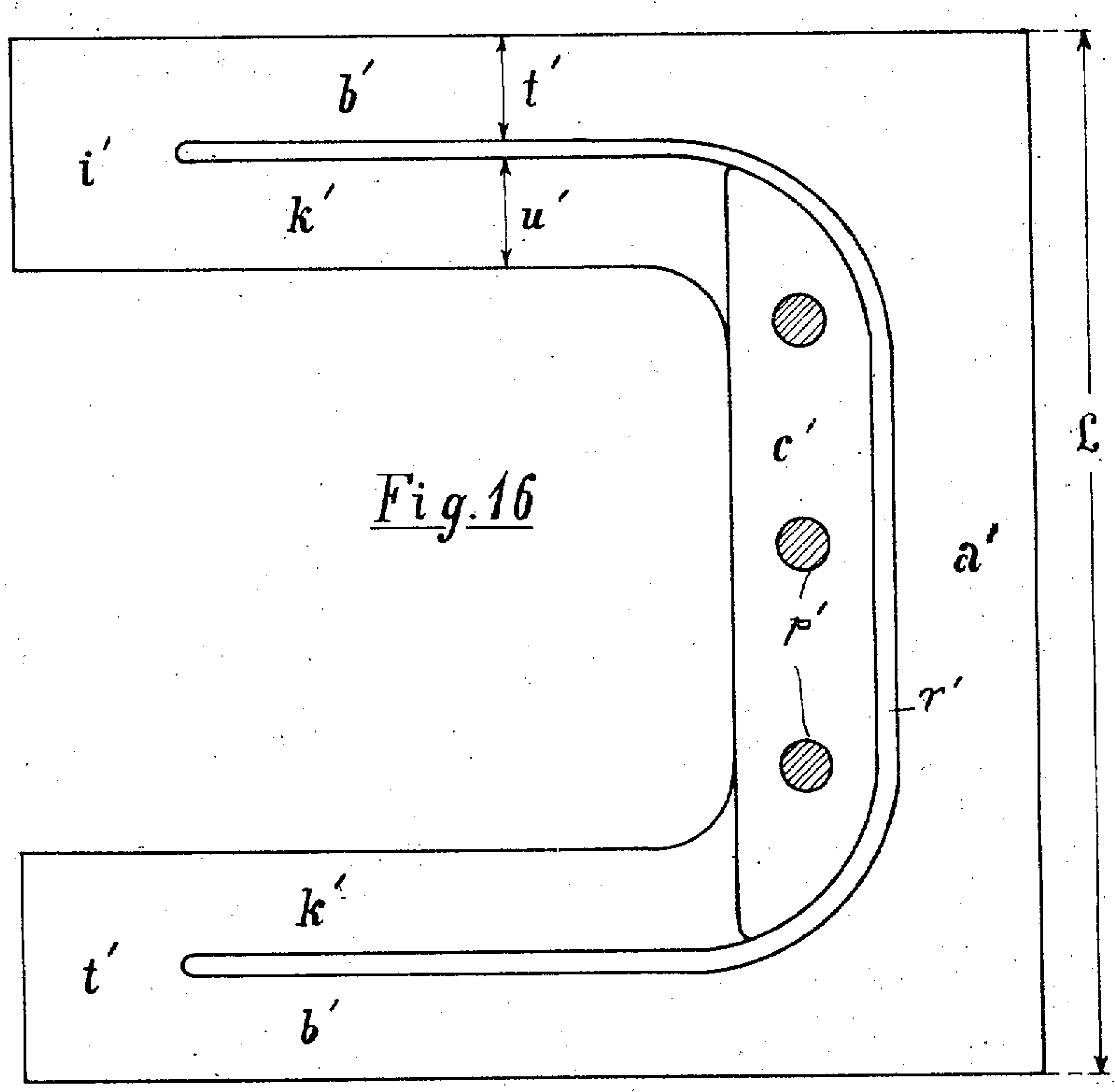


Fig. 16

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Inventor:
Max Friedrich Gutermuth
By [signature] Atty

UNITED STATES PATENT OFFICE.

MAX FRIEDRICH GUTERMUTH, OF DARMSTADT, GERMANY.

AUTOMATICALLY-ACTING SPRING FLAP-VALVE.

978,152. Specification of Letters Patent. **Patented Dec. 13, 1910.**

Application filed June 30, 1908. Serial No. 441,222.

To all whom it may concern:

Be it known that I, MAX FRIEDRICH GUTERMUTH, a citizen of the German Empire, residing at Darmstadt, Germany, have invented new and useful improvements in Automatically-Acting Spring Flap-Valves, of which the following is a specification.

The inventor recently endeavored to considerably improve the so-called "Gutermuth flap valves" which have become known by flap valves" which have become known by his name, and which are shown in Figures 1, 2^a and 2^b of the accompanying drawings, and which with all their advantages have still a number of fundamental defects. As is well known in these automatically acting Gutermuth flap valves a bent up part *b c* is attached to or connected with the actual flap seat plate *a*, which part (*b c*) at its end *c* is so fixed in the valve casing, that the spring tension of part *b* is increased on the opening of the flap valve. These flap valves in spite of their simplicity and their recognized advantages have a number of defects, which on the one hand affect the correctness of their action and their durability and on the other hand render their manufacture difficult and a perfect adjustment impossible. The correct play is hindered by the opened valve not being able to simply rest on the jet of liquid but by being forced to cut into the same, more particularly during the closing movement (Figs. 2^a and 2^b). An unwelcome increase of the throttling resistance is thus produced and the tendency of the valve to vibrate is increased; the valve lift *h* is always greater than the thickness of the jet *s*. Especially at a high speed the large valve lift is very undesirable. The durability of the valve is affected by the great lift of its outer edge and its tendency to vibrate in consequence of the valve surface intersecting the column of liquid. By these vibrations the outer edge of the valve is frequently caused to strike on the seat immediately before closing, whereby a tearing or cracking of the front edge of the valve takes place. The manufacture of the valve is rendered difficult by its having been found practically impossible to maintain exactly the same forms and dimensions of the spring coils, in consequence of the unequal behavior of the material, so that it is seldom possible to make several valves in so exact coincidence that they can be placed on a common spindle and the flat parts of the valves assume an exactly coincident position to the seat surfaces and bear on the seat with uniform pressure. In consequence of the always existent differences in the relative position of the coils to the flat part of the plate, a perfect adjustment of the valves is rendered impossible when the spindles stand at a uniform distance away from the seat surfaces. The correct construction of the flap valves requires special experience and very accurate work and also special skill in the fitter or workman. The inventor has endeavored to remove all these drawbacks by an entirely new form of flap valve.

The invention consists in the actual seat plate, which is connected with the curved and spring part, being made curved and shutting down on a seat provided with a like curved fitting surface which seat contains the slot for the passage of the liquid in such a way that one of the walls of the slot is directed quite or approximately tangentially to the curved seat surface. Consequently the closing valve must rest tangentially on the jet of liquid or gas and the lift *h* of the valve is not greater than the thickness *s* of the jet. The spring part of the flap valve may be connected with the curved seat plate in coils according to the same curved form or in smaller coils. By this formation of the valve and position of the slot in the seat all the drawbacks hereinbefore mentioned of the older Gutermuth valves, are avoided.

Several forms of construction of the invention are shown in the accompanying drawings in which—

Figs. 1, 2^a and 2^b are sectional views showing my flap valve as hitherto made. Fig. 3 is a sectional view showing my improved valve. Fig. 4 is a sectional view showing a modification. Fig. 5 is a plan view partly in section of the valve shown in Fig. 4. Fig. 6 is a view similar to Fig. 4 showing a modification. Fig. 7^a is a plan view of the valve shown in Fig. 6. Fig. 7^b is a plan view showing a slight modification. Fig. 8 is a sectional view of another modification. Fig. 9 is a plan view of Fig. 8. Fig. 10 is a sectional view of another modification. Fig. 11 is a plan view of Fig. 10. Fig. 12 is a sectional view of a modification. Fig. 13 is a plan of Fig. 12. Fig. 14 is a sectional view of another modification. Fig. 15 is a like view showing the valve open. Fig. 16

shows a valve shown in Figs. 14 and 15 being made of one piece.

Fig. 3 shows first that the improved valve, in contrast to the older ones, has not a flat but a curved seat surface *a*, which when the valve closes fits tangentially to one wall *e* of the aperture of passage *f*. The seat surface *g* is itself also made curved. To the curved part *a* of the valve plate a bent up part *b* is connected, which absorbs in one or more coils (Figs. 4–11) or, as shown in Fig. 3, in a fraction of a coil, the bending strains of the valve, the end *c* of which is attached to the valve casing.

In the form of construction shown in Figs. 4 and 5, several coils *b* are provided, the inner end of which is placed on a spindle *o* or attached in other manner to the latter. According to Figs. 6–11 a separate spindle may be dispensed with and the securing of the valve on the seat operated in the following manner. The innermost coil is prolonged at both ends over the side edges *m n* of the flap valve and to these prolongations coils *k* directed in the same or an opposite way to the actual seat plate *a* are connected. By means of these coils *k*, the attachment of the valve to the seat or to a part firmly connected with the seat, or to the casing wall may take place. The attachment is effected most simply to the curved seat surface at the side of the valve (Figs. 8–11) or on the rearward prolongation *l* of the actual seat surface *g* (Figs. 6 and 7[a]). By suitable attachment screws *p* this last coil and therewith the flap may be connected with the seat body. If desired the continuation *k*, serving for the attachment, may also be connected with the middle of the innermost coil *i* and project through a suitable perforation of the spring part *b* (Fig. 7[b]). In the forms of construction shown in Figs. 8–11, the side coils *k*, which project beyond the side edges of the valve, extend to the front and are attached to the sides of the actual seat *g* of the valve body by screws or in other suitable manner.

The superiority of this construction of valve as compared with the older Gutermuth valve with a flat seat and channel walls inclined obliquely to it (Figs. 2[a] and 2[b]) or standing at right angles to it (Fig. 1), consists in the following properties: The seat surface to be tightly closed coincides at the front part of the valve with the guide face of the wall of the passage; the valve rests actually on the jet or stream of fluid without cutting it with its front edge; the valve lift is not greater than the thickness of the jet, the fluid thus undergoes no diversion during its passage to the seat and valve, in contrast to the flat seat surface, in which a more or less great diversion of the jet of fluid, when the valve is open and especially when it is being closed, takes place; the entire length of construction of the valve and its coils is considerably shorter than with a flat plate, the valves and coils and attachment ends can easily be made in one piece, while the part of the valve which forms the seat and serves for the attachment may be made of greater thickness than the spring part of the coils; the mounting is the simplest and most reliable possible, because the valve has only simply to be screwed on the seat without further adjustment; the small length of construction allows a larger number of valves to be introduced and thereby a suitable diminution of the valve lift for the requirements of rapid running and high speed. If desired the curved seat plate, the spring coils and the coils serving for the attachment of the valve may be made of separate pieces of similar or different materials and connected with one another by riveting, screwing, soldering or in other manner.

Instead of, as in the form of construction shown in Figs. 4 and 5 for attaching the flat valve, employing a spindle *o* passed through the valve, the following arrangement shown in Figs. 12 and 13 may also be employed. The spring coiled part *b* is connected with the curved seat *a* of the flap valve. Into the innermost part of the coil a bearing body *o' q r* is passed from each side, which body consists of a socket *o'*, a flat wall *q* connected therewith and a curved or flat edge *r* flanged on this wall. The edge is attached to the valve seat by screws *p* or by riveting or in any other suitable manner. The sockets *o'* of these two bearing bodies are each provided with a slot *t*, in order to allow the bent up end of the inner part of the coil to be conveniently pushed therein. The bearing bodies described may, as mentioned, preferably be made of a piece of sheet metal, so that a particularly easy and cheap construction results. By connecting the valve with its side attachment parts, the mounting and adjusting are considerably facilitated. The combination of the flap and the attachment parts into a whole is designed in such a way that the entirely finished valve may be fixed on the seat without further treatment, by being simply screwed thereon, so that special mounting and adjusting operations are no longer requisite in mounting it.

Finally in Figs. 14–16 a modification of the form of construction shown in Figs. 10 and 11 is shown, in which the two spring coils *b'*, *k'* connected with one another and directed in opposite directions, may be made, with the seat plate *a'* connected with the outer end of one spring coil, and with the attachment plate connected with the end of the other spring coil. This valve is formed from a single piece of flat sheet metal cut out in a U-form.

In Fig. 16, the flat U-shaped sheet of metal is shown from which the flap valve is made. This sheet of metal is perforated by a slot r which is also U-shaped, in such a way that the middle or connecting bar of the U-shaped metal plate is divided into two parts a' and c', and each arm of the plate into two parts b' and k', which latter are connected at the ends i' of the arms with one another. The parts a' and c' of the middle bar, as shown in Fig. 14, are suitably curved to the cylindrical seat surface g', while the connecting parts b' and k' of the arms of the plate are rolled up into similar coils. The front part a' which is connected at the outer end of the first part of the coil b', forms the movable seat plate of the valve flap, and the part c' lying behind it, which forms the end of the second part k' of the coil, serves as the attachment end which is fixed on the valve body by means of the washer plates s' and screws p'. The spring of the flaps and their resistance to movement is now dependent on the two coils b' and k'. According to the proportion of the length L of the flaps to the widths t' and u' of the coils and according to the selection of the thickness of the metal plate, the spring resistance may be correspondingly selected or chosen, while further the thickness of the part forming the seat and also the attachment end c' may if desired be made greater than that of the coils b' and k'. This peculiar Gutermuth valve is also applicable without further difficulty in case the seat plate a', as shown in Fig. 15, is not curved but perfectly flat and fits tightly on the flat seat face g' of the valve body. The attachment part c' lying behind the seat plate a' in this case can either be made curved as shown in Fig. 15, or it can, like the seat plate a', be perfectly flat.

The great advantage of these improved flap valves consists in that they may be made in a very simple way from a piece of sheet metal cut out in a U-form, that they have a small constructional length and that the mounting and adjusting of the valve plates is extremely simple. The continuous metal plate of the valve plate might if desired be made in various thicknesses at separate parts of the closing member, such as at the seat, at the attachment end or at the coils, either by suitably rolling it out or by riveting or soldering thickening pieces and the like thereon.

I declare that what I claim is:—

1. A flap valve comprising a spring flap, means for fixing the position of one end of said flap, a curved seat plate at the other end of said flap, a correspondingly curved seat surrounding a port normally closed by said valve and means for conducting the fluid to said port in a direction approximately tangential to said curved seat.

2. A flap valve, comprising a spring flap, means for fixing the position of one end of said flap, a curved seat plate at the other end of said flap, a seat member having a surface curved to correspond with said plate and a passage normally covered by said plate, one wall of said passage being directed approximately tangentially to the curve of said surface.

3. In a flap valve, a spring flap comprising a part at one end adapted to be fixed in position, a curved seat plate at the other end of said flap, and an intermediate coiled portion; means for fixing the position of the first-mentioned end of said flap, a seat curved to correspond to said seat plate and surrounding a port normally closed by said seat plate, and means for conducting fluid to said port in a direction approximately tangential to the curve of said seat.

4. In a flap valve, a spring flap comprising a curved seat plate and a coiled portion, slotted means for securing one end of said coiled portion, a seat curved to correspond with said seat plate and surrounding a port normally closed by said plate, and means for conducting fluid to said port in a direction approximately tangential to the curve of said seat.

5. In a flap valve, a spring flap comprising a curved seat plate and a coiled portion, two slotted members engaging opposite sides of one end of said coiled portion, means for securing said slotted members in position, a seat curved to correspond with said seat plate and surrounding a port normally closed by said plate, and means for conducting fluid to said port in a direction approximately tangential to the curve of said seat.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

MAX FRIEDRICH GUTERMUTH.

Witnesses:
ALBERT FISCHER,
WALTER HAUSIN.