J. BECKER.

PHOTOGRAPHIC PLATE HOLDER.

APPLICATION FILED DEC. 23, 1903.

975,498.

Patented Nov. 15, 1910.

5 SHEETS—SHEET 1.

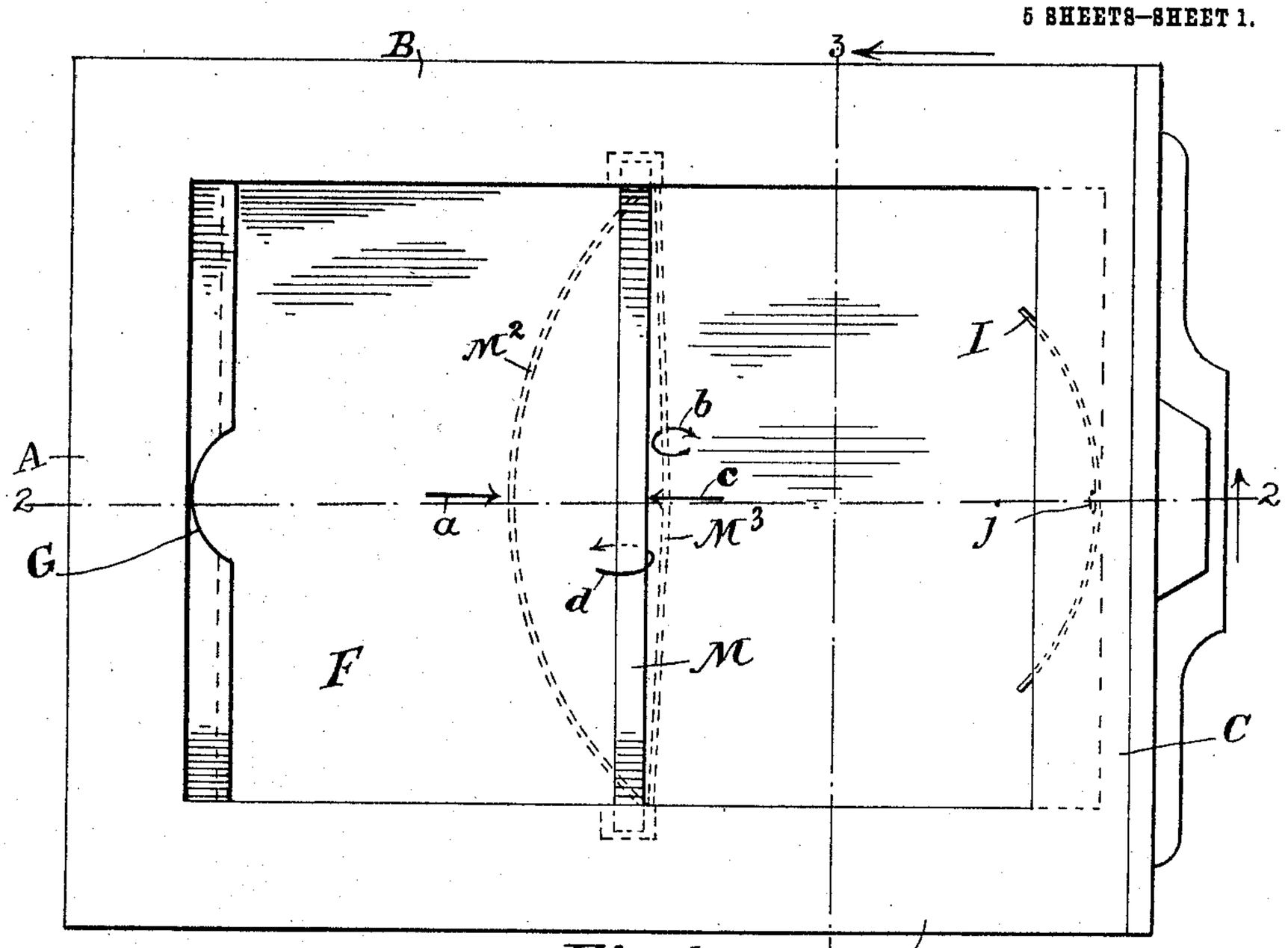

Fig. 1

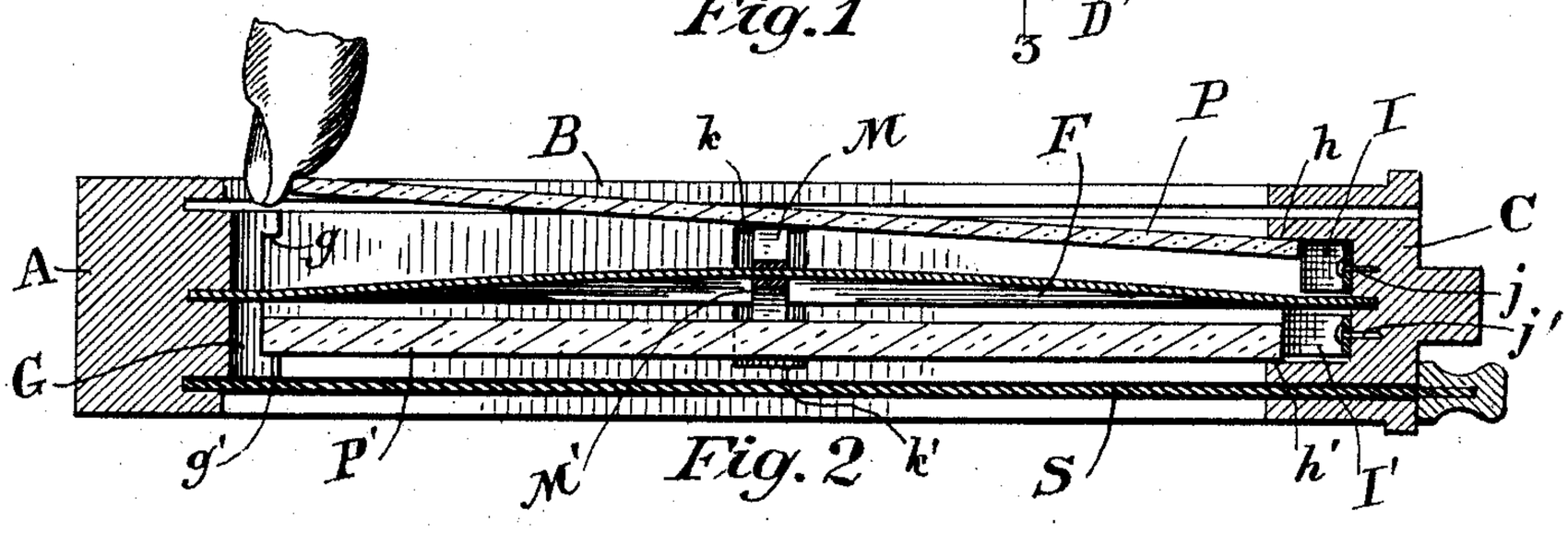

Fig. 2

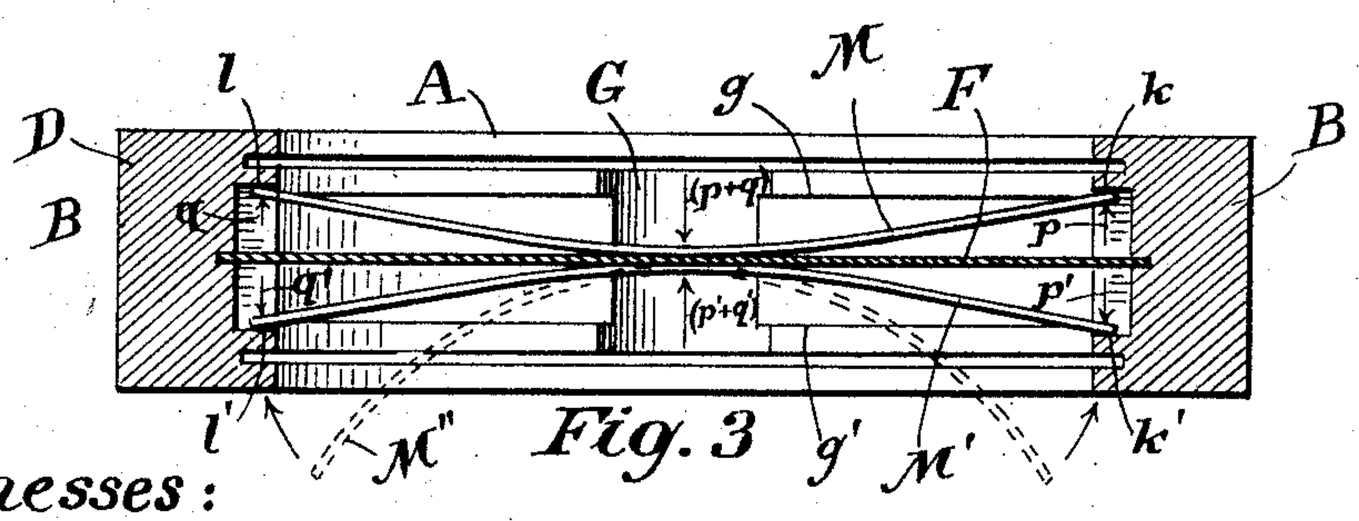

Fig. 3

Witnesses:

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5 SHEETS—SHEET 2.

Fig. 4

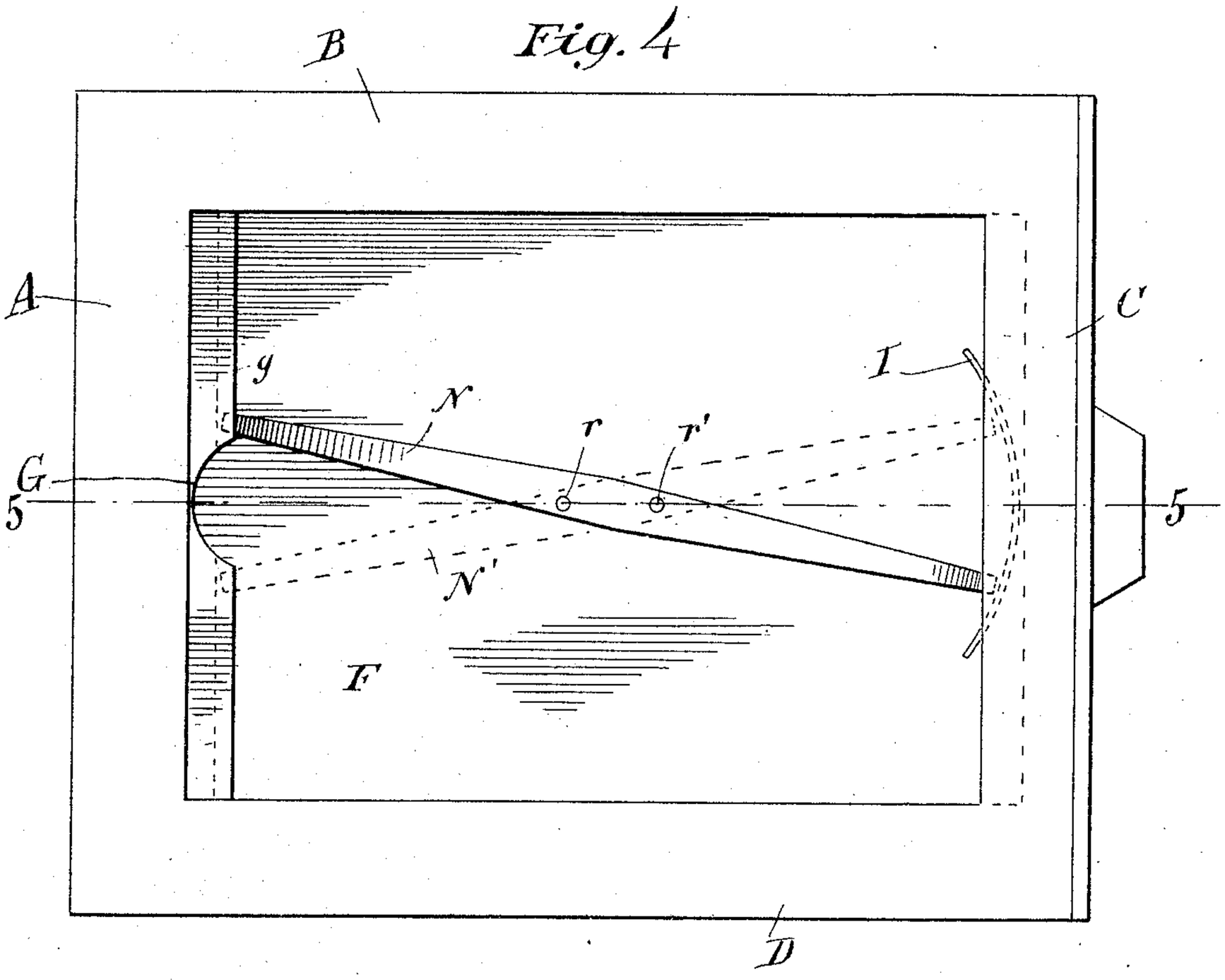
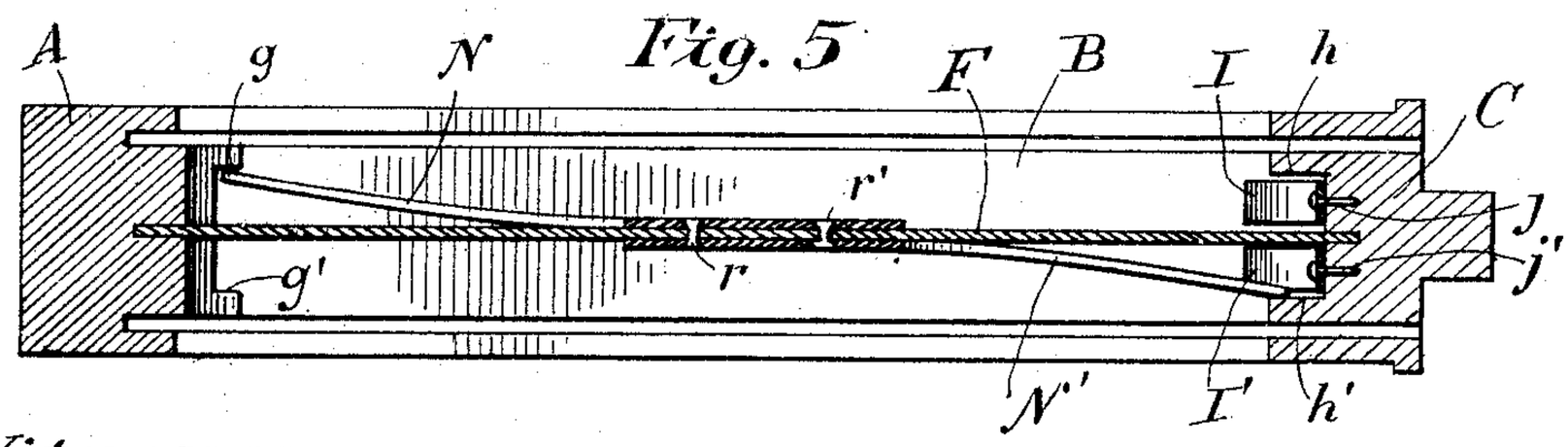


Fig. 5



Witnesses

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5 SHEETS—SHEET 3.

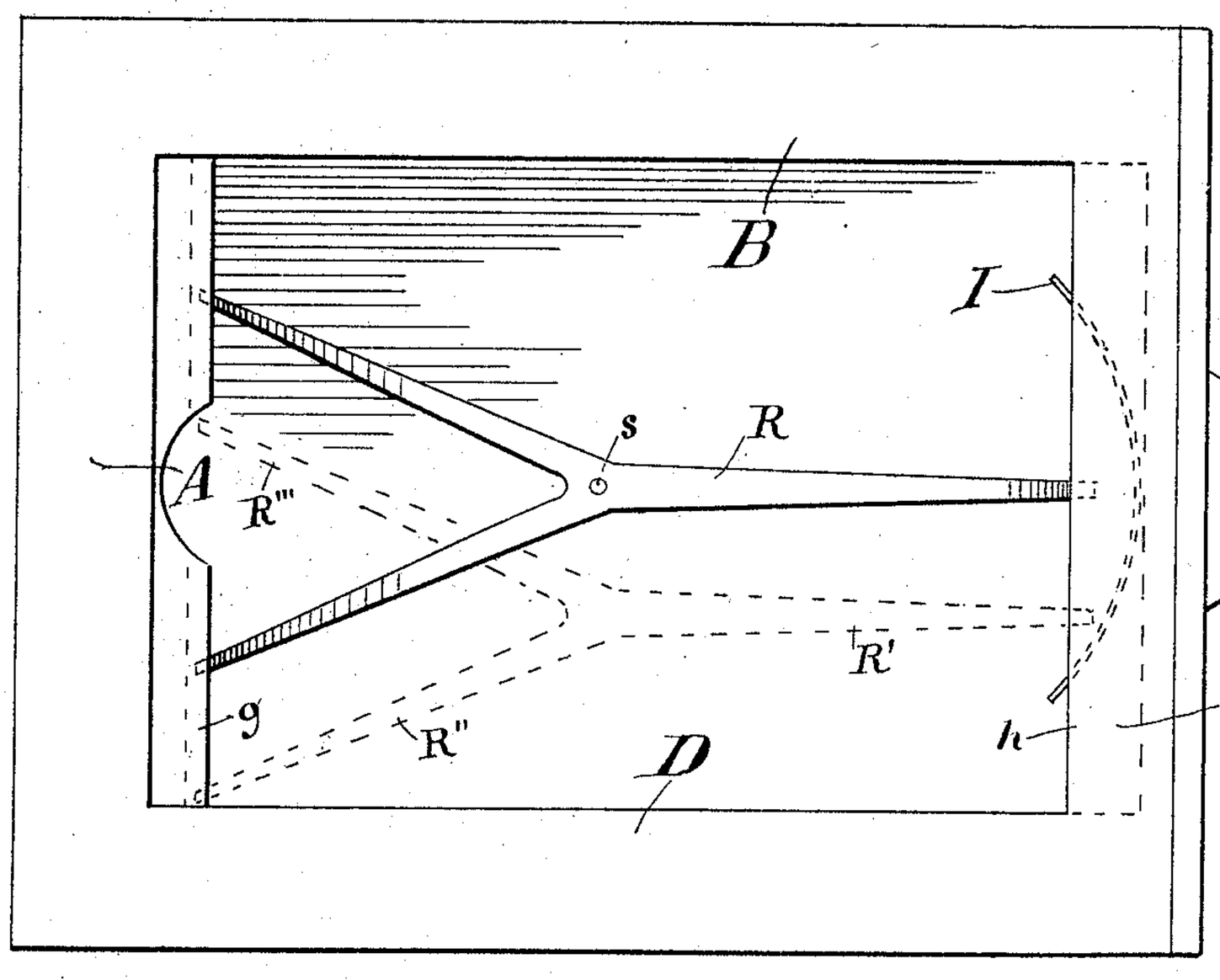

Fig. 6

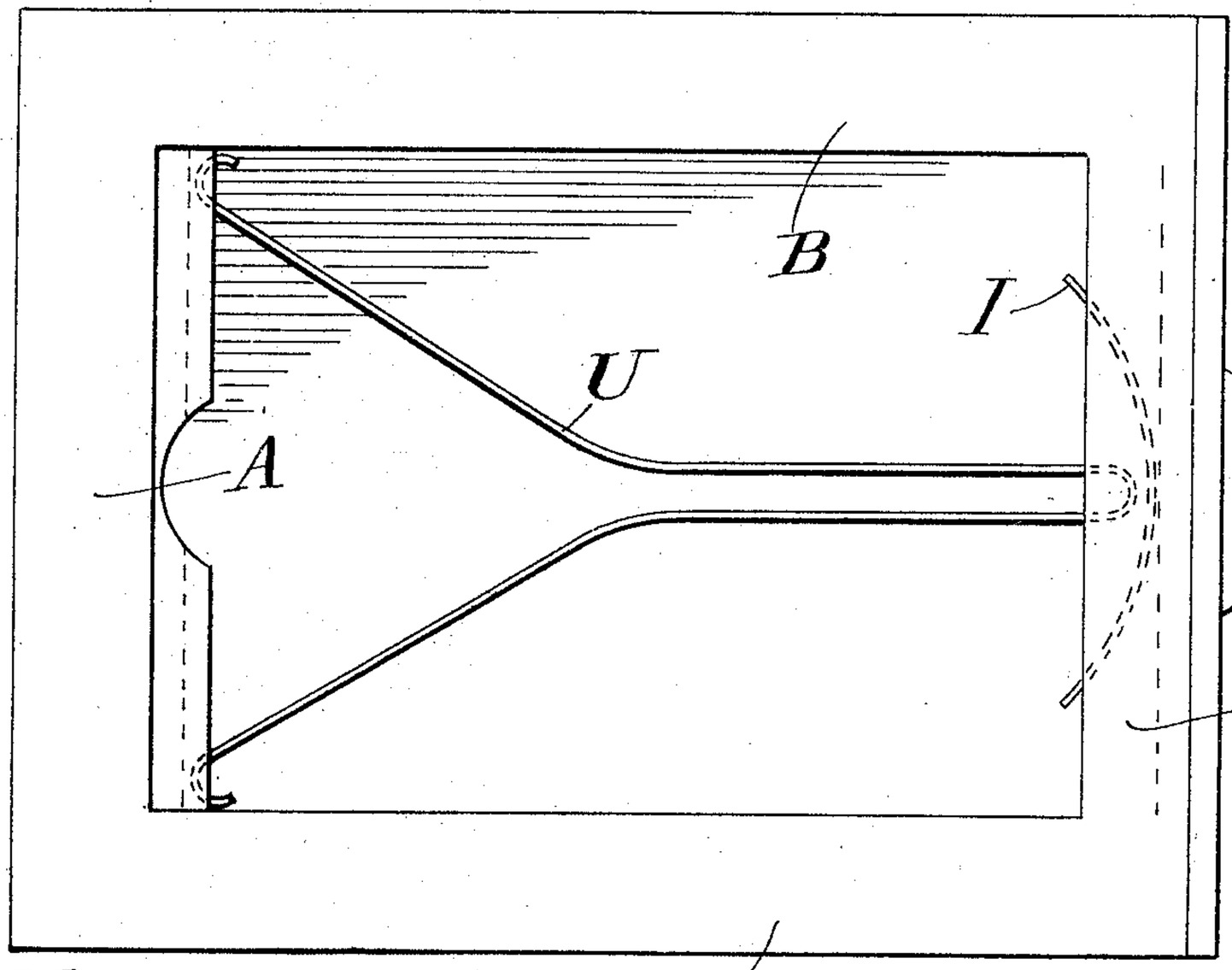

Fig. 7

Witnesses

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PHOTOGRAPHIC PLATE HOLDER.

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5 SHEETS—SHEET 4.

Fig. 8

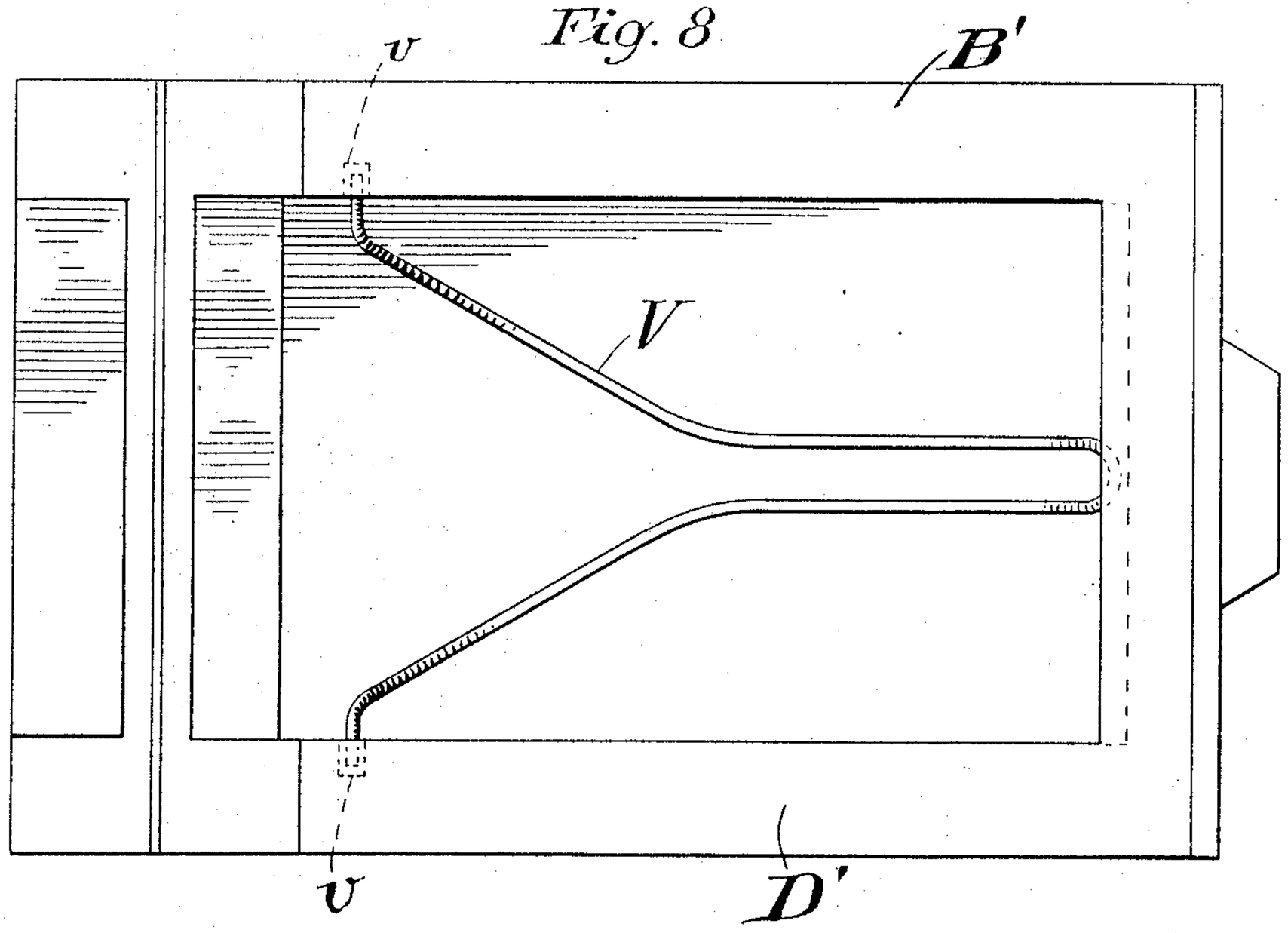
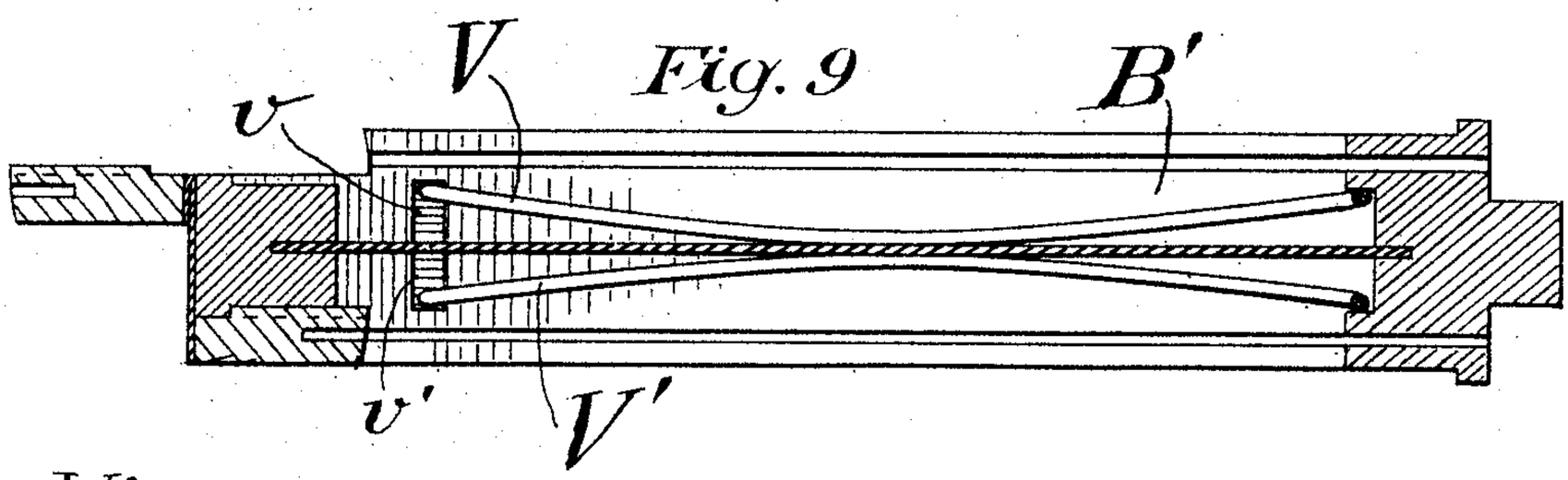


Fig. 9



Witnesses

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PHOTOGRAPHIC PLATE HOLDER.

APPLICATION FILED DEC. 23, 1903.

975,498.

Patented Nov. 15, 1910.

5 SHEETS—SHEET 5.

Fig. 10

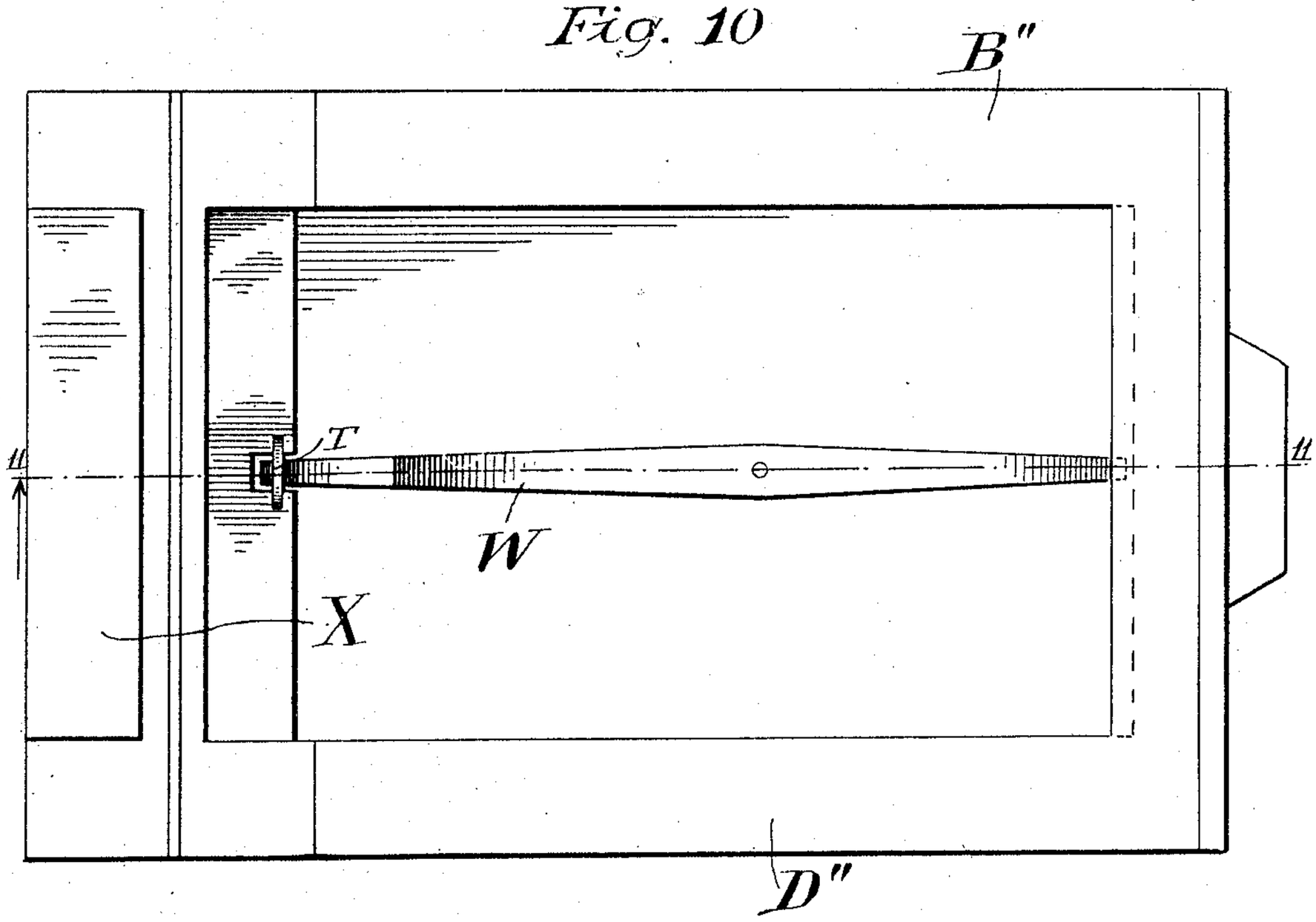
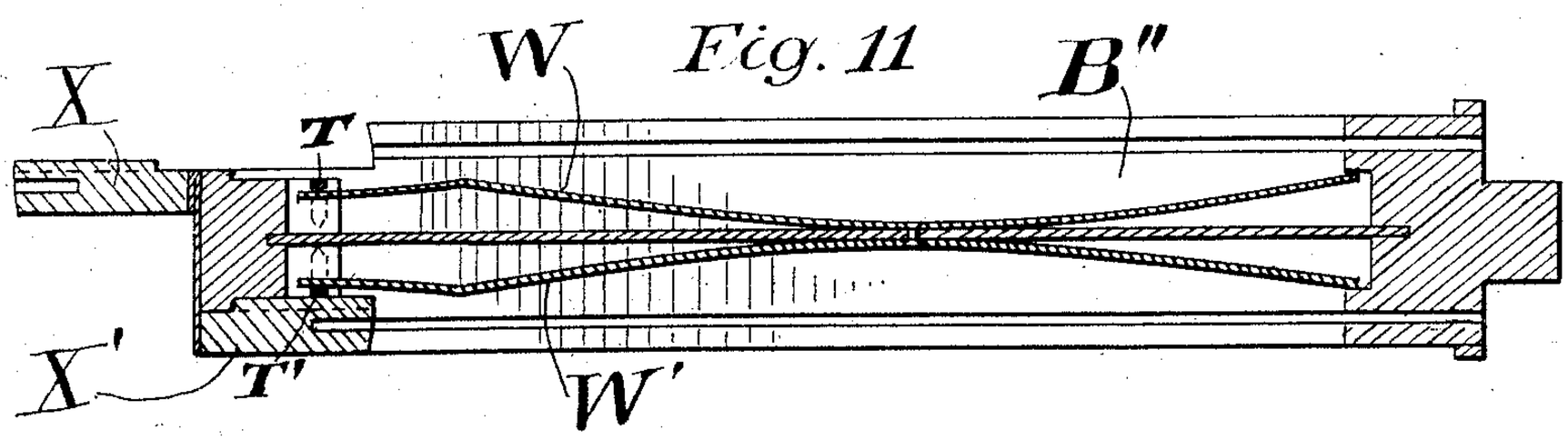


Fig. 11



Witnesses:

Walter B. Lindmarsh

Everett D. Bladwick.

Inventor:

Joseph Becker

UNITED STATES PATENT OFFICE.

JOSEPH BECKER, OF WASHINGTON, DISTRICT OF COLUMBIA.

PHOTOGRAPHIC-PLATE HOLDER.

975,498. Specification of Letters Patent. **Patented Nov. 15, 1910.**

Application filed December 23, 1903. Serial No. 186,297.

To all whom it may concern:

Be it known that I, JOSEPH BECKER, a citizen of the United States, residing at Washington, District of Columbia, have invented certain new and useful Improvements in Photographic-Plate Holders, of which the following is a specification.

My invention relates particularly to the means used for insuring that the sensitized surface on the glass plate shall be held in a certain plane of the holder, which plane may be called the "focal plane of the holder."

In every properly constructed holder this "focal plane" is determined by fixed plate-retaining ledges against which the sensitized face of the plate is held pressed by springs acting on the back of the plate.

Efficient holders as heretofore made, such as the so-called book-holder, for instance, are generally heavy and clumsy. Their back springs bear at or near the middle of the plate where the bearing point of the springs wears bright, producing detrimental reflections into the central and most important part of the image. These springs are, moreover, unequal in action, being too light for thin plates or too heavy for thick ones, unless the extra room allowed for the springs, in thickness of the holder, is made considerable, necessitating increase in bulk and weight.

In view of the imperfections of back springs as heretofore constructed, and of the disadvantages they have in use, many holders, especially the lighter double holders, are now made without such springs. As glass plates come in different thicknesses, these springless holders must be made deep enough to take the thickest plates; they cannot, therefore, properly hold a thin plate, that is to say, the thin plate, instead of being held positively with its sensitized face in what I have called the "focal plane" of the holder, is left free to fall through a certain distance back of such plane. This is a very serious defect when the objective used is of high quality, capable of yielding very sharp images with full aperture, and where, therefore, great refinements are resorted to in focusing. It is nonsensical to focus to the fiftieth of an inch when the sensitized surface is left free to fall back a sixteenth of an inch or more.

The main objects of my invention are: to secure any desirable degree of spring pressure on the back of the plate without appreciably increasing the strength, bulk or weight of the lightest holders as usually made without back springs; to secure an even pressure that shall be very nearly the same for plates of all thicknesses; to secure this pressure, however great it may be, without obliging the operator to do the work of compressing the spring; to avoid detrimental reflections from the back spring into the image on the plate and secure better distribution of pressure on the plate. I attain these objects and other minor objects and advantages by means of the invention defined in the appended claims.

A few preferred forms of my invention are shown in the annexed drawings, in which similar reference signs refer to similar parts.

Figure 1 is a plan of a holder to which one form of my invention is adapted. Fig. 2 is a longitudinal section on plane 2, Fig. 1. Fig. 3 is a cross section on plane 3, Fig. 1. Figs. 4 is a plan and 5 is a section of a form in which the plate-retaining ledges are used as spring-retaining ledges. Fig. 6 shows a modified type of spring. Figs. 7 and 8 show two modifications of the form shown in Fig. 6. Fig. 9 shows a form of mixed type, that is, a form having special spring-retaining ledges at one end of the holder, and a plate-retaining ledge, used as spring-retaining ledge, at the other end of the holder, the holder being of a form to which this form of back spring is specially suited. Fig. 10 is a plan showing a special form of my invention as applied to a special known type of plate holder; and Fig. 11 is a section on the median line of Fig. 10.

In Figs. 1, 2, 3 my invention is shown as applied to a double plate holder of standard type.

A, B, C and D represent the four bars which make up the holder frame. These bars have a middle groove or kerf running all around on the inside, and in this groove is held a thin, light, tight partition F. The end bar A is further grooved on the inside to form two plate-retaining ledges *g g'*, and the end bar C is similarly, but more deeply, grooved to form plate retaining ledges *h h'* and to form a deep recess in which are fastened springs I I' by suitable fasteners *j j'*. The springs I I' serve to force the plates P toward the opposite bar A under ledges *g g'*. Bar A has at its middle part a transverse semi-cylindrical groove G to admit the operator's finger in the act of inserting or re-

moving a plate, as seen in Fig. 2. The parts so far named are of the normal construction and of the usual proportions, although I have shown all thicknesses exaggerated for the sake of clearness. In applying my invention to such holder only one slight change is necessary in the side bars B and C. Bar B should be provided with a rectangular recess to form spring-retaining ledges *k k'*; and bar C with a similar recess to form similar spring-retaining ledges *l l'*. Into these recesses are sprung, as explained later, springs M M', which are made of common strip steel cut into pieces of proper length and bent to the shape shown in dotted lines at M'', Fig. 3. Spring M, therefore, exerts rather strong outward pressures *p* and *q* against ledges *g* and *h* and a pressure $(p+q)$ against the partition F. Spring M', which is the same as M turned around, exerts similar counterbalancing pressures p', q' and $(p'+q')$.

When a plate P' has been inserted as shown in the lower compartment, Fig. 2, the ends of the spring are forced back, off their normal bearings *k' l'* (better seen in Fig. 3), so that the pressure p' and q' are wholly applied with full force to the edges of the plate P'. The pressure on the plate is of the same amount as if the spring had been flattened down from its natural and free shape shown at M'', but as the spring is normally held down under initial strain by the ledges *k' l'*, nearly all the energy required to flatten the spring is saved, having been given once for all when the springs were sprung into place. Another point to be noted is that the insertion of a plate, however thick, does not materially increase the stress of the springs because such stress is proportional to the total strain or deformation as measured from the shape M'', Fig. 3, which the springs assume when entirely free, and such total deformation or strain is about the same for all plates; hence the stress is itself very nearly constant and the pressure on the thinnest plate used is nearly the same as on the thickest. A thin plate, therefore, is as firmly held as a thick one, and a thick plate is as easily inserted as a thin one. This uniformity of pressure is a very important feature of my invention. Back springs as heretofore made generally exert too little pressure on thin plates: or, if they are made stiff enough for thin plates, they are apt to be so hard for thick plates that the insertion of the thickest plates is generally very difficult and is sometimes impossible.

A very important feature of the invention is that the partition F need have no part in resisting the spring pressures, for the springs would be equally efficient if the partition were wholly removed; and the presence of the partition is only needed to stop light. This is explained as follows: Supposing partition F to be thin and to yield under the slightest effort; it will yield until the pressure $(p+q)$ and the pressure $(p'+q')$ are exactly equal and counterbalanced; and as the springs are equal in every respect they always assume equal strains, that is, the one is always bent as much as the other, and no more. Therefore, when the holder contains two equally thick plates or no plates at all, as in Fig. 3, the partition F sets midway and flat; and if only one plate is inserted in the holder, as in Fig. 2, the middle point of the partition F yields from the middle position toward the empty compartment, through a distance equal to one-half the thickness of the plate that has been inserted. This is so, no matter how great the pressures may be, and as, therefore, no tearing or breaking strain is put upon the partition F, this partition may be as light and thin as if no springs were present. Indeed, it may be lighter than if no springs were present because it is firmly supported at its middle point between the two springs. The springs themselves are very thin, and having, as explained above, constant stress due to initial strain, great elasticity due to their great length and no rivet heads, they may be pushed down flat against the partition by the thickest plates; and, therefore, my improved back springs can be adapted to the lightest springless holders made, without appreciably reducing their plate holding capacity.

The height or length of the spring-retaining recesses, that is, the distance between ledge *k* and its opposite *k'*, or ledge *l* and its opposite *l'*, should be at least equal to the distance between opposite plate-retaining ledges *g g'* or *h h'*, in order that the insertion of the thinnest possible plate shall certainly push the spring back off its retaining ledges. In Figs. 2 and 3 this height from *k* to *k'* is intentionally made a little greater than the distance from *g* to *g'*, with the object of facilitating the removal of a plate from the holder, as now to be explained. In removing a plate, the plate is first pushed back against spring I to disengage the plate from under ledge *g*, as seen in Fig. 2, for plate P, and then it is lifted out of the holder. This lifting out action is aided by the back spring M which pushes the plate up into the position shown, and holds it there with the full force of its total pressure if need be, perfectly free from possible re-engagement with ledge *g*.

A very important feature of my invention is that the springs M M' are held in place without special rivets or other fasteners, and that they may very easily be sprung into place, so that my improved holders cost very little more to manufacture than holders that have no back springs.

To insert a spring it is first set on edge

in position M², Fig. 1, with its ends engaged in the spring-retaining recesses. The spring is then seized between index finger and thumb, at its middle point, and is pushed in the direction of arrow *a* until it assumes the position M³ a little beyond the straight position, and at this point it is turned down flat by a twisting motion indicated by arrow *b*.

To remove a spring all that is necessary is to push on it lengthwise of the plate holder at the middle point of the spring, as indicated by arrow *c*, Fig. 1, just as if it were intended to slide the spring along on partition F. The spring will then of itself turn up on its pressed edge, as indicated by arrow *d*, bend into position M² and finally slip out free.

As the springs are long, they will keep their elasticity well and they will not need to be removed except when the operator desires to use a spring that is either weaker or stronger.

If the partition F is weak, to prevent it from being subjected to undue strain, it should be properly supported while the first spring is being inserted. No special support is needed, however, if the two springs are twisted home simultaneously.

If very thin photographic plates are used that might be bulged by the pressure of my springs M, M′ of Fig. 1, I use a form such as shown in Figs. 4 and 5 in which the plate-retaining ledges act also as spring-retaining ledges.

In Figs. 4 and 5 the holder proper is of the same construction as that of Figs. 1 to 3; indeed, it may be the same identical holder, although the spring-retaining recesses in bars B and D are now unnecessary and are, therefore, omitted in these figures. Diametral springs N, N′ similar to the diametral springs M, M′ of Figs. 1 to 3, but longitudinal instead of transverse, are provided. These springs N, N′ are held down by having their ends engaged under the plate-retaining ledges *g*, *h*, *g′*, *h′*. The springs are set to one side in order that they shall not interfere with the recess G and they are kept from shifting laterally out of place by means of rivets *r*, *r′*, which are made flush with the springs. The rivets need not be headed, as the stresses exerted have no tendency to strip the springs off the rivets. It is obvious that these springs N, N′ can only press the plates firmly against their retaining ledges and cannot bend the plates in the least; and, therefore, that the thinnest plates can be used without fear of bulging them with the back springs, if such plates are otherwise stiff enough for use in the holder.

The form shown in Fig. 6 is substantially the same as that of Figs. 4 and 5 and is, therefore, provided with the same reference letters, A, B, C, D and I. The holder here has Y-shaped springs, only one of which, R, is seen. The opposite one, if shown dotted, would have its outline coincident with R. The two springs are fixed in place by a single rivet *s*, made flush like the rivets *r*, *r′* before described. To insert these springs R they are first placed with arm R″ in one corner under ledge *g*, then turned in the plane of the paper to the position shown in dotted lines to bring the arm R′ under ledge *h*. Then arm R‴ is pushed down into recess G and the spring as a whole is then shifted laterally from its dotted position to the full line position.

In Fig. 7 I show the wire equivalent U of the form of Fig. 6 in which the torsional elasticity of the wire is utilized as well as its transverse elasticity. These wire springs are light, cheap, and easily sprung into place; being made to reach into the corners of the holder, they need not be held against lateral displacement by any rivets or other special fasteners.

I have so far shown only one kind of plate holder, but my invention is applicable to any plate holder. Its application in the form of Figs. 1 to 3, to a holder of the type shown in Schaub's U. S. Patent No. 603,972 of May 10, 1898, is so obvious as to need no special illustration. The Schaub holder is substantially of the form shown in Figs. 8 and 9 with springs omitted. It is sufficient to note that Schaub's recess made to permit of lifting the plate out of his holder (corresponding to recess G in my Fig. 1), becomes unnecessary because the plate is then forced out by my back spring as explained above in referring to plate P of my Fig. 2. In the holder of my Figs. 1 to 3 recess G is needed because the plate cannot be lifted out before it has been pushed back against the end springs I, but no such end spring is used or needed in Schaub's holder. As Schaub's plate-retaining ledges on the left are not fixed, the forms of 4 to 7 with longitudinal springs are not directly applicable to the Schaub holder, unless the holder partition be made heavy and stiff enough to withstand the pressure of the springs when a plate is inserted. When empty, the free ends of the springs would, moreover, project out of the holder and be in the way. When, therefore, longitudinal springs are to be used in holders of the Schaub pattern, I prefer to so make them that they shall be held down at one end by special spring-retaining ledges, and at the opposite end by the plate-retaining ledge.

A simple form shown in Figs. 8 and 9 consists of a plain wire V bent to Y shape and having its ends bent around to engage in spring-retaining recesses *v*, *v′* formed in the side bars B′, D′. This form is, of course, applicable to the plate holder shown in the

preceding figures, but it is well suited to the Schaub holder and is, therefore, shown in combination therewith.

The form of Figs. 4 and 5 is applicable to Schaub's holder in the manner shown in Figs. 10 and 11. Here staples T, T′ are used to hold down the springs W, W′ when the plate-retaining ledges X, X′ have been turned back. These staples T, T′ are not absolutely necessary, but, if omitted, the springs would normally project and be in the way, as before explained, and the holder would require an unusually strong partition.

In all of these forms it will be noted that the springs are counteracting, that is, that any strain put on the one spring is shared by the opposite spring, if the partition is flexible; that the springs contact with the plate at or near its edges and, therefore, cannot cause detrimental reflections into the image when they have worn bright at the point of contact; that the springs may all be under as strong initial stress and strain as desired to secure great pressure for thin plates and very nearly constant pressure for plates of all thicknesses; and that the thickest plates can, nevertheless, be inserted with very little exertion on the part of the operator; finally, that all of these advantages except the first are retained when the partition is made rigid, in which case the spring or springs in one compartment act independently of the spring or springs in the opposite compartment, as if such opposite compartment were omitted and the partition F were the rigid back of a single holder, or the rigid bottom of a single compartment or chamber.

It should be noted that my improved holders with back springs, bearing at or close to the edges of the plate, are specially suited to the holding of films having a stiffened edge or rim, or fastened to a rigid frame and that such frame or equivalent stiffening of the periphery of the film is all that is required. As plate holders have heretofore been made films could not be adapted for use in them unless provided with a stiff backing to take the pressure of the back springs; or where no back springs were used a similar backing of suffcient thickness was needed to fill the holder and bring the film into its focal plane: in either case the backing had to be removed to develop and use the negative for printing. My system, by dispensing with the necessity for any such backing, permits the use of films having only a stiff rim which far from being an interference may, on the contrary, be preserved as a highly desirable and permanent feature of the film at all stages of its handling.

What I claim as my invention and desire to secure by Letters Patent is:

1. The combination with a plate holder for photographic cameras having a plate receiving chamber comprising a bottom and walls; of a back spring for the plates to be held in said chamber, said spring extending from one wall of the plate holding chamber to another wall of the said chamber; and abutments fixed with relation to said chamber walls; said spring having ends engaged under the said abutments and also having an intermediate point resting against the bottom of the said plate holding chamber.

2. A plate holder for photographic cameras having a back spring for the plates, said spring extending from one wall of the plate holding chamber to another wall of the said plate holding chamber and abutment surfaces in fixed relation to said chamber walls, said spring being adapted to press outwardly against said abutment surfaces and inwardly at an intermediate point against the bottom of the said plate holding chamber.

3. A plate holder for photographic cameras having a back spring for the plates, said spring extending from one wall of the plate holding chamber to another wall of the said plate holding chamber and abutment surfaces formed by recessing said chamber walls, said spring being adapted to press outwardly against said abutment surfaces and inwardly at an intermediate point against the bottom of the said plate holding chamber.

4. A plate holder for photographic cameras having a back spring for the plates, said spring extending from one wall of the plate holding chamber to the opposite wall of the said plate holding chamber and abutment surfaces in fixed relation to said chamber walls, said spring being adapted to press outwardly against said abutments and inwardly at an intermediate point against the bottom of the said plate holding chamber.

5. A plate holder for photographic cameras having a back spring for the plates, said spring extending from one wall of the plate holding chamber to the opposite wall of the said plate holding chamber and abutment surfaces formed by recessing said chamber walls, said spring being adapted to press outwardly against said abutment surfaces and inwardly at an intermediate point against the bottom of the said plate holding chamber.

6. The combination with a plate holder for photographic cameras having two opposite plate receiving chambers formed by walls and an intermediate partition to serve as a bottom for each of said chambers; of a back spring in each of said chambers extending from one wall of the chamber to another wall of the same chamber, and abutments fixed with relation to the said chamber walls; each of said back springs having ends lodged under the abutments of its plate

receiving chamber and also having an intermediate point resting against the bottom of its plate receiving chamber, the intermediate resting points of the two springs being located at substantially opposite points of the said partition.

7. The combination with a plate holder for photographic cameras having two opposite plate receiving chambers formed by walls and an intermediate partition to serve as a bottom for each of said chambers; of a back spring in each of said chambers extending from one wall of the chamber to another wall of the same chamber, and abutments fixed with relation to the said chamber walls; each of said back springs having ends lodged under the abutments of its plate receiving chamber and also having an intermediate point resting against the bottom of its plate receiving chamber, the intermediate resting points of the two springs being located at substantially opposite points of the said partition; and means passing through the said partition at the resting points of the said springs to fasten them together.

8. The combination with a plate holder having a plate holding chamber comprising walls and also plate retaining ledges to determine the focal plane of the holder; of a back spring adapted to bear close to the edge of a plate inserted in said holder and projecting beyond such edge into a recess formed in the adjacent wall of the said plate holding chamber.

9. The combination with a plate holder having plate retaining ledges to determine the focal plane of the holder; of a back spring having ends adapted to bear close to the edge of a plate inserted in said holder and projecting beyond such edge, and an abutting surface for each of said projecting parts adapted to hold said springs under stress when the holder is empty.

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

JOSEPH BECKER.

Witnesses:
MARY E. COWELL,
JNO. T. MEANY.