

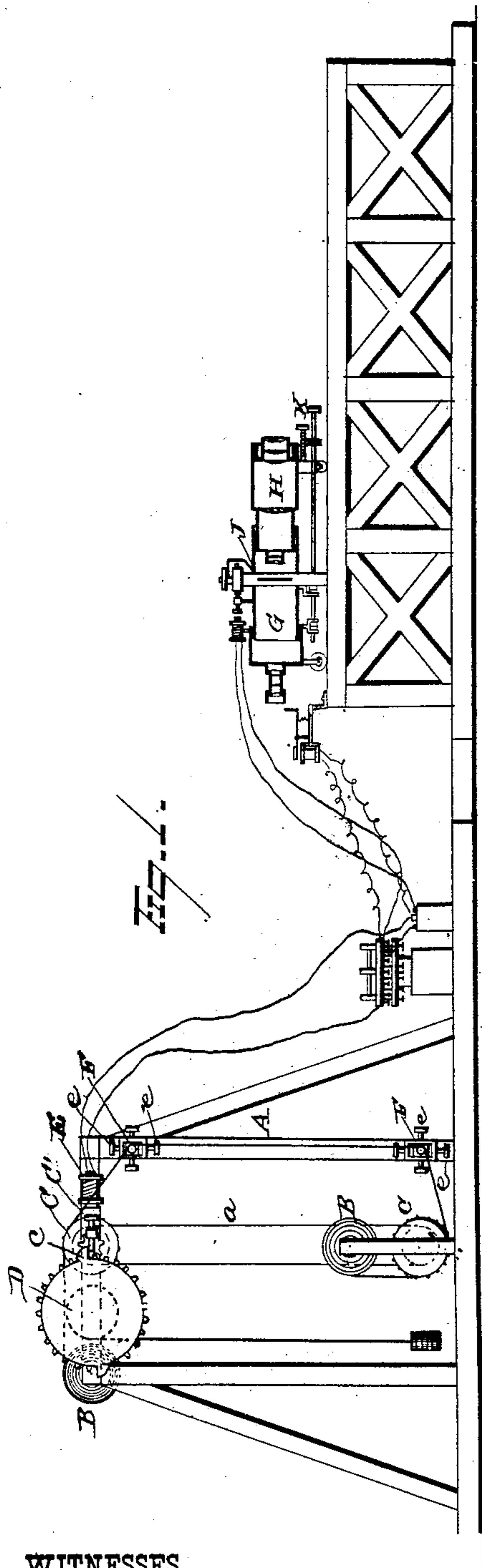
E. J. MOLERA & J. C. CEBRIAN.
Photographic Apparatus for Reducing to a Microscopic
Scale.

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Scale.

No. 230,324.

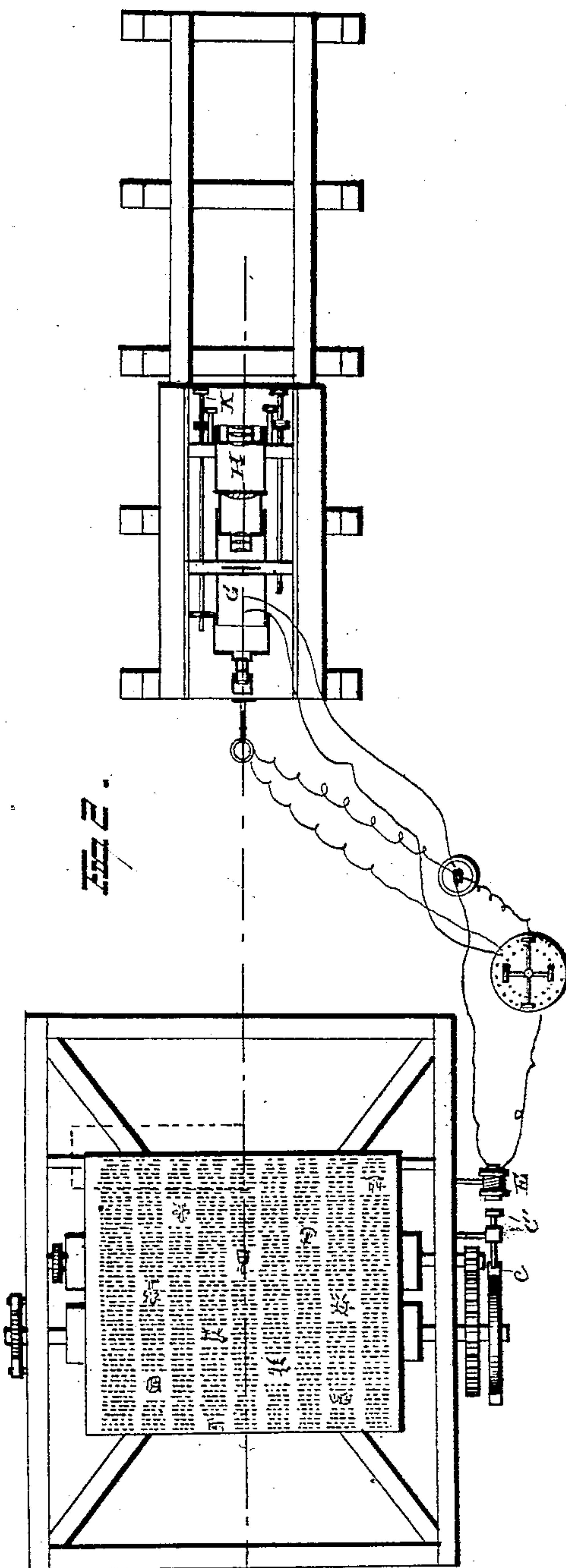
Patented July 20, 1880.



WITNESSES

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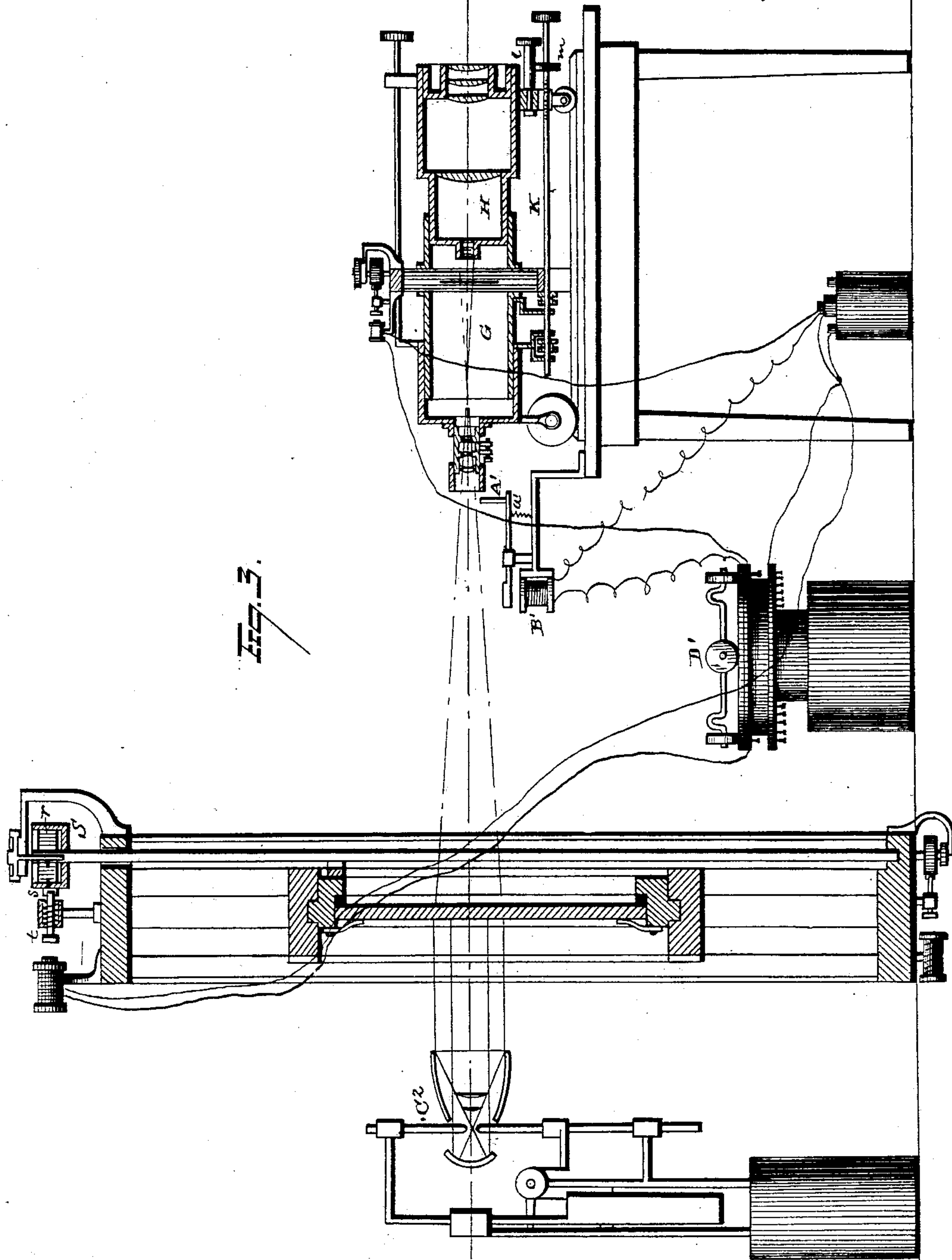
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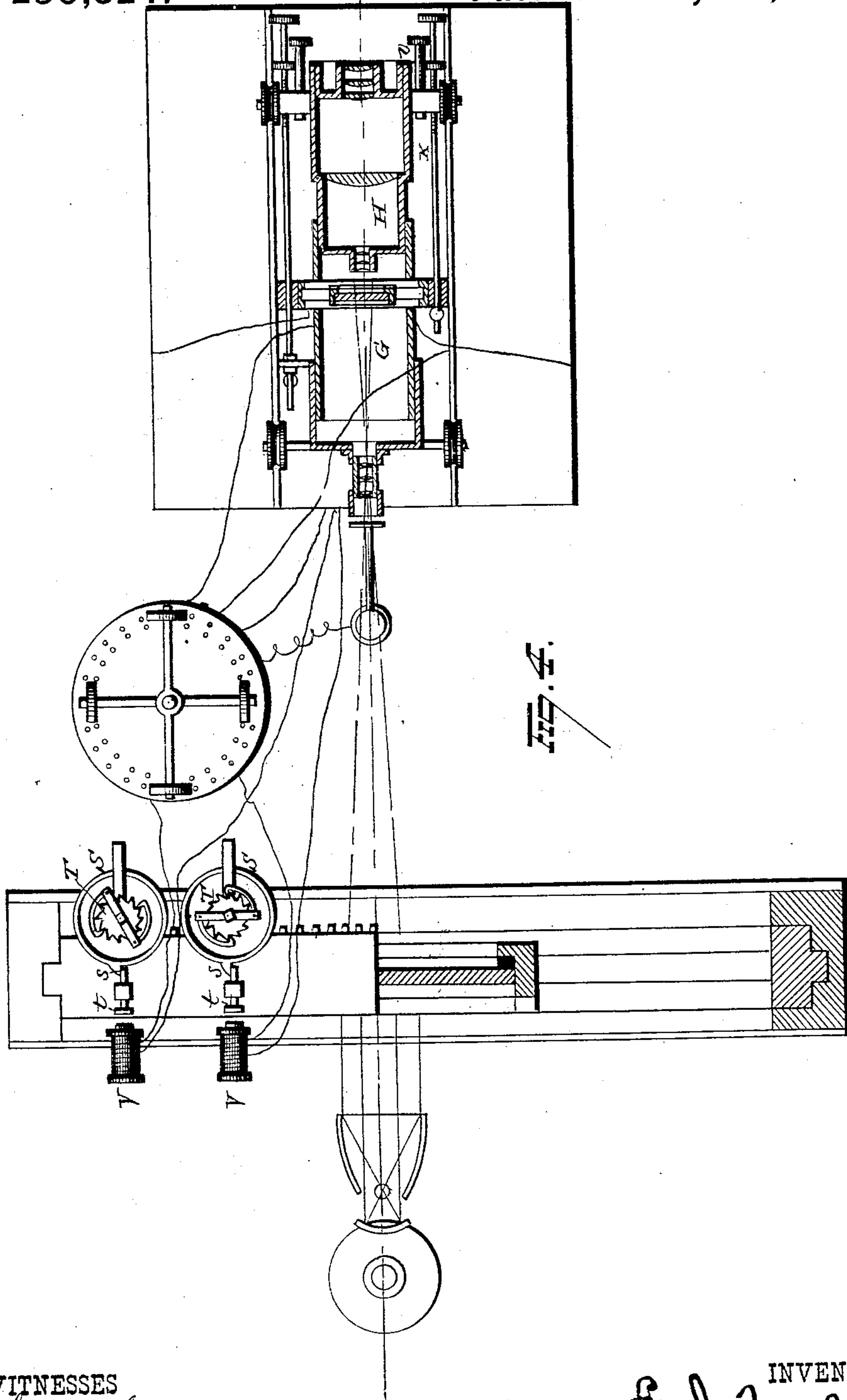
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Fig. 5.

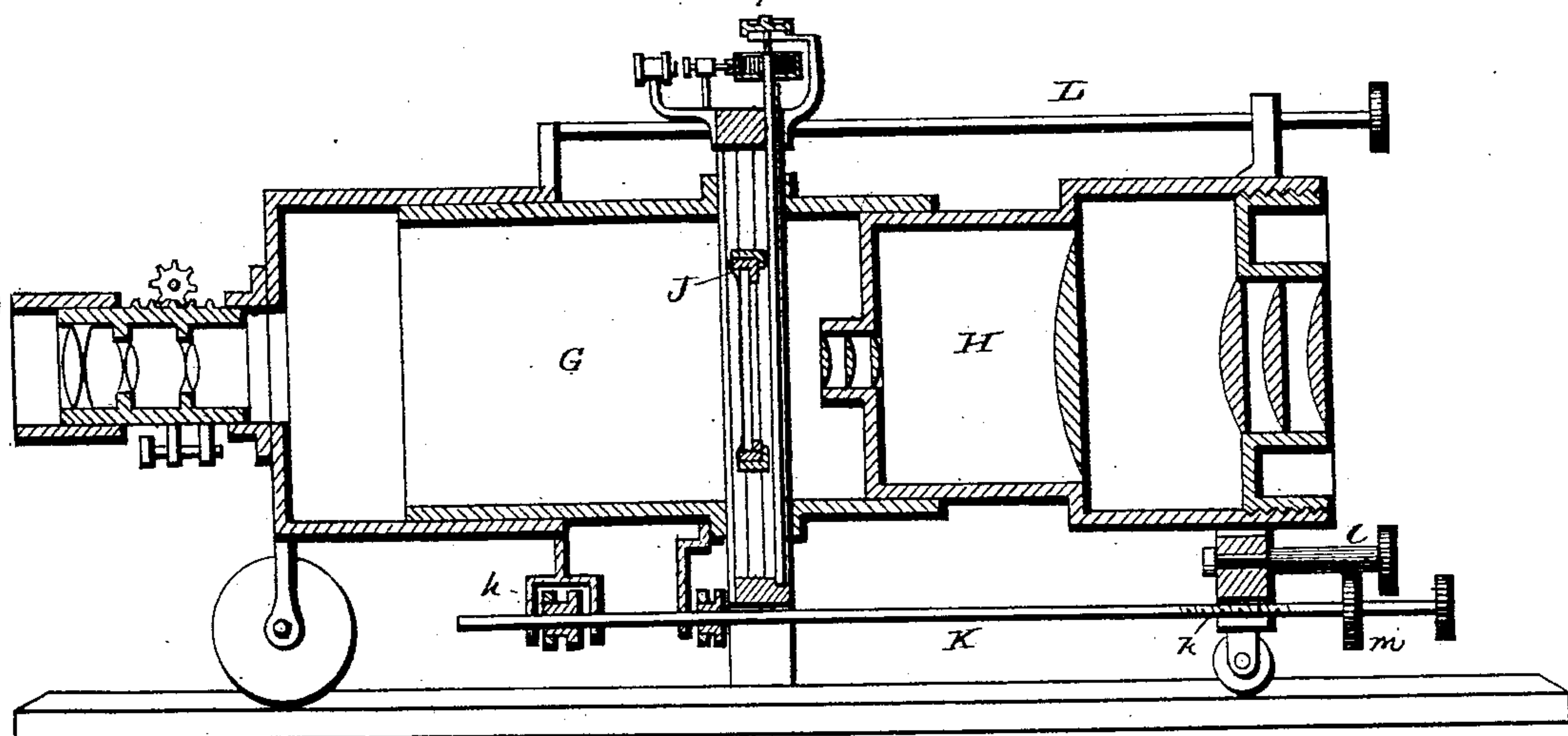
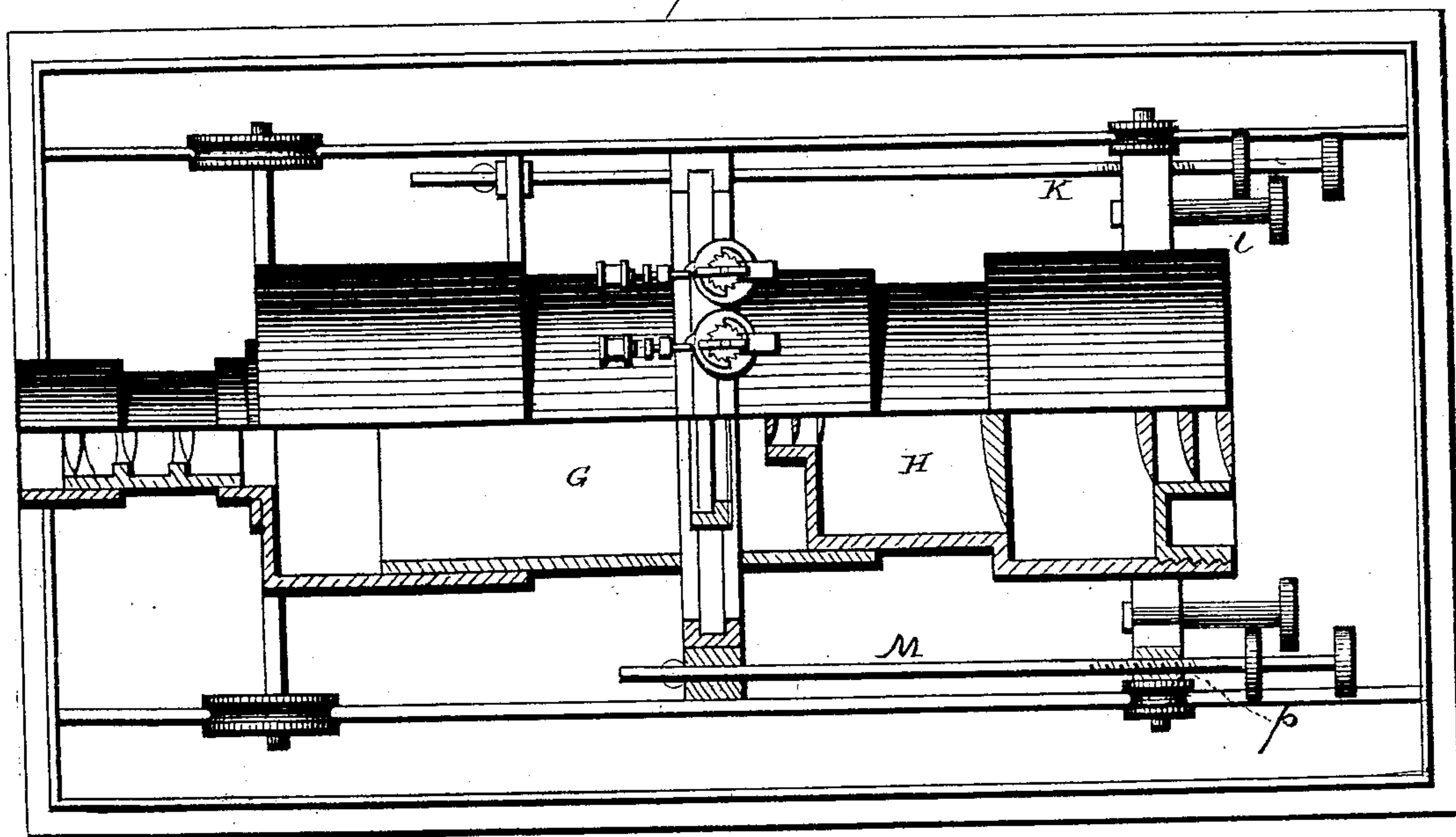


Fig. 6.



WITNESSES

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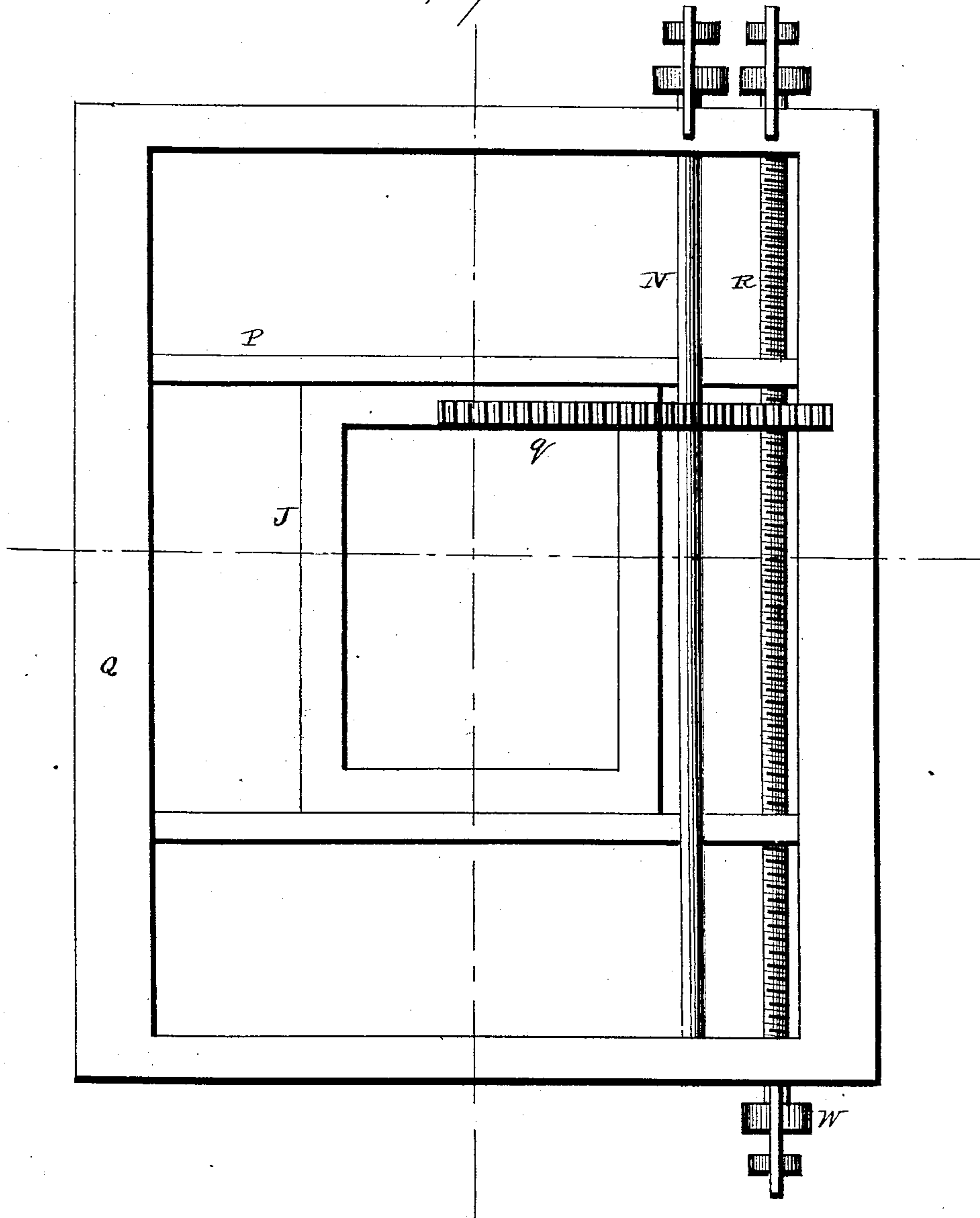
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Fig. 7.



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UNITED STATES PATENT OFFICE.

EUSEBIUS J. MOLERA AND JOHN C. CEBRIAN, OF SAN FRANCISCO, CAL.

PHOTOGRAPHIC APPARATUS FOR REDUCING TO A MICROSCOPIC SCALE.

SPECIFICATION forming part of Letters Patent No. 230,324, dated July 20, 1880.

Application filed January 27, 1880.

To all whom it may concern:

Be it known that we, EUSEBIUS J. MOLERA and JOHN C. CEBRIAN, of San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Photographic Apparatus for Reducing any Suitable Matter to a Microscopic Scale; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

Our invention relates to photographic apparatus for reducing to a microscopic scale any suitable matter, whether the latter be manuscripts, printings, engravings, lithographs, photographs, pictures, chromos, statuary, natural objects, or other matter.

The means employed by us in printing positives from the reduced negatives constitutes the subject-matter of a separate application for a patent; also, the microscopical apparatus, intended for use in reading or examining the reduced matter, constitutes a separate application for a patent.

The matter to be reduced is arranged in columns on a band, which is adapted to intermittently present a new photographic field.

The apparatus employed to make the reduction is composed of a photograph-camera, a microscopical focusing device, and an intermediate plate-holder, the latter adapted to be moved so as to present space for a new impression simultaneously with the movement of the band which presents a new photographic field. If an additional reduction is required, the matter is subjected to a further process, which is substantially the duplicate of the first.

The matter to be reduced in such case is preferably contained on a plate whose holder is adjustable in the same manner as the plate-holder of the camera. The camera employed in making the additional reductions, whether the latter be one or more, following the first reduction, is the same as the one employed in making the first reduction. In making any one of these several reductions a screen automatically closes over the objective glass of the camera immediately prior to the simultaneous movement of the photographic plate and

the band or plate which contains the matter to be reduced; and also immediately after said photographic plate and band or plate containing the matter to be reduced have simultaneously ceased their movement the screen automatically exposes the objective glass of the camera.

Referring to the drawings, Figure 1 is a central vertical section of an apparatus for making the first reduction. Fig. 2 is a plan of the same. Fig. 3 is a central vertical section of an apparatus for making an additional reduction. Fig. 4 represents a part of this latter apparatus in plan view and the remainder in horizontal section. Fig. 5 is a central vertical section of the camera employed alike in making the first and additional reductions. Fig. 6 is partly a plan and partly a horizontal section of said camera. Fig. 7 is a front elevation of the plate-holder, alike used in the above camera and in the field-frame of the apparatus for making the additional reduction.

The matter to be subjected to the first reduction is placed in one or more longitudinal columns on a band, A, whose ends are wound on upper and lower rolls, B. The band passes over the two feed-rollers C, respectively, before entering and after leaving the photographic field.

An automatically-rotating shaft, D, gears with the upper feed-roller, and a belt, a, connects the latter with the lower feed-roller. The roll on which the lower end of the band containing the matter to be reduced is connected is adapted to automatically wind said band around it as the feed-rollers feed it.

A sliding stop, C', is maintained in engagement with one or more cams, c, formed on shaft D, by a spring, and an electro-magnet, E, operates to retract the stop and release it from said engagement when the circuit is closed through said electro-magnet.

The gearing between shaft D and the feed-roller is adapted to cause the band to be fed forward to present a new photographic field each time that the stop is released from engagement with the cam. If the gearing is not thus adapted the same result may be accomplished by controlling the duration of the closed circuit through said electro-magnet.

The photographic field is maintained smooth

and in one position by upper and lower transverse bars, F, over which the band passes. One or both extremities of each bar are adapted, by set-screws *e*, to be adjusted horizontally and vertically.

The camera employed consists of a photographic camera, G, a microscopical focusing apparatus, H, and an intermediate adjustable plate-holder, J. A rotary shaft, K, has its forward extremity connected to that portion of the photographic camera which carries the objective glass by a clamp, *h*, which permits it to be loosened therefrom when desired.

The rear extremity of the shaft is screw-threaded and works in a corresponding screw-threaded opening, *k*, formed in that portion of the focusing apparatus which carries the eyepiece. This shaft may be operated directly, or a delicate movement of it may be obtained, by turning a long pinion, *l*, which engages with a gear-wheel, *m*, rigidly secured to said shaft. This shaft adjusts the objective glass of the photographic camera relative to the plate-holder and the focusing apparatus.

A rod, L, has its forward extremity secured to the portion of the photographic camera which carries the objective glass, and it extends rearward to be in reach of the observer. By loosening shaft K from clamp *h* the said rod may be drawn rearward or pushed forward, so as to rapidly adjust the objective glass of the photographic camera relative to the plate-holder and focusing apparatus. A rotary shaft, M, has its forward extremity connected to the plate-holder, and its rear extremity screw-threaded and working in a screw-threaded opening, *p*, formed in that portion of the focusing apparatus which carries the eyepiece. It may be adapted to have a delicate movement, the same as described for shaft K, and its function is to adjust the plate-holder relative to the focusing apparatus. If desired, similar means may be employed to adjust the field-glass of the focusing apparatus relative to the eyeglass.

The plate-holder J is provided with a horizontal rack, *q*, in which meshes a pinion secured to an upright rotary shaft, N. As this shaft rotates the plate-holder is moved in a horizontal direction. To accomplish this result the plate-holder has free sliding movement in a transverse frame, P. This latter frame has free sliding movement in a vertical frame, Q, and is adjusted therein by a rotary screw-shaft, R, which works in screw-threaded openings formed in said transverse frame. Each shaft N and R is provided at one extremity with a spring, *r*, having one end secured thereto and the other end secured to a box, S, provided with one or more cams, *s*, on its outer periphery. This spring can be wound like a watch-spring, and a ratchet device, T, prevents the shaft from rotating under the pressure of said spring.

Spring-pressed stops *t* engage with the cams of the spring-boxes, and electro-magnets V operate to retract the stops and free said en-

gagement when the circuits through said electro-magnets are closed.

The lower extremity of the screw-shaft is provided with mechanism, as shown at W, the duplicate of the mechanism just described as being connected with its opposite extremity. The spring and connecting parts are, however, adapted to operate in the opposite direction to said mechanism at the upper extremity of the shaft, and hence the mechanisms at both ends of the shaft operate independently of each other. The screw-shaft is thereby adapted to be rotated either to the right or the left, as may be desired, thus adjusting the plate-holder either up or down, according as the vertical column of matter undergoing reduction is being photographed from the bottom upward or from the top downward. If the matter to be reduced is arranged in horizontal columns, it is apparent that shaft N should be adapted in this manner to move the plate-holder either to the right or the left, and shaft R need not be thus adapted.

The objective glass of the camera is provided with a screen, A', which is maintained in a position to expose the glass by a spring, *a'*. An electro-magnet, B', operates to overcome the force of said spring, and when its circuit is closed said electro-magnet draws the screen over the glass. The camera employed in the additional reduction of the matter to be reduced is the same as that employed in making the first reduction; but the means for presenting a photographic field thereto is preferably different from the traveling band used for the first reduction.

We employ a plate-holder and connecting parts the duplicate of the corresponding parts used in the camera. A light may be thrown upon the plate-holder in such case, and the apparatus C² is shown by way of illustration. If the plate containing the matter to be reduced is opaque, the light should be thrown on its front face.

The several electro-magnets hereinbefore mentioned connect with an electric switch, D', the particular construction of which constitutes the subject-matter of a separate application for a patent. This switch is adapted to permit a current, or several different currents, to form closed circuits through their respective electro-magnets at predetermined intervals and for any length of time. Thus, if five seconds are required in which to make an impression on the sensitized plate, and fifty-five seconds are required in which to move said plate and the band or plate presenting the photographic field, then the switch may be regulated so as to close the circuit every sixty seconds through the electro-magnets controlling the movements of said sensitized plate and of said band or plate presenting the photographic field. One second before closing said circuits the regulator will close the circuit through the electro-magnet which controls the screen of the objective glass of the camera, and one second after the circuits through the electro-mag-

nets governing the movements of the sensitized plate and the band or plate presenting the photographic field are opened. Then the circuit through the electro-magnet governing the screen is opened; hence the regulator operates to move the several different parts of the apparatus orderly, automatically, and swiftly.

In the foregoing description we have set forth the construction and operation of certain specific mechanism constituting one form of complete apparatus for carrying out our invention. It is obvious, however, that the principle of the invention is only illustrated by said detail mechanism.

Many changes, substitutions, and omissions may be made as regards the means previously described, provided only that the elements of invention set forth in the following claims are employed.

It is also apparent that certain parts of the invention are relatively distinct, and may be independently used or omitted.

Having fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a photographic apparatus adapted to reduce any suitable matter to a microscopic scale, the combination, with a camera, of a movable band or plate containing said matter, and intermediate mechanism connecting the two said parts, being adapted to operate substantially as described, so that the band or plate may automatically expose new photographic fields and the camera may automatically photograph said fields, substantially as set forth.

2. In a photographic apparatus adapted to reduce any suitable matter to a microscopic scale, the combination of the following parts: a camera provided with an adjustable plate-holder, an adjustable band or plate containing the matter to be reduced, an automatic device for adjusting said plate-holder, an automatic device for adjusting said band or plate, and electric mechanism connecting said two automatic devices, whereby said plate-holder and said band or plate may be automatically adjusted at proper times relative to each other, substantially as set forth.

3. In a photographic apparatus adapted to reduce to a microscopic scale any suitable matter, the combination, with a band containing said matter and means for intermittently exposing new photographic fields on the band, of a photographic camera, a microscopic focusing device, and an intermediate transparent sensitized plate, substantially as set forth.

4. In a photographic apparatus adapted to reduce to a microscopic scale any suitable matter, the combination, with a band containing said matter and mechanism for intermittently exposing new photographic fields on the band, of a photographic camera, a microscopic focusing device, and an intermediate adjustable plate-holder, substantially as set forth.

5. In a photographic apparatus adapted to

reduce any suitable matter to a microscopic scale, the combination of the following parts: an adjustable band or plate containing the matter to be reduced, a camera provided with an adjustable plate-holder, spring-ratchet device for adjusting said band or plate, spring-ratchet device for adjusting said plate-holder, and automatic electric mechanism connecting said two ratchet devices, whereby the latter may operate at the proper times relative to each other, substantially as set forth.

6. The combination, with a camera provided with an adjustable plate-holder, an adjustable screen for the objective glass, and an adjustable band or plate containing the matter to be reduced, of electric connections and automatic devices, substantially as described, adapted, first, to move said screen over the glass; secondly, to move said band or plate into new positions; thirdly, to move said screen from the glass, substantially as set forth.

7. The combination, with a photographic camera and a microscopical focusing apparatus, of an intermediate plate-holder and mechanism adapted to automatically adjust the latter so as to bring any point thereon in photographic line, substantially as set forth.

8. The combination, with a plate-holder, a shaft-gearing connected therewith, and ratchet mechanism, of a spring coiled about the shaft, a spring-pressed stop which prevents said spring from uncoiling, and an electro-magnet which operates to retract the stop and permit the shaft to rotate, substantially as set forth.

9. The combination, with a plate-holder, two rotary shafts respectively gearing therewith to move it in different directions, and independent ratchet mechanisms, of coil-springs fitted in boxes secured to the shafts, spring-pressed stops which engage with said boxes, and electro-magnets adapted to retract said stops, substantially as set forth.

10. The combination, with a plate-holder, a shaft gearing therewith, and a coil-spring having one end secured to the shaft and the opposite end secured to a box fitted on the shaft, of ratchet mechanism, a spring-pressed stop which engages with a cam formed on the spring-box, and an electro-magnet which operates to retract said stop from its cam-engagement, substantially as set forth.

11. The combination, with the plate-holder of a camera and a rotary shaft gearing connected therewith, of spring-ratchets secured, respectively, to the shaft extremities and adapted to rotate said shaft in opposite directions independently of each other, substantially as set forth.

12. The combination, with a photographic camera, an intermediate plate-holder, and a microscopical focusing apparatus, of a rotary shaft whose forward end is detachably clamped to the photographic camera and whose opposite end works in a screw-threaded opening formed in the focusing apparatus, and a sliding shaft, the forward end of which is secured

to the photographic camera and whose opposite end extends rearward, substantially as set forth.

13. In a photographic apparatus, the combination, with an objective glass and a horizontal lever provided at one extremity with an upright screen, of an electro-magnet located below the opposite extremity of the lever, said lever being pivoted on a vertical bearing at a point between the screen and magnet and adapted to maintain the screen normally below the line of the glass, substantially as set forth.

14. The combination, in a photographic apparatus, with a band containing the matter to be reduced and one or more feed-rollers provided with a device for automatically rotating them, of a spring-pressed stop which prevents said device from actuating the roller or rollers and an electro-magnet which operates to retract said stop, substantially as set forth.

15. The combination, in a photographic apparatus, with a band containing the matter to be reduced, rolls on which the band ends are wound, and one or more feed-rollers, of an automatically-rotating shaft connected to said

roller or rollers, a spring-pressed stop engaging with said shaft, and an electro-magnet which operates to retract said stop, substantially as set forth.

16. The combination, in a photographic apparatus, with a band containing the matter to be reduced and means for intermittently moving it, of a transverse bar over which the band passes in presenting its photographic field, one or both extremities of said bar being adapted to be adjusted vertically and horizontally, substantially as set forth.

In testimony that we claim the foregoing—

I, EUSEBIUS J. MOLERA, do hereunto set my hand this 16th day of January, A. D. 1880.

EUSEBIUS J. MOLERA.

Witnesses:

THOMAS D. GRAHAM,
GEO. J. SPECHT.

And I, JOHN C. CEBRIAN, do hereunto set my hand this 15th day of December, 1879.

JOHN C. CEBRIAN.

Witnesses:

T. B. HALL,
A. W. BRIGHT.