

1,309,798.

8 SHEETS—SHEET 1.



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AUTOMATIC AEROPLANE CAMERA.
APPLICATION FILED DEC. 10, 1917.

Patented July 15, 1919.
8 SHEETS—SHEET 3.

Fig. 5

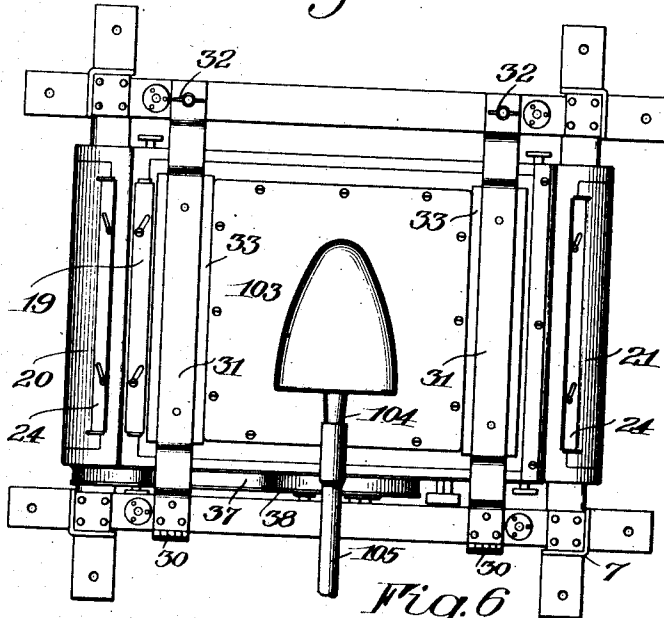


Fig. 6

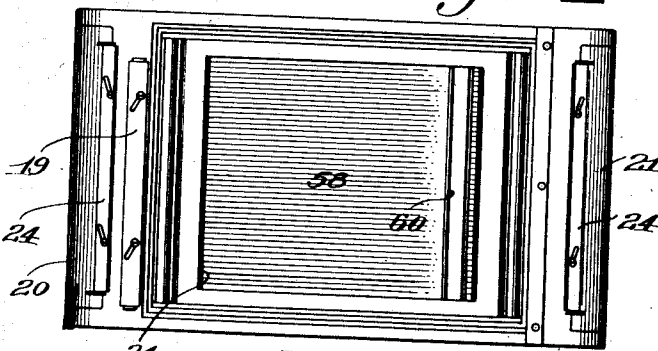
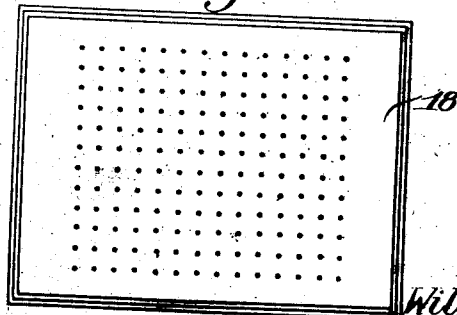


Fig. 7



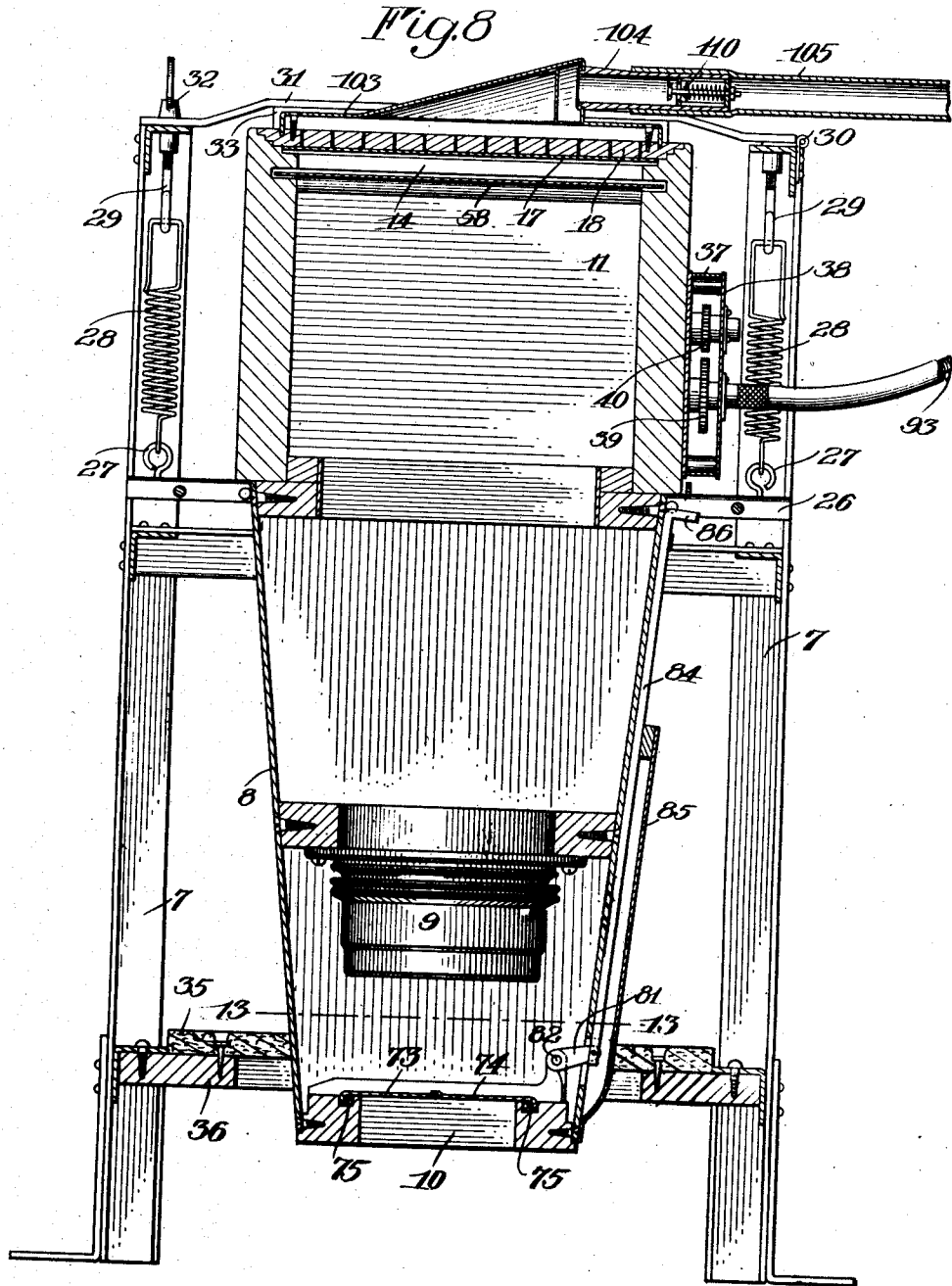
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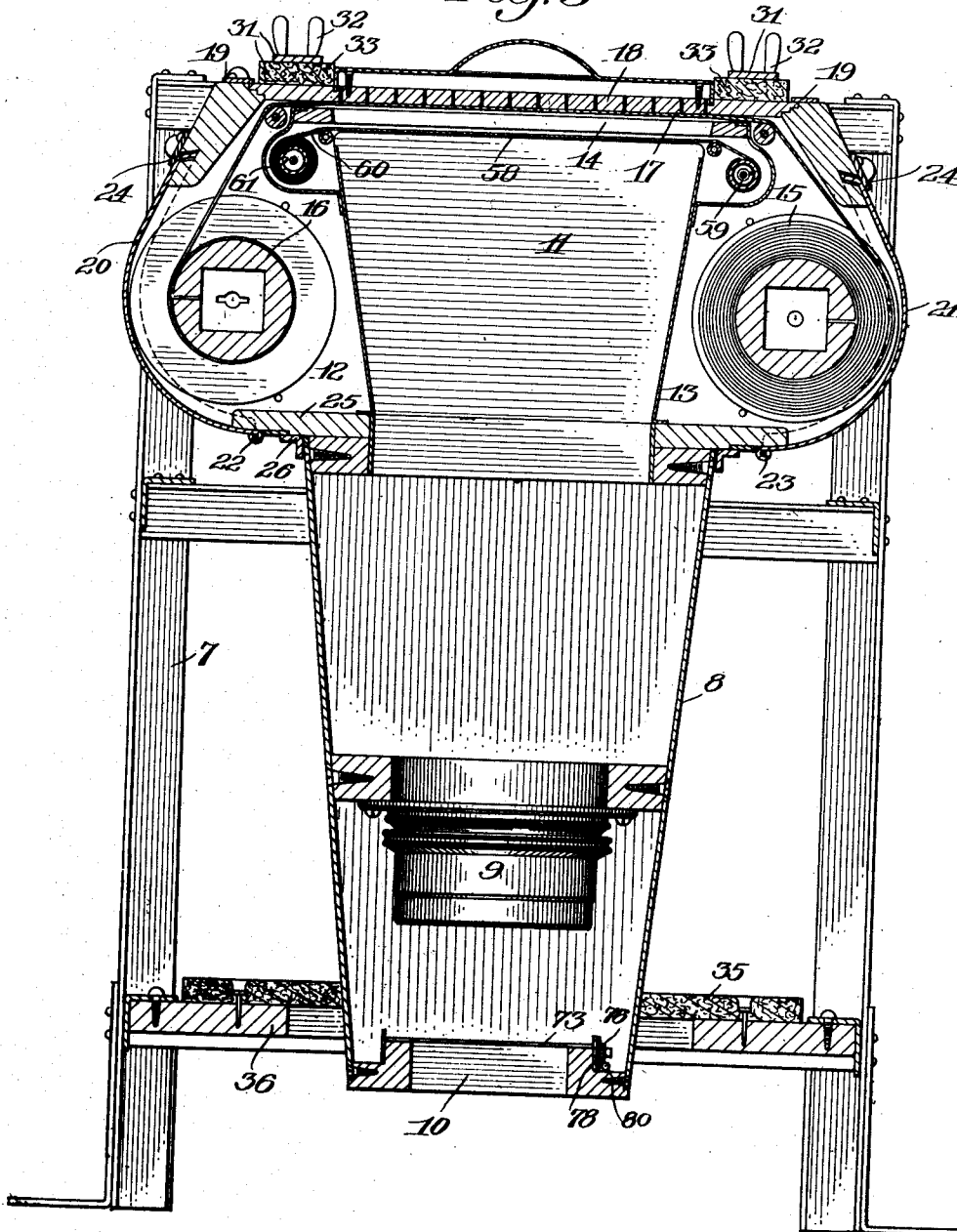
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Fig. 9



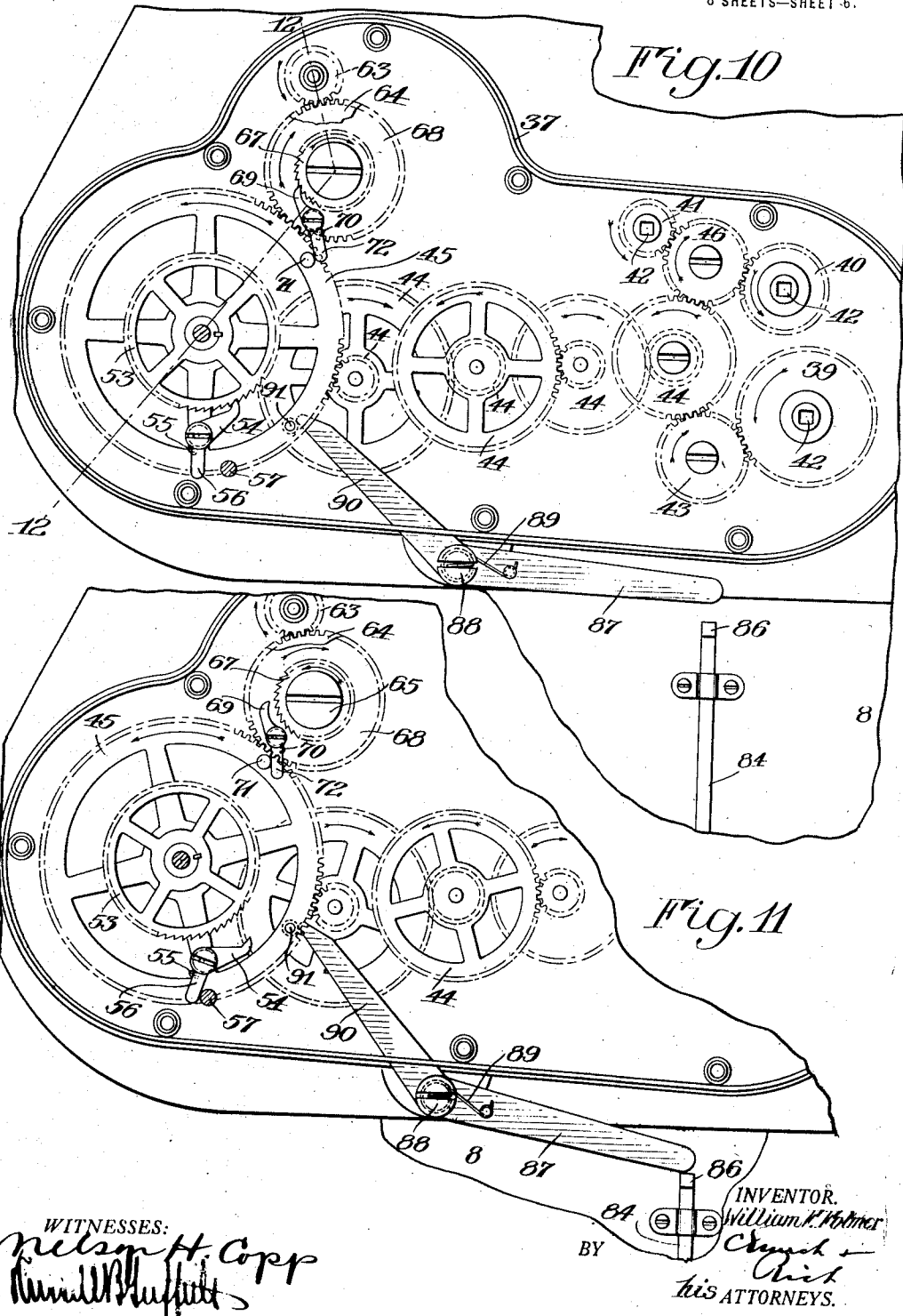
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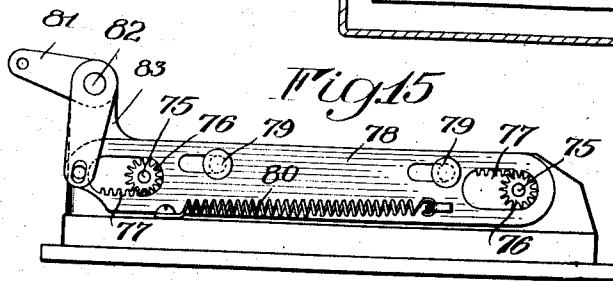
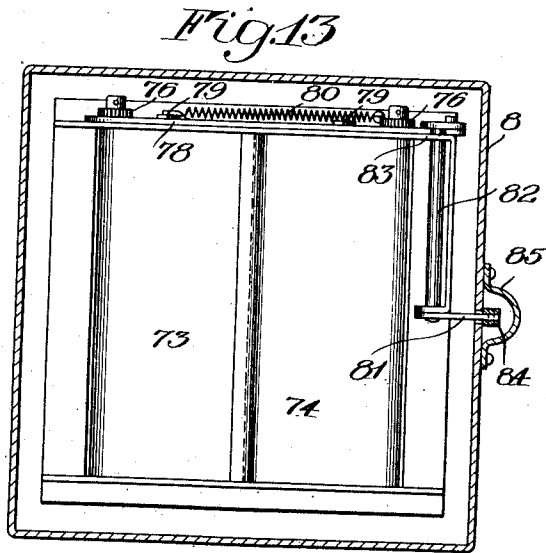
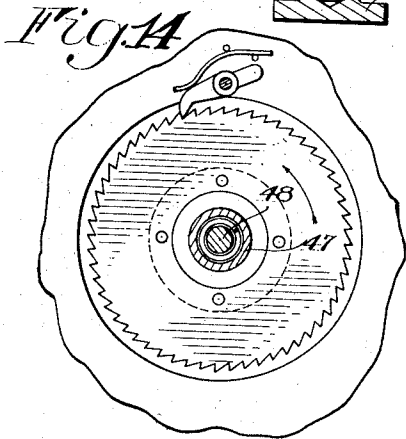
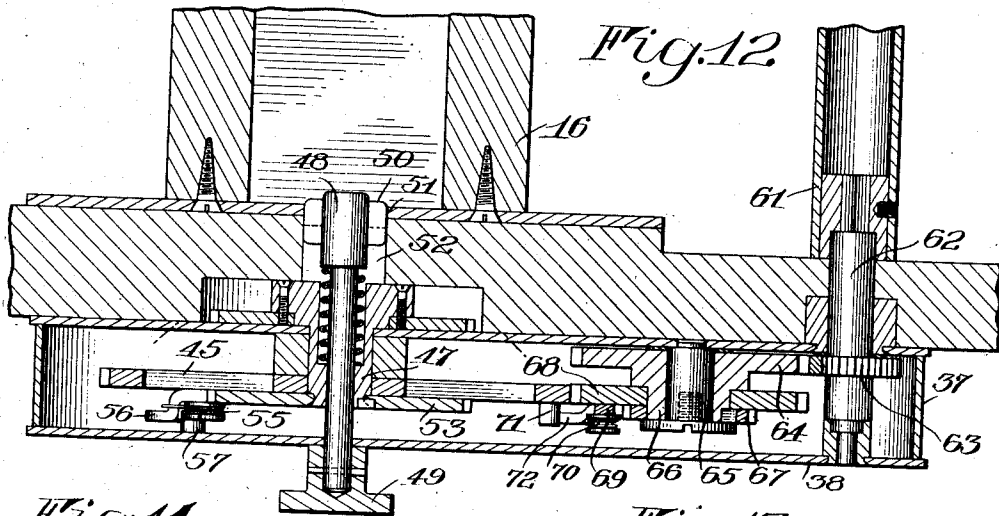
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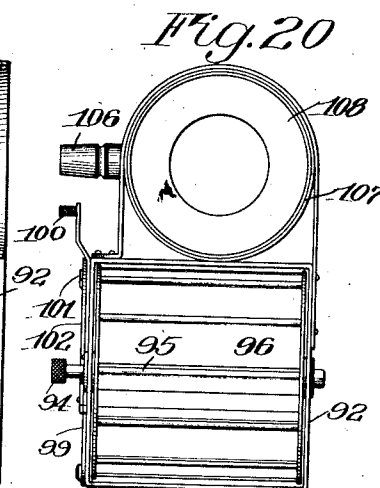
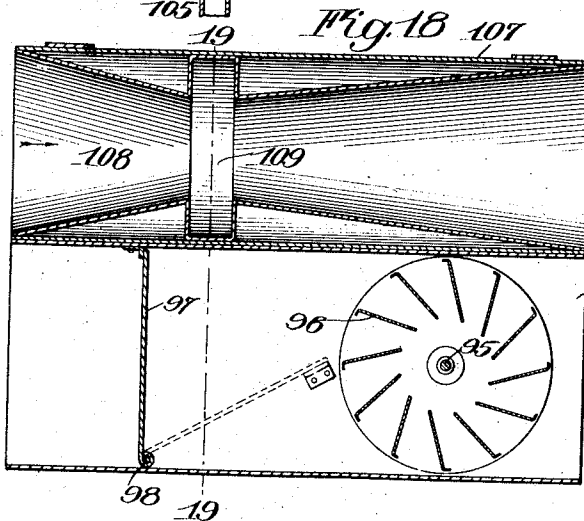
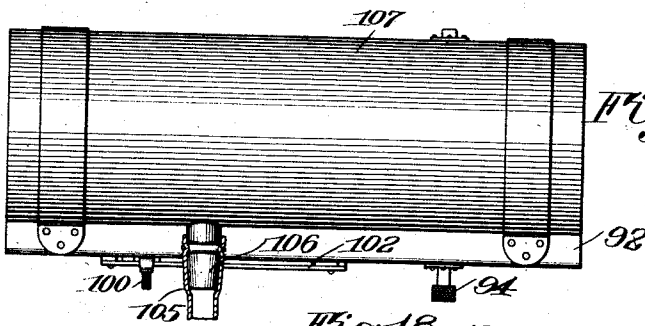
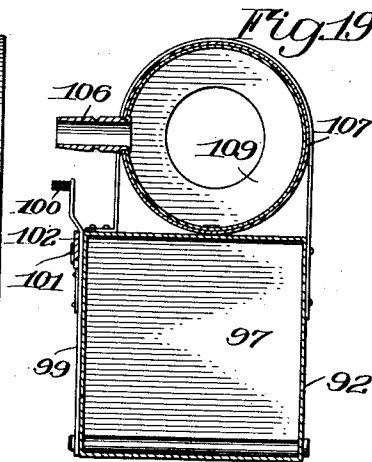
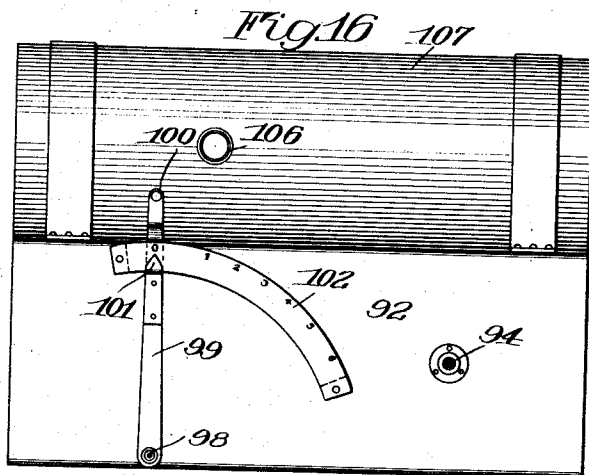
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UNITED STATES PATENT OFFICE.

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AUTOMATIC AEROPLANE-CAMERA.

1,309,798.

Specification of Letters Patent.

Patented July 15, 1919.

Application filed December 10, 1917. Serial No. 206,460.

To all whom it may concern:

Be it known that I, WILLIAM F. FOLMER, of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Automatic Aeroplane-Cameras; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the reference-numerals marked thereon.

My present invention relates to photography and more particularly to photographic cameras and it has for its object to provide an improved camera for automatically recording a panoramic view of the ground beneath from an aeroplane while in motion. The improvements relate in part to the mounting of the camera in the body of the aeroplane; to the motor devices for driving the film and other parts and to the arrangements whereby exposures are automatically made at the proper intervals in synchronism with the movements of the film strip through the camera. To these and other ends the invention resides in certain improvements and combinations of parts all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Figure 1 is a side elevation of an aeroplane provided with a camera constructed in accordance with and illustrating one embodiment of my invention;

Fig. 2 is an enlarged top plan view of a portion of the aeroplane body showing the camera and motor in top plan also;

Fig. 3 is a side elevation of the camera and its support;

Fig. 4 is a rear elevation thereof (with respect to the aeroplane);

Fig. 5 is a top plan view of the camera and its support;

Fig. 6 is a similar view of the camera alone with its back removed;

Fig. 7 is a plan view of the inner or under face of the back;

Fig. 8 is an enlarged section taken substantially on the line 8—8 of Fig. 3;

Fig. 9 is an enlarged section taken substantially on the line 9—9 of Fig. 4;

Fig. 10 is an enlarged view of the film winding and shutter operating mechanism

with the cover plate shown in Fig. 3 removed and with the parts in the position occupied before an exposure takes place;

Fig. 11 is a similar fragmentary view showing the positions of the parts during an exposure;

Fig. 12 is a section taken substantially on the line 12—12 of Fig. 10;

Fig. 13 is an enlarged horizontal section through the camera taken substantially on the line 13—13 of Fig. 8 to illustrate the mechanism of the safety shutter;

Fig. 14 is a fragmentary view partly in section showing the device for preventing back wind on the part of the film;

Fig. 15 is an enlarged side view of the mechanism of the safety shutter;

Fig. 16 is an enlarged side view of the wind motor that drives the camera;

Fig. 17 is a top view thereof;

Fig. 18 is a central longitudinal sectional view of the motor;

Fig. 19 is a transverse section taken substantially on the line 19—19 of Fig. 18, and

Fig. 20 is an end view of the motor.

Similar reference numerals throughout the several views indicate the same parts.

To first briefly describe the general nature of my apparatus in its present embodiment, it comprises a camera fixed to the body of an aeroplane with the axis of its lens vertically disposed so as to be directed toward the ground over which the machine flies. A film strip is wound through the camera in a direction opposite to that of flight; is halted at intervals while shutters are operated to effect an exposure and as its winding movement is continued between exposures, the main shutter is reset under the protection of a safety shutter, all of these movements being successive and automatic through the action of a constantly moving driving means so that a panoramic record of the area traversed is obtained. The power required is obtained from a wind motor under the convenient control of the pilot and in connection with the motor is provided an exhaustor for producing a vacuum whereby the film is held flat during exposure.

Referring more particularly to the drawings, there is shown in Figs. 1 and 2 an aeroplane of which 1 indicates the body, 2 the cock pit, 3 the deck and 4 the pilot seat. In rear of the latter is a hatch or opening 5.

and, directly below it, a smaller opening 6 in the bottom of the body. Above this opening 6 and accessible through the hatch or opening 5 is a preferably rectangular supporting structure 7 for the camera the body of which latter is indicated at 8.

Within the body portion 8 of the camera is the lens 9 opposite an opening 10 at the lower end alined with the opening 6 in the aeroplane bottom and above the lens 9 the camera body is widened to provide an exposure chamber 11 and film chambers 12 and 13 at the front and rear sides thereof. Above the exposure chamber 11 is the exposure opening 14 past which the film is fed (to the left in Fig. 9) from a supply roll 15 in chamber 13 to a winding roll or spool 16 in chamber 12, the portion of the film that is spread for exposure in the focal plane being indicated at 17. In rear of or above such portion is the camera back 18 which defines the focal plane and supports the film in a flat condition in a manner to be later described. This back may be removed bodily and when in place is secured (Fig. 5) in any suitable manner such as by the type of sliding bolt indicated at 19 which is commonly used in the art for this purpose. The film chambers 12 and 13 are provided with doors 20 and 21 pivoted at 22 and 23 to swing downwardly and held closed by bolts 24. These doors are of such extent as to give free access to the interior and through them the rolls 15 and 16 can be easily inserted or removed.

The camera is resiliently supported on the frame work 7. An enlargement thereof in the region of the film chambers strengthened by a frame 25 rests upon a floating frame 26 (Figs. 3, 8 and 9) and this frame 26 is suspended by means of eyes 27 from springs 28, the upper ends of which engage hooks 29 at the top of the support 7. Hinged at 30 at one side of the top of the framework 7 are a pair of retaining bars 31 having suitable devices 32 at the opposite side of the framework for securing them down. On their under sides they carry (Figs. 5 and 9) pads 33 of sponge rubber or similar elastic yielding material that engage the camera back 18 and hold the camera down with the springs 28 under slight tension. The lower end of the camera body 8 is held and steadied by engagement with sponge rubber contacting pads 35 carried on a frame 36 at the bottom of the framework 7. In this way, the camera is protected from sudden shocks and jars which would otherwise be apt to reduce the quality of the picture taken as a result of abrupt movements of the aeroplane.

The film winding mechanism is best illustrated in Figs. 3, 9 and 10 and in Fig. 12, it being borne in mind in considering these figures that the camera moves bodily with

the aeroplane to the right in each of them. The mechanism is inclosed within a case 37 secured to a side of the camera body and closed by a cover plate 38. Within the case are a plurality of gears 39, 40 and 41 having hubs 42 with square sockets therein accessible from their exterior through the cover plate 38 for the selective attachment of a power shaft hereinafter described. The large gear 39 communicates through a gear 43 with a train of gears 44 that drives a large gear 45 hereinafter called the driving member while the smaller gears 40 and 41 turn the same train through a gear 46 each at different speeds as will be understood. The driving member 45 turns freely on a hub 47 (Fig. 12) that contains the usual sort of spring winding key 48 terminating on the exterior in a knob 49. The enlargement 50 on this key locks into the usual slot 51 in the film winding spool or roll 16 and is also interlocked with a slotted portion 52 of the hub 47 so that it turns with the hub. Fixed to the latter is a ratchet 53 with which coöperates a pawl 54 on the driving member 45. This pawl is normally held in engagement with the ratchet by a spring 55 and when so engaged, the driving member turns the ratchet and with it the hub 47 and key 48. When the pawl is not engaged, the driving member 45 turns idly but continuously.

This pawl and ratchet mechanism just described is provided for the purpose of halting the travel of the film during an exposure and this is accomplished automatically. Upon every revolution of the winding roll or spool 16 and the driving member 45, one picture area of the film is drawn off and a new area presented in the focal plane. Upon the completion of that revolution, an arm 56 on the pawl 54 engages a stationary button 57 which trips the pawl as shown in Fig. 11 so that the driving member 45 turns idly for a brief space sufficient to make an exposure and the pawl rides off of the abutment and engages again with the ratchet to start another winding movement and carry on to the winding roll the exposed area of film. The feed of the latter is therefore intermittent.

Turning now again to Fig. 9, the main shutter employed is a curtain shutter 58 that moves across in front of the exposure opening 14 in the usual manner. It comprises a tension roll 59 upon which it is wound up during an exposure wherein a slit or aperture 60 normally retracted from the exposure chamber, passes across the focal plane. The shutter is set by being wound upon a winding roll 61 against the tension of the tension roll 59. The shutter is shown set in Fig. 9.

Referring now to Figs. 10, 11 and 12, this winding roll 61 of the shutter has fixed to

its journal 62 and within the case 37 a gear 63 that meshes with a gear 64 turning freely on a stud 65. Fixed to a hub 66 on this gear 64 is a ratchet 67 while turning freely on the hub beneath the ratchet is a gear 68 that is in constant mesh with the driving member 45. Carried by this gear 68 is a pawl 69 that is held against the ratchet by a spring 70. Thus, the driving member 45 continuously drives the gear 68 and it turns the gear 64 and hence the shutter winding roll 61 through the medium of the ratchet.

At the time the winding of the film is halted by the throwing out of pawl 54, the shutter 58 is released. This is accomplished by a trip or abutment 71 on the driving member 45 which comes in contact with an arm 72 on pawl 69 as shown in Figs. 10 and 11. Both of the pawls 56 and 69 are thrown out of engagement at the same time and the tension roll 59 thereupon actuates the shutter, gear 63 on the winding roll 61 turning idly and with it gear 64 and ratchet 67. As soon as the pawl 54 rides off of its abutment 57 and abutment 71 rides off of pawl 69, both pawls go back into engagement and the film begins to wind again and the curtain shutter to be reset.

During the resetting of the shutter, the film 17 is moving to the left in Fig. 9 and the shutter opening 60 also moves to the left across the field of exposure. It is therefore necessary to protect the film from exposure to light during the resetting of the shutter and for this purpose I provide a safety shutter best shown in Figs. 8, 9, 13 and 15 which shutter normally closes the opening 10 at the bottom end of the camera body. In the present instance, it is a pivoted blade shutter having overlapping leaves 73 and 74 turning on pintles 75. On the ends of the pintles are gears 76 which mesh with racks 77 on a sliding bar 78 guided on headed pins 79 secured to the frame in which the opening 10 is formed. A spring 80 normally holds the slide bar as shown in Fig. 15 so that the blades are closed and they are opened by the depression of a bell crank lever 81 pivoted at 82 on a fixed bracket 83.

Connected to the bell crank 81 is a push rod 84 partly housed in a case 85 on the outside of the camera body (Fig. 3). The upper end of the push rod is adapted to be engaged and depressed at 86 (Figs. 10 and 11) by a lever 87 pivoted at 88 adjacent to the casing 37. This lever is normally held raised out of contact with the push rod as shown in Fig. 10 by a spring 89 but the other arm 90 of the lever lies in the path of an abutment 91 on the driving member 45. Just before the pawls 54 and 69 are thrown out to halt the film and release the main shutter 58 and while they are out, the said abutment 91 rocks the lever 87 as in Fig. 11 and holds the safety shutter 73—74 open.

It closes immediately, before the rewinding of the curtain shutter commences again, under the influence of spring 80.

Referring now to Figs. 1, 2, 3 and 16 to 20, the power for driving the film winding and shutter operating mechanism is derived from a wind motor, the oblong tubular casing of which is indicated at 92. It is transmitted through a flexible shaft 93 one end of which is adapted to be selectively connected to any one of the square-socketed hubs 42 of the gearing whereby a gear ratio proportional to the speed of the aeroplane may be used and the film fed at the proper rate to obtain successive sections of a panoramic picture without either intervals or overlappings. The other end of the shaft is connected by a similar squared socket 94 to a shaft 95 (Fig. 18) extending transversely of the motor casing 92. Fixed to this shaft 95 is a wind wheel 96 in rear of an adjustable vane or gate 97 fixed to a rock shaft 98. The gate is shown in closed position in full lines in Fig. 18 and completely open in dotted lines. It may be regulated between these positions to admit greater or less air to the wheel 96 by means of an operating handle 99 on shaft 98. The operating member has a handle 100 and an indicator 101 that traverses the segmental scale 102 to indicate the position of the gate and hence the speed of the wind wheel. The motor is conveniently arranged at the side of the cock pit 2 so as to be convenient to the hand of the pilot.

It is also particularly desirable in a camera of this kind that the film be held flat and prevented from vibrating in the focal plane relatively to the lens as it would ordinarily have a tendency to do. For this purpose, the foraminous back 18 previously described is employed. Referring, for instance, to Fig. 8, a plate 103 spaced from the back and secured thereto forms a vacuum chamber above it provided with a nipple 104 to which is attached an air pipe 105. This pipe leads (Fig. 17) to a nipple 106 on an exhaustor 107. The said exhaustor embodies and contains a Venturi tube 108 with the central chamber 109 of which the nipple 106 communicates. A strong air current is driven through this tube by the travel of the aeroplane which, through the pipe 105, rarefies the air in the vacuum chamber 103 and keeps the film 17 flat against the back 18.

In order that the film may not be pressed so tightly against the back as to cause undue friction or interfere with the feeding movement thereof, I provide in the nipple 104 a familiar form of check valve as shown in Fig. 8.

I claim as my invention:

1. The combination with an aeroplane body having an opening in the bottom thereof, of a support above the opening, springs on

the support and a camera hung from the springs with its lens alined with the opening.

2. The combination with an aeroplane body having an opening in the bottom thereof, of a support above the opening, a frame movable vertically on the support, springs connecting the support and frame and a camera carried by the latter with its lens in alinement with the opening.

3. The combination with an aeroplane body having an opening in the bottom thereof, of a support above the opening, springs thereon, a camera suspended from the springs with its lens in alinement with the opening and resilient retaining members clamped against the camera against the tension of the springs.

4. The combination with an aeroplane body having an opening in the bottom thereof, of a support above the opening, springs thereon, a camera suspended from the springs with its lens in alinement with the opening, said camera having a removable back at the top of the frame and resilient retaining members clamped against the back to hold it in place and to hold the camera against the tension of the springs.

5. The combination with an aeroplane body having an opening in the bottom thereof, of a support above the opening, a camera arranged with its lens in alinement with the opening, springs connecting the upper portion of the camera with the support and a frame of soft resilient material surrounding the lower portion of the camera.

6. In an aerial camera, the combination with an aeroplane and a camera mounted thereon with the axis of its lens vertically disposed, of means for feeding film through the camera, a foraminous back support for the film and an exhaustor arranged to receive and be operated by air currents created by the passage of the aeroplane through the air for creating a vacuum in rear of said support.

7. In an aerial camera, the combination with film winding mechanism embodying a

winding roll, and a continuously moving driving wheel, of a curtain shutter, a spring actuated tension roll therefor, a shutter winding roll therefor normally turned by the driving wheel, a clutch connection between the latter and the winding roll and means for throwing out the clutch to permit the operation of the shutter under the influence of the tension roll.

8. In an aerial camera, the combination with film winding mechanism embodying a winding roll, a continuously moving driving wheel and a clutch connection between the two, of a curtain shutter, a winding roll therefor, a clutch connection between the latter and the driving wheel, means for throwing out the first mentioned clutch to halt the film and means for simultaneously throwing out the last mentioned clutch to permit the operation of the shutter.

9. In an aerial camera, the combination with film winding mechanism embodying a winding roll, a continuously moving driving wheel and a clutch connection between the two, of a curtain shutter, a winding roll therefor, a clutch connection between the latter and the driving wheel, a normally closed safety shutter between the curtain shutter and the lens, means for throwing out the first mentioned clutch to halt the film, means on the winding mechanism for at the same time opening the safety shutter, and means for throwing out the last mentioned clutch to permit the operation of the curtain shutter while the film is at rest.

10. In an aerial camera, the combination with film winding mechanism embodying a continuously moving driving member and a curtain shutter, connected for rewinding to the driving member to move with the film, of means for halting the film, means for tripping the shutter while the film is halted and a closure for the camera lens operable while the film and shutter are in motion.

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