

Fifty Years of Aerial Photography— Beginning in 1880*

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ABSTRACT: A survey of old patents reveals an interesting story about the progress of aerial photography and photogrammetry over a fifty-year period beginning about 1880. There are illustrations showing original patent drawings for early balloon, kite and airplane airborne equipment. Many of the problems we still have were recognized and attempts were made to solve them. The present advanced state of photogrammetry and aerial photography owes a lot to the ingenuity and persistence of these early pioneers.

SHORTLY after assuming my present job in 1945, I discovered in the rather complete files of our office three large notebooks containing patents on various types of photographic and photogrammetric equipment. This group of patents represented more than someone's hobby collection. They were carefully indexed and tabbed. A red pencil had been used liberally on many of them to underline certain claims or other items of interest or to make marginal comments. Correspondence associated with the patents indicate that they had been collected by one of our former members, the then Captain, now Brigadier General, B. B. Talley. The patents covered a period from 1886 to 1936, very important years in the history of aerial photography and photogrammetry.

The purpose of this paper is to share with you some of the more interesting patents of this collection. It is not possible, in the time allotted, to discuss more than a few of the many dozens on hand. I have selected at random, without attempting to show trends in development, old principles which should be reconsidered, or any other particular line. In other words, this speech is for entertainment only, with no axes to grind.

I will not attempt to show enough views of the equipments nor to describe them sufficiently to explain how they work. In the first place, there is not enough time for



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this; in the second place, I do not know how most of them work.

Some of these are quite comical and some of the claims seem a bit naive, but it is not my intention to ridicule any of the patents nor the inventors. Rather than ridicule, I wish to praise the ingenuity, foresight, and industry of these early pioneers in photogrammetry.

* Presented at 23rd Annual Meeting of the Society, Shoreham Hotel, Washington, D. C., March 3-5, 1957.

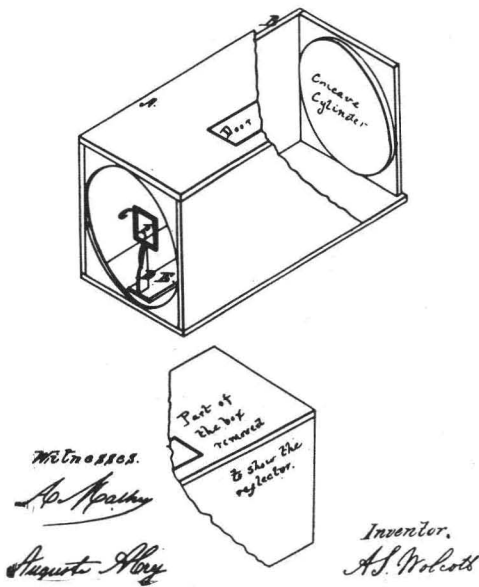


FIG. 1

FIGURE 2. On Aug. 2, 1887, Mr. J. Fairman, of New York City, obtained a patent for an "Apparatus for Aerial Photography" (No. 367,610). Mr. Fairman states, "The object of my invention is to provide a method of and apparatus for taking photographic views from a great altitude without the necessity of the presence of an operator. In carrying out my invention I attach to a balloon, kite or suitable projectile a photographic camera, with its lens and tube pointing vertically downward, or at any desired angle, and I provide the camera with a shutter actuated by a spring and controlled by clock-movements or other time arrangement, and I inclose the whole in an inverted funnel to insure steadiness during the ascent."

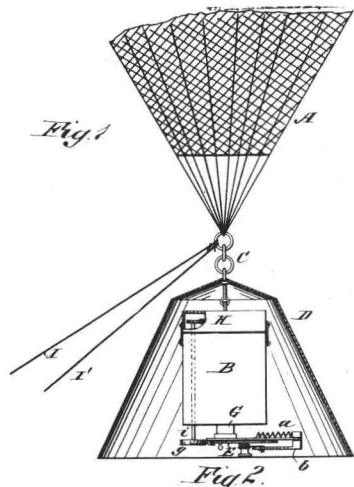


Fig. 2.

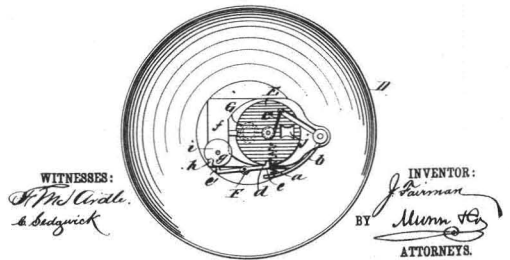


FIG. 2

FIGURE 3. A patent was granted to Mr. Edmund Edwards for Mr. Ludwig Rahrman, Germany, on July 25, 1891 (No. 12,669) for "A New Or Improved Apparatus for Obtaining Bird's-Eye Photographic Views." The description reads, "The present invention is applicable more especially to military operations, by taking

photographic bird's-eye views of fortifications or other positions occupied by an enemy from a distant position where they are not visible. The projectile is fired high in the air in the direction of the object to be photographed, a charge of explosive being then ignited and the parachute appara-

(continued on next page)

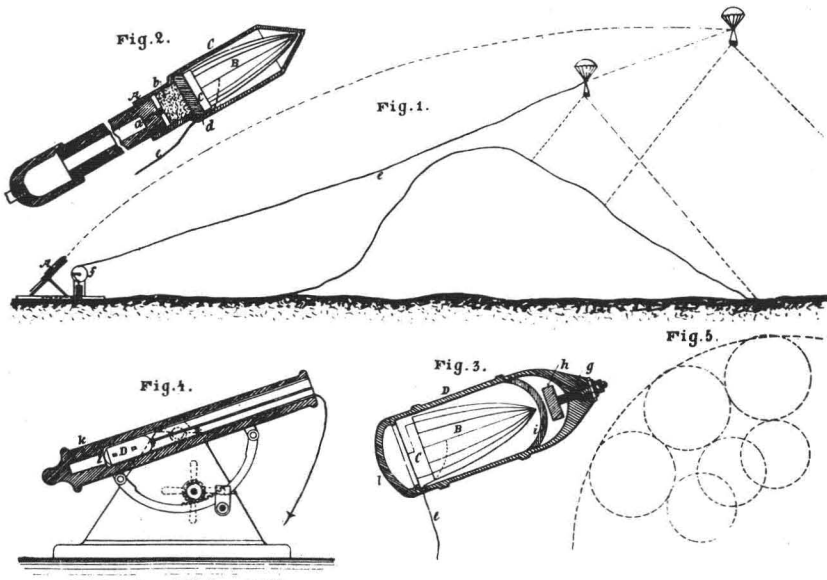


FIG. 3

tus being thereby set free from the projectile. The parachute then opens automatically, falling by itself, the photographic apparatus hanging perpendicularly below it, and by a suitable arrangement taking one or more instantaneous photographs of the positions on the earth below, the para-

chute being then brought back to the point from which it was projected by a line, one end of which is attached to it, the other being retained at the starting point." Mr. Rahrman suggests that his invention will work both with ordinary guns or with rockets.

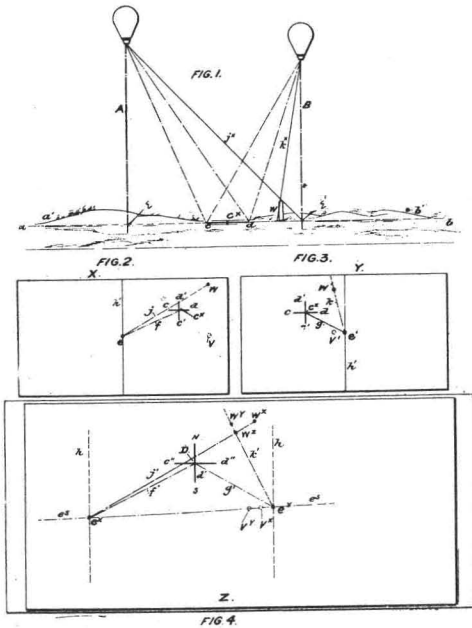


FIG. 4

FIGURE 4. On Dec. 12, 1893 (No. 510,758) Mr. C. B. Adams, Augusta, Georgia, obtained a patent on a "Method of Photogrammetry." He declares, "My invention has for its object to produce a method of obtaining aerial photographs, in such a manner, that the pictures obtained can be converted into topographic maps, to delineate not only the horizontal positions and distances of the objects correctly, but from which the altitude of the objects can be quickly and accurately ascertained, and such results obtained without the aid of other field instruments. My invention has also for its object to produce a method in which the results stated can be obtained in a simple manner with absolute accuracy."

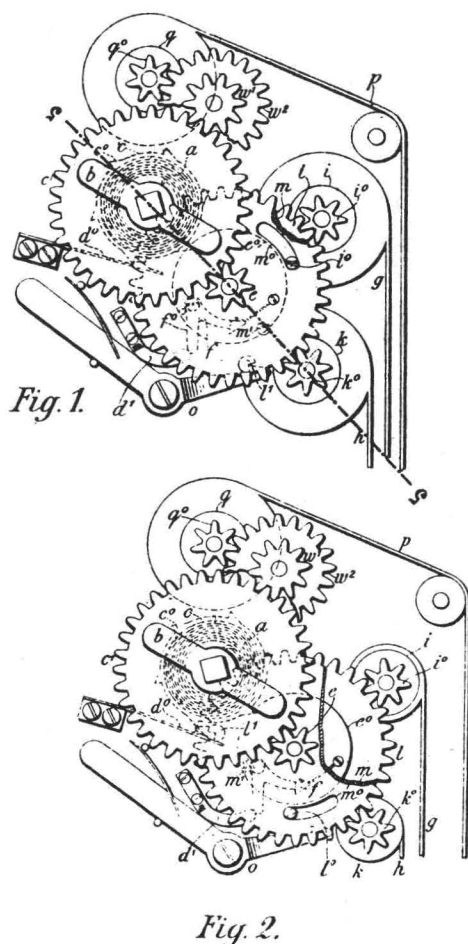


Fig. 2.

FIGURE 5. Mr. George Orth, Jena, Germany, was granted a patent on Jan. 18, 1901 (No. 1,196) on "Improvements in and Connected With Safety-Shutters for Use in Photography." "The invention is applicable to photographic cameras fitted with safety shutters, i.e., shutters which can, after exposure, be brought back to their former position without the necessity of obviating exposure by the use of objective cover or slide, as the exposure slit (or the like) of the shutter is automatically covered over before it repasses the opening. For shutters answering this description, the invention provides a winding mechanism which acts automatically after each exposure. Its principal working part is a mainspring which, after being wound up, acts by a series of partial movements corresponding to the number of successive releasements until its energy is exhausted."

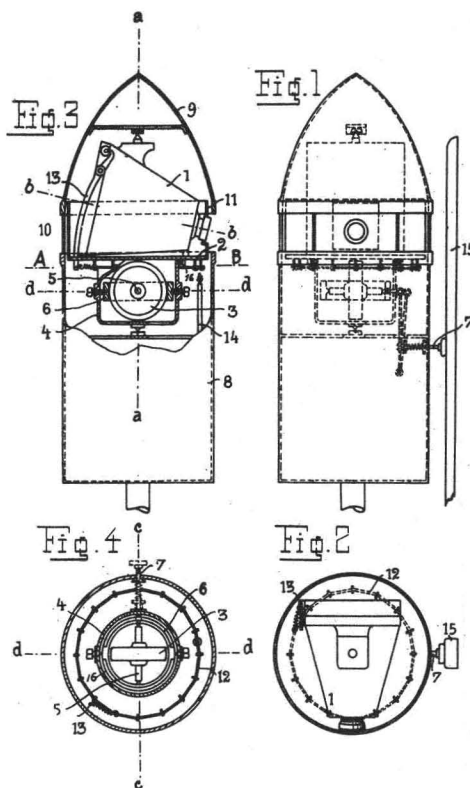


FIGURE 6. Mr. Alfred Maul of Germany obtained a patent on Aug. 13, 1907 (No. 863,035) for a "Device for Maintaining Instrument in Adjusted Positions." Mr. Maul states, "The subject of my invention is a device for maintaining an instrument in the position in which it has been adjusted, and is particularly applicable to apparatus, which, for the purpose of obtaining photographs of surrounding country, is projected into the air. The device consists of a vertical flywheel connected with the instrument and mounted so as to turn on two horizontal axes located at right angles to each other. After the instrument has been adjusted, the flywheel is caused to rotate at a very high speed, and since it is suspended by means of a universal joint, the instrument will be prevented from revolving on its vertical axis."

FIGURE 7. On Sept. 12, 1911, a patent was granted to Mr. Nat Brown of Grand Rapids, Michigan (No. 1,002,897) for an "Aerial Photographic Apparatus." Quoting Mr. Brown, "My present invention relates to the photographic art and has for its object to provide an apparatus adapted for use particularly in taking aerial photographs by means of a camera suspended in any suitable manner, as from a kite string or a captive balloon, at any desired elevation above the surface of the ground. More specifically, my invention comprehends an apparatus designed to be used in conjunction with a camera of the usual or any preferred construction, and comprising operating mechanism, whereby the camera may be automatically rotated, successive portions of the sensitized photographic surface brought into exposure position and the shutter operated, to enable one or more negatives to be made or pictures taken while said apparatus, and the camera, are out of reach of the operator and beyond his control."

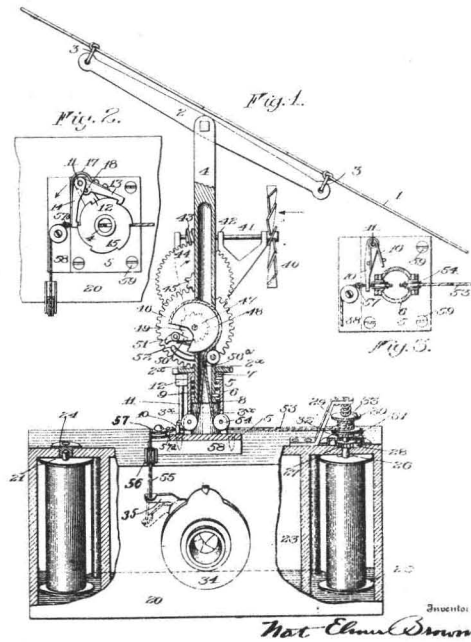


FIG. 7

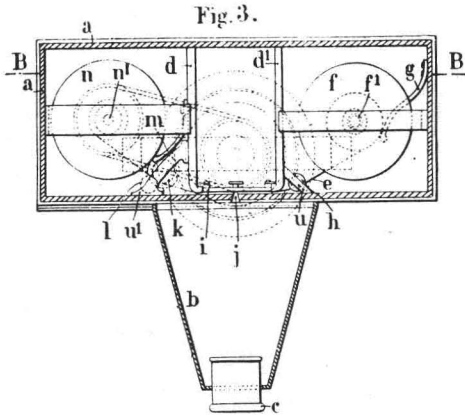


Fig. 3.

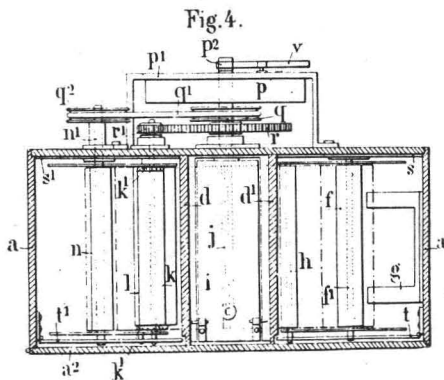


Fig. 4.

FIG. 8

FIGURE 8. Mr. Auguste Baron of Paris, France, was issued a patent on Aug. 3, 1912 for "Improvements Relating to Panoramic Photographic Apparatus." (No. 18,026). "This invention relates to photographic apparatus comprising a panoramic or like camera of the kind wherein the film is moved across a slot through which the image to be photographed is projected, at approximately the same speed as the movement of the image due to movement of the camera. The present invention is characterized by the application to an aeronautical machine of a camera of the type in which a film is moved behind a wall of the apparatus having a slot formed therein, whereby during the combined movement of the film and of the aeronautical machine, successively forms an image on successive portions of the film. The said apparatus provides for registering on a sensitized film of indefinite length a topographic photograph of territory of an unlimited length."

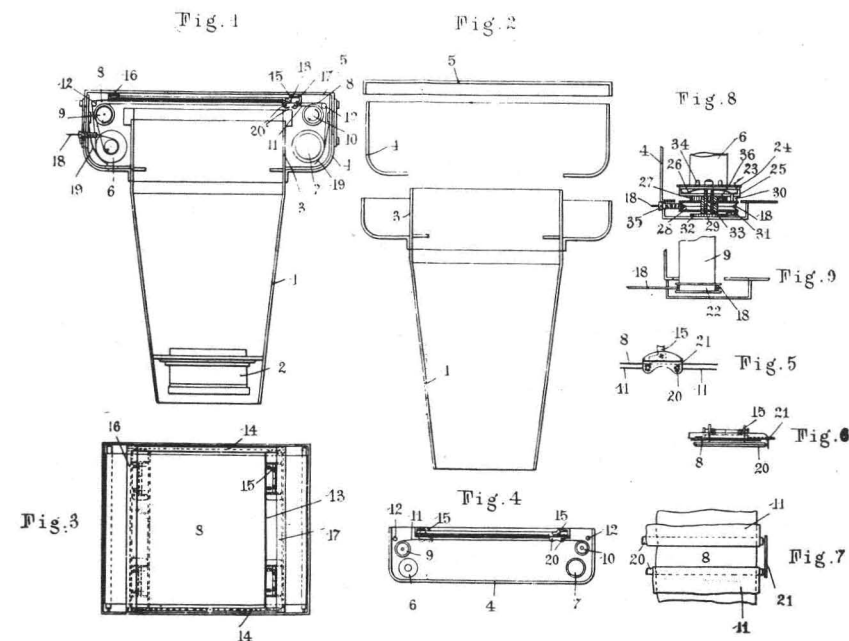


FIGURE 9. On Jan. 16, 1914, Mr. Paul Boucher of France was given a patent on "Improvement in or Relating to Photographic Apparatus" (No. 1,276). Mr. Boucher states, "This apparatus has been specially designed for facilitating photography from an aeroplane. It is known that the airman is obliged to give all his attention to the operation of the aeroplane and that consequently it is impossible, or very difficult, for him to take photographs, or at least good photographs, with the existing apparatus. The apparatus according to this invention differs from all known arrangements, and enables photographs to be obtained by the simple operation, even from a distance, of a cord which, in one movement, effects all the manipulations required for obtaining a negative. A single pull of the cord effects the following operation:

1. It moves the film for a new exposure.
2. It sets the roller-blind shutter, without it being necessary to cap the lens in order to prevent exposure of the film during

the setting.

3. It releases the film thus brought in front of the object glass.

4. It exposes the film.

All these operations are rendered possible by the general construction of the apparatus, and more particularly by the use of an absolutely new feature, namely, a carriage with claw tappets, which moves the film to the desired amount, releases it when it has been moved, maintains the said film with the greatest accuracy in the focus of the lens, and finally, in view of the space existing under the carriage between the two ends of the shutter blind, exposes the film during the return of the blind to its original position." Mr. Boucher declares further, "It must be pointed out that no accident in working is possible, that no error can be made, the working of the shutter blind and the stoppage of the film can take place only when the carriage has struck one of the cross-bars arranged for the purpose, and has thus released the film."

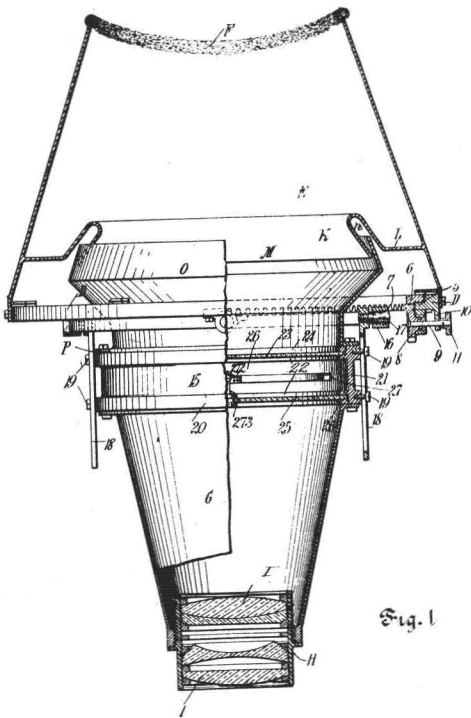


Fig. 1

FIGURE 10. Mr. Melvin Vaniman of Atlantic City was granted a patent on Jan. 20, 1914 for a "Speed and Direction Indicator for Airships" (No. 1,084,831). He writes, "With such apparatuses as the balloonist has at his disposal in the existing state of the art, it is difficult for him to obtain any accurate idea of the direction in which, or the speed at which, his ship is going. My invention presents to the balloonist an instrument by which, as long as some point on the surface of the earth is visible, he can tell his direction of motion quite as accurately as can a mariner at sea and by which, as long as the height above earth is known, he can tell his velocity with somewhat similar accuracy."

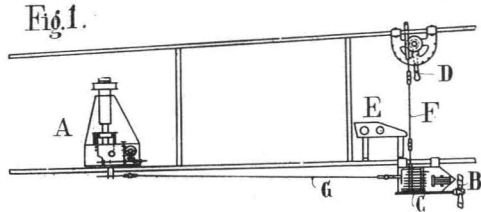


FIGURE 11. On Oct. 10, 1916, Lt. Col. Guilio Douhet of Italy and Mr. Ernesto Zollinger of Switzerland were issued patents on a "Photographic Apparatus for Use in Aerial Navigation" (No. 1,200,819). The inventors state, "The present invention relates to a photographic apparatus for aeroplanes, dirigible airships, and like machines for aerial navigation by means of which it is possible to photograph automatically upon a continuous film, the ground flown over by the aeroplane, and moreover register for each successive plate, the position and the corresponding height of the aeroplane. In the constructional form shown in Fig. 1, the whole of the apparatus is mounted on the chassis of an aeroplane. The camera *A* has a compass and a barometer on its top; the feeding of the film and the tripping of the shutter of both objectives is controlled automatically by means of the screw *B* actuated by the current of air produced either by the engine screw or the aeroplane itself, owing to the speed of the latter. The change speed gearing *C* is controlled by the lever *D* situated in easy reach of the aviator from the seat *E*, which lever is connected by an articulated shaft *F* with said gearing and the latter is connected with camera controlling means by the articulated shaft *G*."

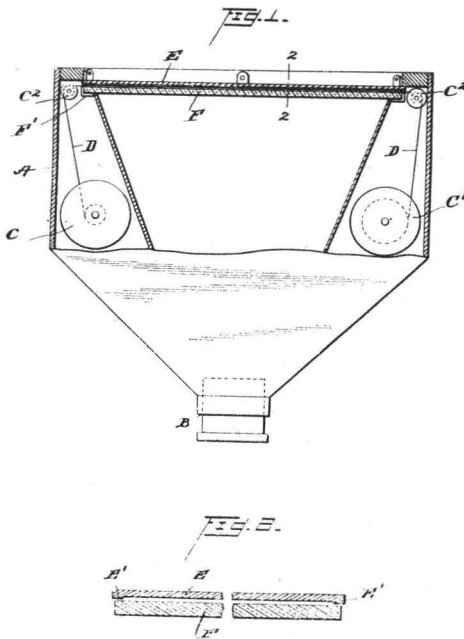


FIGURE 12. On April 8, 1919, Mr. Arthur Brock, Jr., of Philadelphia, Pennsylvania, received a patent for a "Film Camera" (No. 1,300,114). He states, "My present invention has for its object to provide a film camera with simple and effective film guiding means adapted for the successful production of large scale negatives comparable in size with large plate negatives, notwithstanding the tendency to wave effects in, and the buckling of the film, which have heretofore made it practically impossible to make film negatives comparable in size with the larger plate negatives." This invention "comprises a glass plate through which exposure takes place, and a plate located at the opposite side of the film from the glass plate, and having opposite side edges separated from the glass plate by a distance approximately equal to the thickness of the film and being slightly cut away between said side edges."

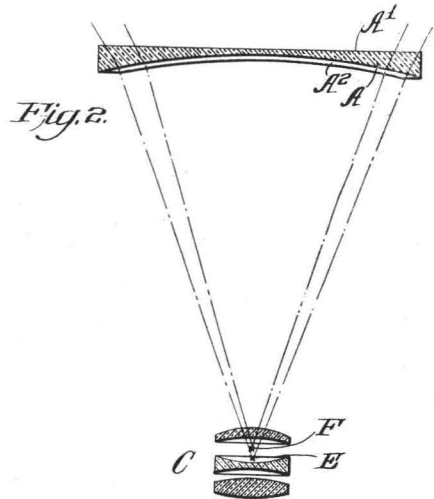
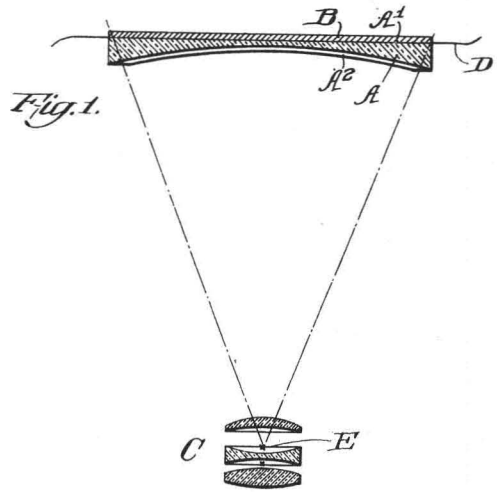


FIGURE 13. Photographing through a glass plate causes distortions, so on September 9, 1919, Mr. Lodewyk Holst, of Philadelphia, received a patent for "Film Support for Cameras" (No. 1,315,307). "The purpose of the present invention," the patent states, "is to provide means whereby in fixed focus film cameras the film can be maintained accurately flat by resting on a transparent support, being pressed in contact therewith by pressure plates, and by which means the shortening or distortion of the image is prevented."

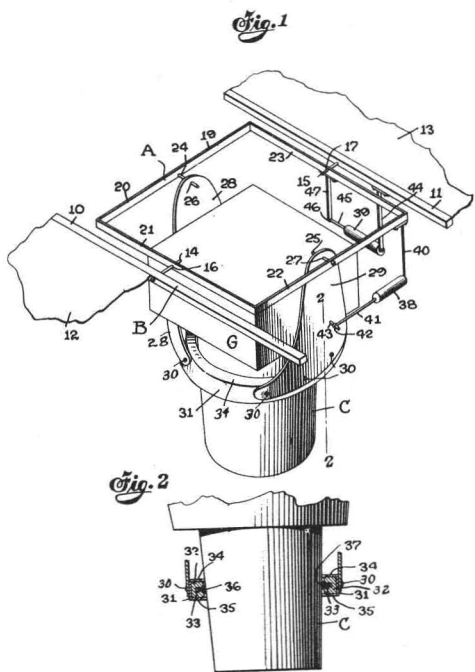


FIGURE 14. On Jan. 29, 1924, Mr. Edmund R. Morton, of New York City, was issued a patent on "Airplane-Camera Suspension" (No. 1,482,244). He declares, "It is the object of the present invention to provide camera mountings of the type referred to which shall avoid the numerous defects of the mountings hitherto used, by providing mountings which shall not only render it possible to maintain the camera in a substantially vertical or other predetermined position, but which shall also minimize the various oscillatory, vibratory and other undesirable motions of the camera which tend to blur the image of the objective, especially when the camera is used on an airplane or similar device which is subject to changes of speed and direction and to the vibrations due to the motor and to air currents."

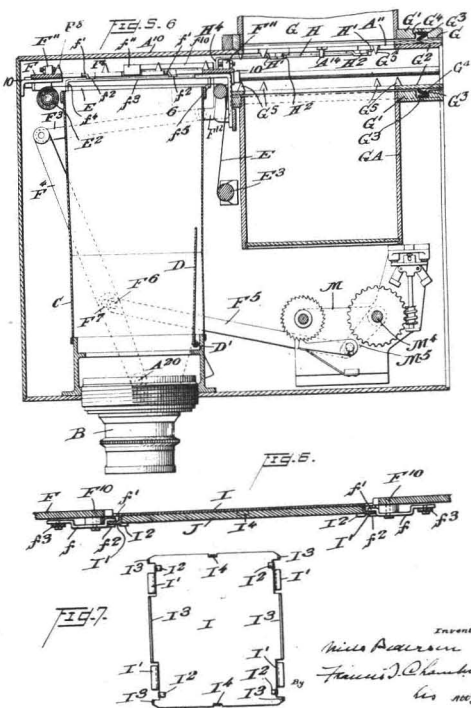


FIGURE 15. On July 29, 1919, Mr. Niels Pedersen, Assignor to Arthur Brock, Jr., of Philadelphia, Pennsylvania, was awarded a patent on an "Automatic Plate Camera" (No. 1,311,416).

Inventor
 Niels Pedersen
 Francis J. Chambers
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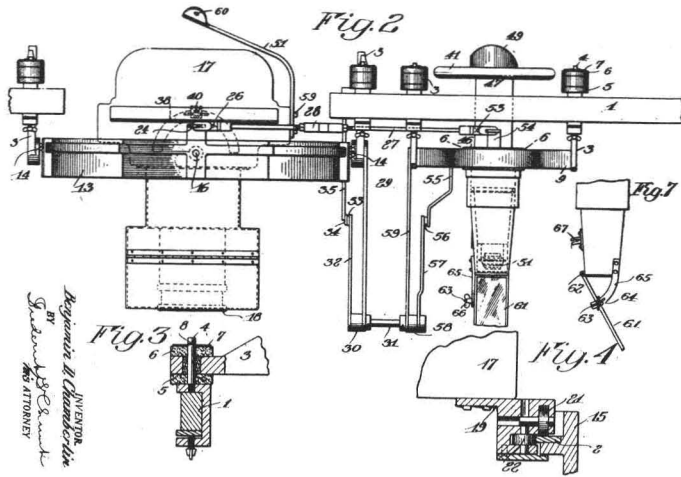


FIGURE 16. Mr. Benjamin Chamberlin, Assignor to Eastman Kodak Company, of Rochester, New York, was granted a patent on July 22, 1924 (No. 1,502,173) for an "Aerial Camera" which had a viewfinder associated with the controlling member

and "having its movements correlated with those of the camera whereby the operator may both view his object and operate his camera from a seat arranged at a distance therefrom."

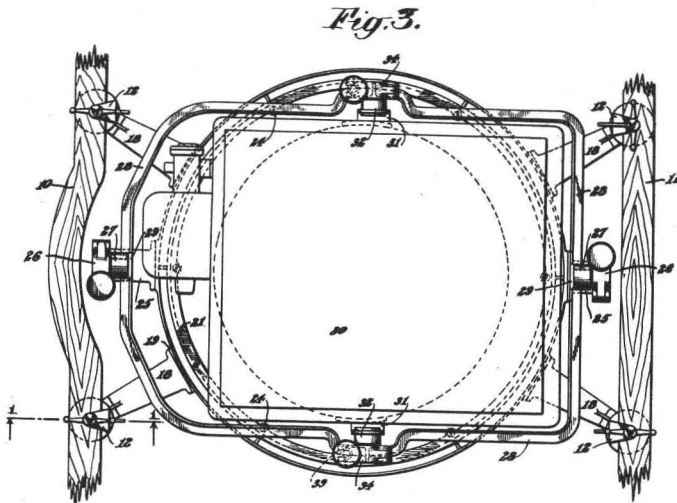
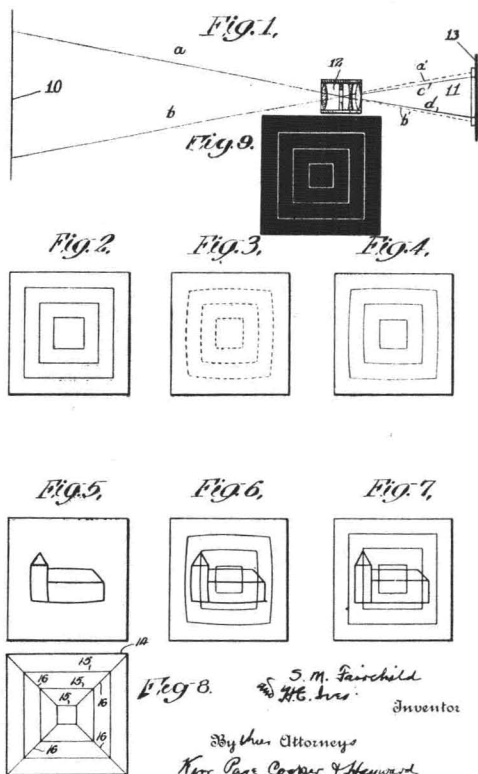


FIGURE 17. On Dec. 2, 1924, Mr. Sherman Fairchild of New York City was

granted a patent for a "Universal Mounting for Aerial Cameras" (1,517,550).

FIGURE 18. Mr. Sherman Fairchild of New York City and Mr. Herbert Ives of Montclair, New Jersey, in June 1925 received a patent on "Making Photographs for Mapping and Other Purposes" (1,541,555). The chief object of this invention was "to provide a simple and effective method of making photographs so that film negatives or prints therefrom, even when the negative is made with a non-rectilinear lens, or through a glass filter or supporting plate, can be used for the purpose indicated without material sacrifice of accuracy in the drawing, or can be used as photographic maps without rectification."



S. M. Fairchild
H. E. Ives
Inventor

By their Attorneys
Kerr, Page Cooper & Heywood

FIG. 18

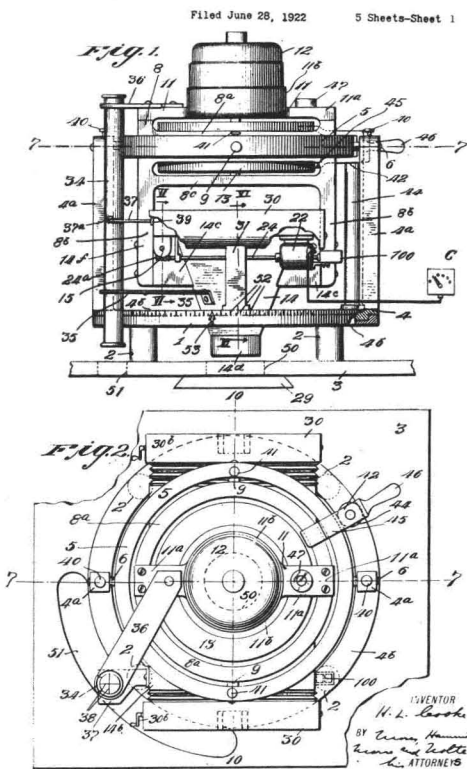


FIG. 19

FIGURE 19. On May 25, 1926, Mr. Lester Cooke, Princeton, New Jersey, Assignor to Aero Survey Corporation, was awarded patents on "Method of and Apparatus for Taking Photographs" 1,586,071 and "Method of Taking Photographs and Camera Mounting for Use in Connection Therewith." Mr. Cooke describes equipment and methods for providing forward image motion of a gyroscopically stabilized camera mount. One invention further provides "gyrostatic mechanism whereby the camera may be placed under neutral gyrostatic control so the axis of the camera will not be affected by small irregularities in the flight of the aircraft. The invention further contemplates a mechanism whereby the sensitized medium or film of the camera is carried by supports independent of the gyrostatic system so that . . . the position of the center of mass of the gyrostatic system will not be disturbed by the change of weight from one reel to the other."

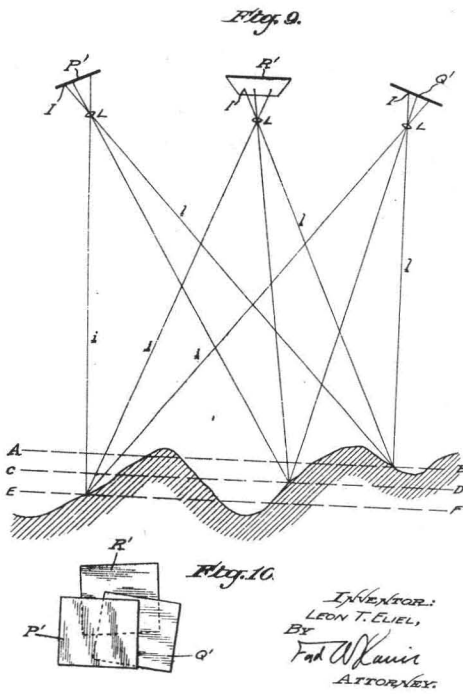


FIGURE 20. Shortly after going on active duty with the 30th Engineer Topographic Battalion in 1940, the author was told by his commanding officer, Col. (then Captain) F. O. Dierks, to investigate a method for determining tilts without ground control. The method was suggested by Mr. L. T. Eliel, Fairchild Survey Corporation, and was referred to by him as the three-plate method. The investigation showed that the method was practical if accurate differential flying heights could be established. I prepared a report on the investigation. When looking through these patent files, I discovered that Mr. Eliel had applied for a patent on the "Three-Plate Method" in 1925 and had been granted the patent on Jan. 15, 1929 (1,699,136).

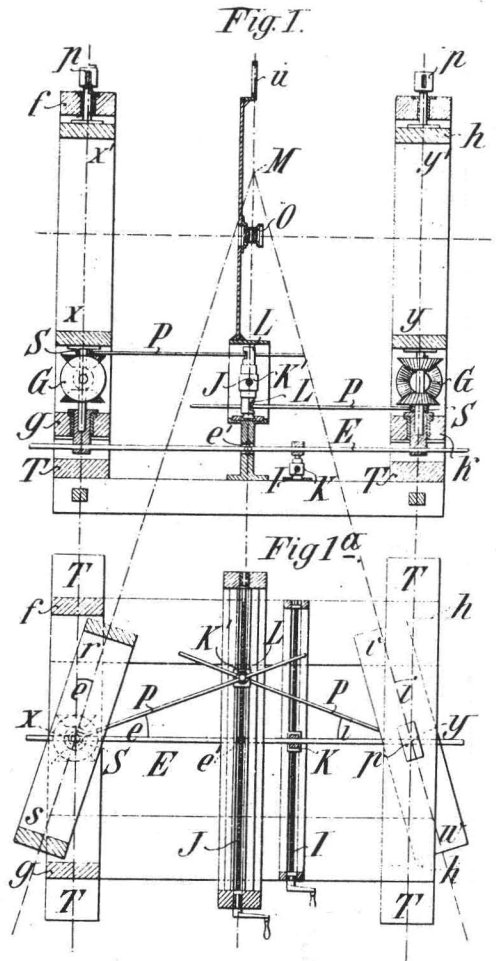


FIGURE 21. On Feb. 16, 1904, a patent was granted to Mr. Theodore Scheimpflug for "Apparatus for the Systematic Alteration of Plane Pictures by Means of Spherical Lenses or Mirrors" (No. 752,596). Near the beginning of a rather lengthy description he states, "The first condition to be satisfied in order to produce clearness of definition of the image is the following: The plane of the original, the plane of the image, and the plane of the objective must always intersect one another in a straight line."

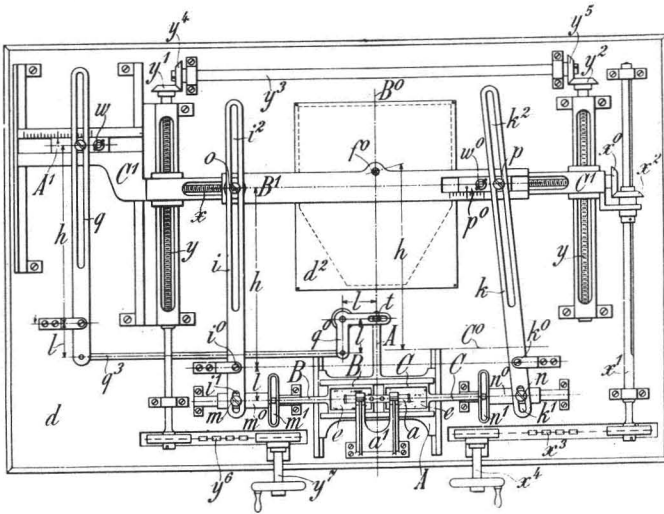


FIGURE 22. On March 17, 1914, Mr. Edward Von Orel of Austria patented the "Stereo-Isohypsograph" (1,090,494).

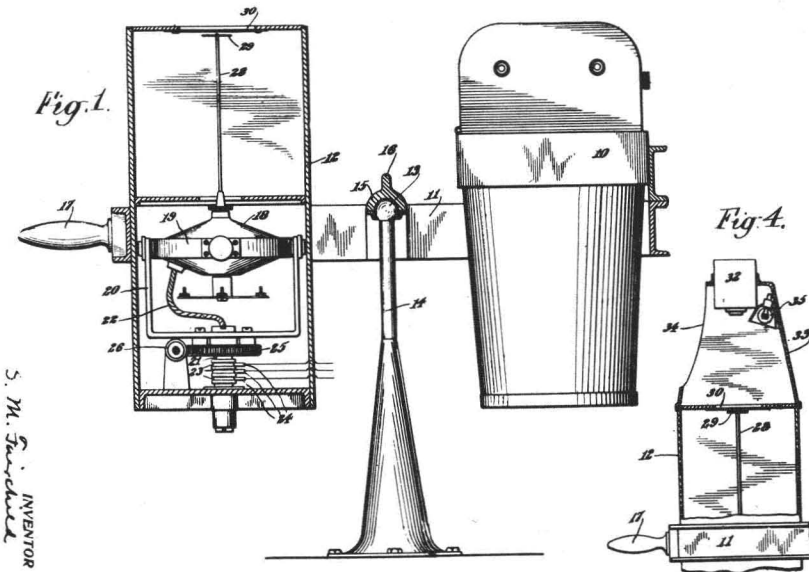


FIGURE 23. On July 21, 1925 (No. 1,546,372) Mr. Sherman Fairchild patented a means for "erecting" a gyro used as a vertical indicating device and also in-

cluded a means for photographing the indicator to record the divergence, if any, of the camera axis from the desired position.

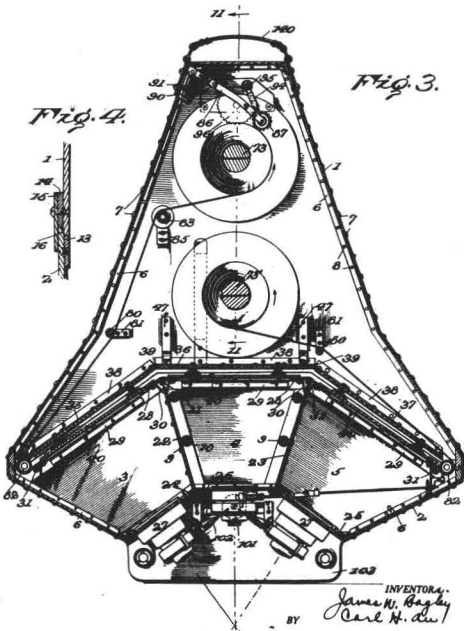


FIGURE 24. Major James W. Bagley of Fayetteville, Tennessee, and Carl Au of Washington, D. C., patented a three-lens camera on Oct. 27, 1925 (No. 1,559,400).

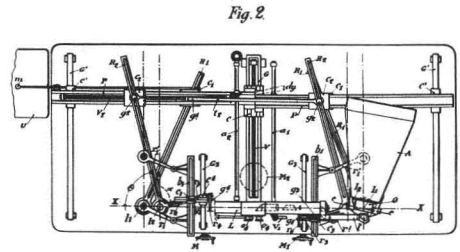


FIGURE 25. On Nov. 12, 1929, Mr. L. T. Eliel patented a "Process of and Apparatus for Making Aerial Photographs" (No. 1,735,109). This apparatus turned out to be a camera with nine lenses.

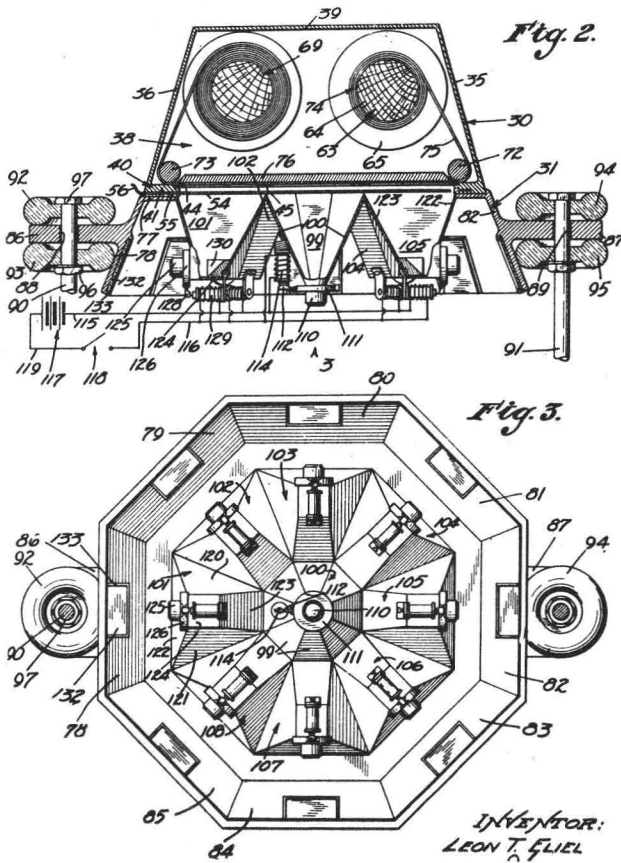
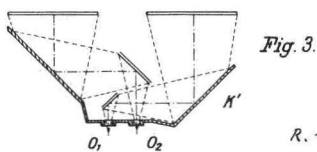
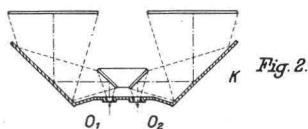
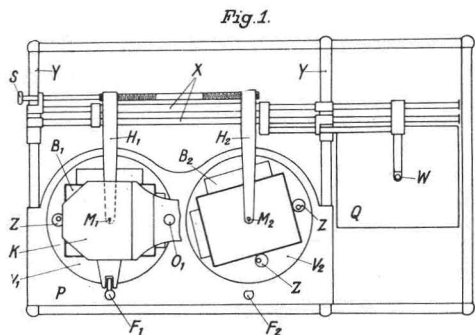


FIGURE 26. Georges Jean Poivilliers of Paris, France, was granted a patent on July 10, 1928 on an "Apparatus for Automatically Drawing Maps and Plans From Two Terrestrial or Aerial Photographs" (No. 1,676,708).



Inventor:
R. Hegershoff

FIGURE 27. On Oct. 13, 1931, Mr. Reinhard Hegershoff of Dresden, Germany, patented a "Tracing Appliance for Pairs of Measuring Pictures" (No. 1,847,473).

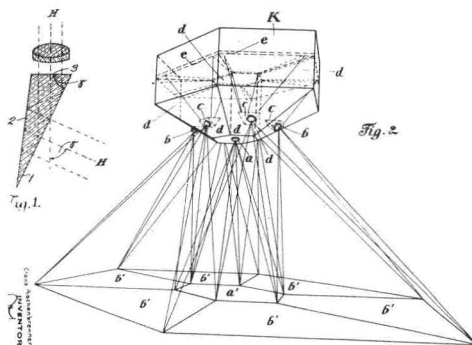


FIGURE 28. Dr. Claus Aschenbrenner of Munich, Germany, was granted a patent on March 24, 1931, for "Multiple Chamber for Taking Photographs from Airplanes" (No. 1,797,849).

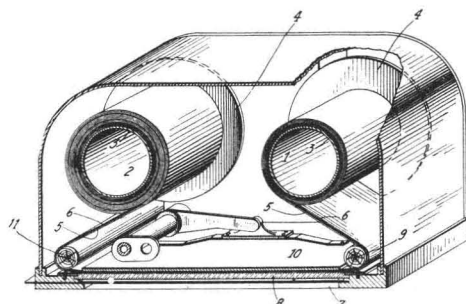


FIGURE 29. On March 8, 1932, Mr. E. H. Corlett of Lewisburg, and Mr. George M. Smith, Jr., of Brooklyn, Assignors to Fairchild Aerial Surveys, were issued a patent for "Means for Dissipation of Static Electricity in Film Cameras" (No. 1,848,871).

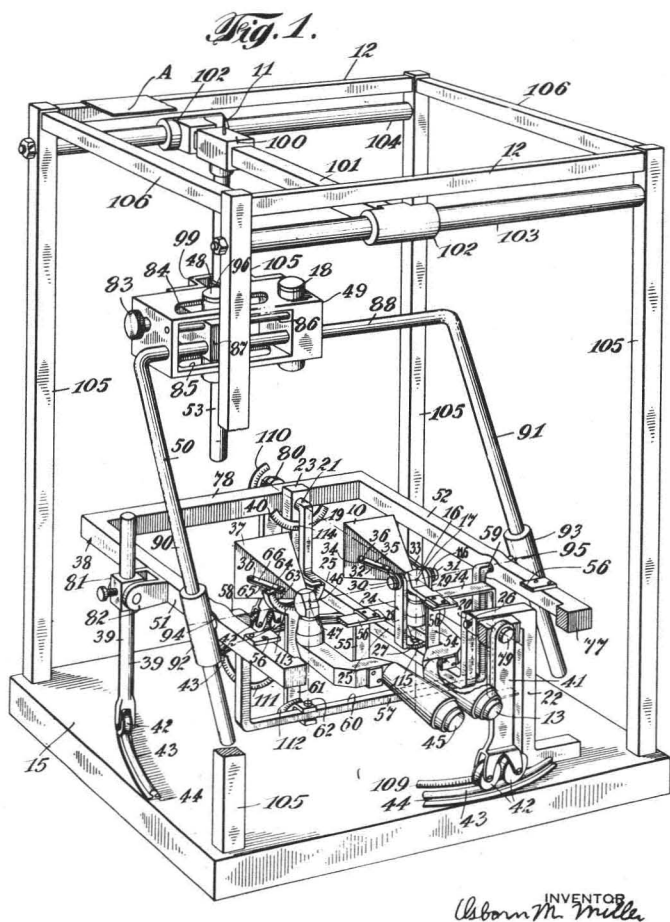


FIGURE 30. And on Dec. 25, 1934, Mr. O. M. Miller, of New York City, patented

an instrument for "Stereoscopic Plotting of Contour Maps" (No. 1,985,260).

In the year 1934, a small group of men began experimenting with a thing called the American Society of Photogrammetry. As the result of a lot of work, faith, and foresight, this experiment has been developed into a progressive and respected technical society of which we all can be proud. The presentation in this paper considered only a small percentage of the pio-

neers who laid the firm foundation in photogrammetry and aerial photography on which our Society was built. This Society and photogrammetric societies throughout the world are a living tribute to all who have contributed and are still contributing to the great science of photogrammetry.