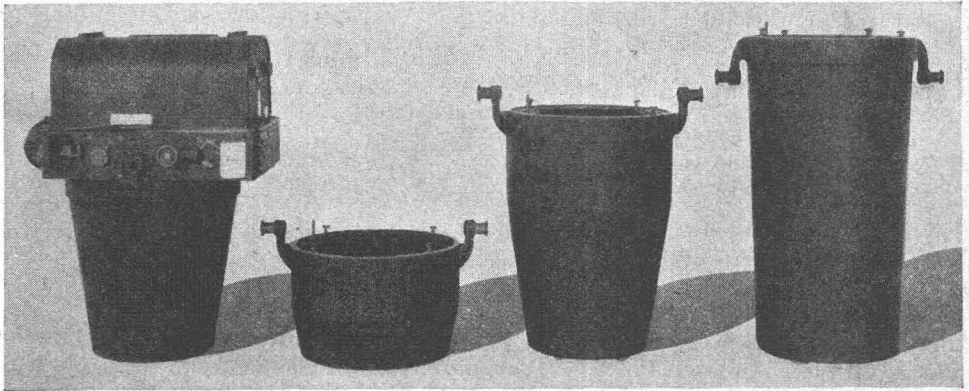


AERIAL CAMERAS AND PHOTOGRAMMETRIC EQUIPMENT: A QUARTER CENTURY OF PROGRESS

Revere G. Sanders, Fairchild Camera and Instrument Corp.

IT HAS been said of any scientific development that it has to pass through three stages. The first, in which the popular verdict is that the thing can't possibly be done; the second, in which it begins to be said that perhaps it could be done, but even if it could it wouldn't be of any use; the last, in which it is impatiently asserted that of course it can be done, and that everybody had always known it to be both feasible and indispensable. The average human mind develops great pessimism at the first news of an experiment. Pessimism is followed



Fairchild Camera and Instrument Corp.

Fairchild K-3 Aerial Camera with 12" cone attached.
Left to right: 8 $\frac{1}{4}$ ", 20", 24" cones.

by inertia, the ball and chain that wastes years of the early life of a science and which can be shaken loose only through a patient repetition of convincing demonstrations or else the stress of an emergency—or both, as in the case of aerial photogrammetry.

The development of photogrammetric equipment in this country reflects the history of the science itself in its acceptance: from a purely military expedient with no peacetime uses to one that is now constantly on the minds of civilian engineers, city planners, industrialists and government agencies.

Dragging out the old catalogues, dusting them off, placing them as near as possible in chronological order and looking over the tools of the past and present may not be an inappropriate gesture at the point where we stand now.

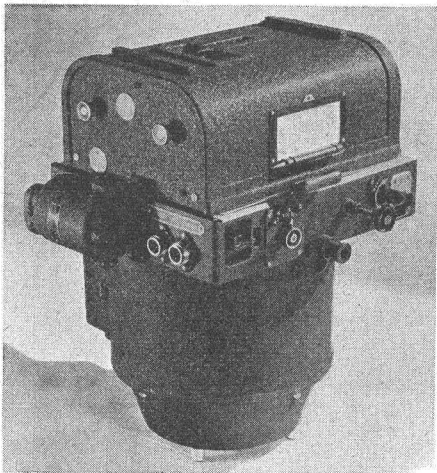
The emergency of World War I, which brought out the K-1 aerial camera, the K-2 and, in 1918, Sherman Fairchild's K-3 with its intervalometer and between-the-lens shutter, provided an impetus which might have made of the twenties a fairly productive era, had a greater number of civilian surveyors then and there recognized the value of the new aerial method. But, cautious and thorough by training, they needed time to investigate and compare before giving acceptance. Also during those years the mapping needs of this country were of the kind that could be taken care of well enough with existing equipment and methods to satisfy general purposes. Thus no incentive existed for radical changes or developments in this line. Aerial surveying might have remained at a stand-

still had it not been for the help of military and naval organizations, the solving of whose special problems brought about developments which might never have taken place had they depended on the initiative of purely peacetime functions.

CAMERAS, SINGLE LENS

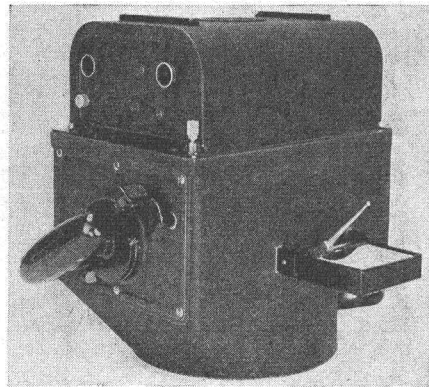
Shortly after its appearance, the K-3 was altered for automatic electrical operation. For a long time this Fairchild camera and the Folmer-Graflex hand-operated, focal-plane-shutter K-5 were the only ones in the field. They were pressed into service for many uses, including extensive mapping.

The policy of the Army and Navy, as the years went by, has been to branch out from the basic, general-utility instrument and to move into specialization. Back in the twenties they started gradually to break down their needs into cate-



Fairchild Camera and Instrument Corp.

Fairchild K-3A Aerial Camera.



Fairchild Camera and Instrument Corp.

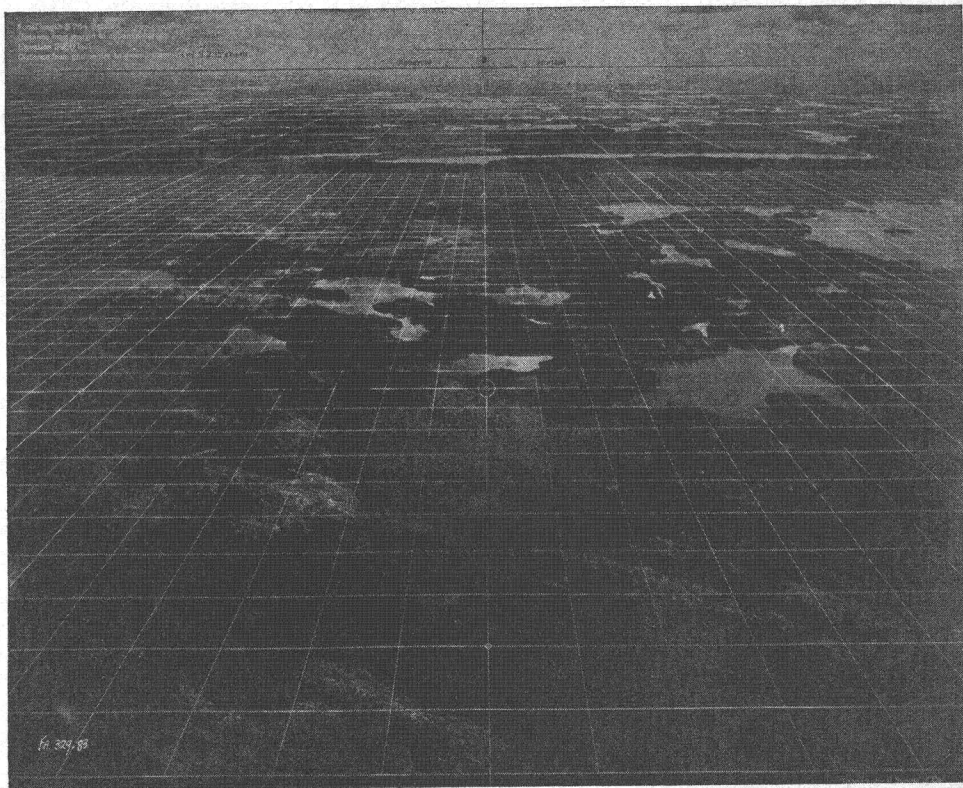
Fairchild F-1 Aerial Camera with 7" focal length lens.

gories and to put in requests for instruments that would meet each specific condition as it became defined.

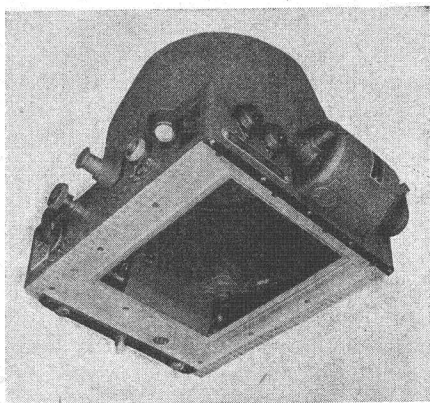
In 1925, the Army requested that the Fairchild company modify the K-3 to include a device that would automatically record certain data which otherwise had to rely on human memory and written notes—both unreliable in the stress of combat. Fairchild designed the K-3A, in which each negative was marked, at the time of exposure, with date, hour, serial number, name of operator, altitude of the plane and level condition of the camera. The Navy also took over this camera and used it extensively for mapping in Puerto-Rico and Alaska.

The following year, the Army and the Navy both expressed the need for a special camera of smaller size than was then available. For the Navy, Fairchild re-designed an existing model, the F-1, which the company had previously built according to Navy specifications. It was hand-held, had a ratchet-wind and between-the-lens shutter and could be equipped with lenses of 7", 10" and 20" focal lengths. It had no provisions for mounting and no mapping applications. For the Army, the T-4 came into existence, equipped with focal plane shutter and taking a picture 5×5 in size.

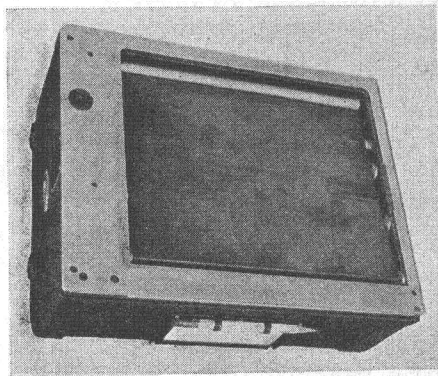
At about this time, Canada developed its grid system of oblique mapping.



Courtesy of Department of National Defence of Canada.
Canadian Grid System.

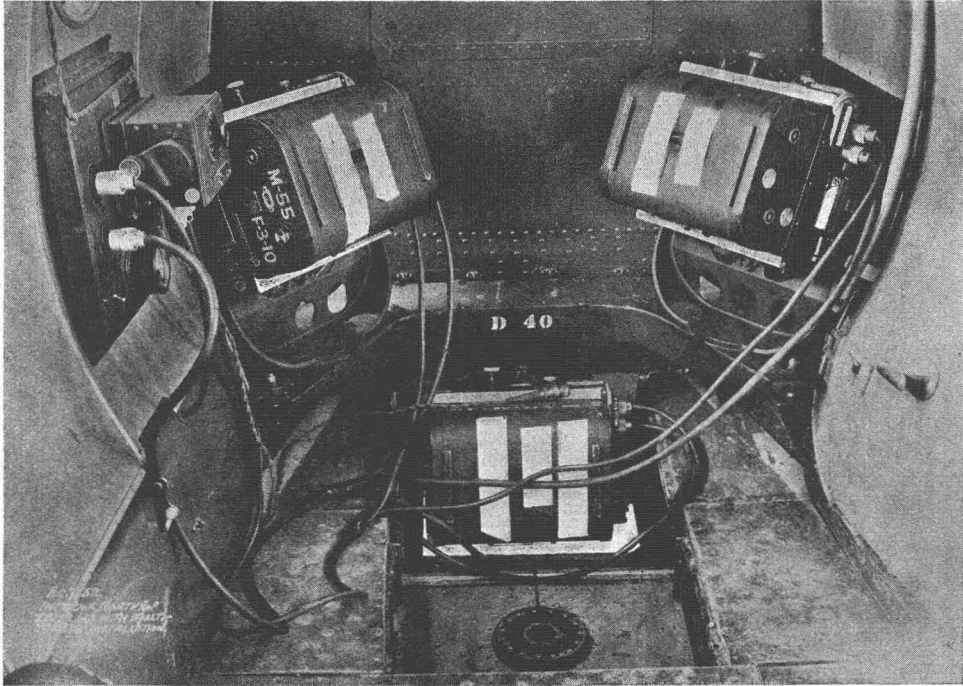


Fairchild Camera and Instrument Corp.
Body of Fairchild F-3 Camera, in
which the focal plane is located.



Fairchild Camera and Instrument Corp.
Unit 30 Magazine of Fairchild
F-3 Camera.

Through exhaustive studies, the Department of National Defence and the Bureau of Topographic Surveys of Canada lined up the requirements for the camera to be used in this method. In the obliques the center of the picture had to be very accurately located, for which it was required that the camera's lens and focal plane be in close relationship. Fairchild altered the K-3 and produced the F-3, with the focal plane and fiducial marks placed in the camera body instead of the magazine, since it was felt that with interchangeable magazines the fiducial marks were not uniform enough for the degree of precision required.



Royal Canadian Air Force Photo.

Three Fairchild F-3 Aerial Cameras installed in a photographic Airplane of the Department of National Defence of Canada. They are mounted in a fixed position to take oblique views at a predetermined angle.

To Canada goes the credit as being the first government that required calibrated precision cameras be used for all aerial photogrammetric work. F-3s were given a routine calibration each year by R. H. Field of the National Research Council in Ottawa, with the very first apparatus and methods set up for this purpose.

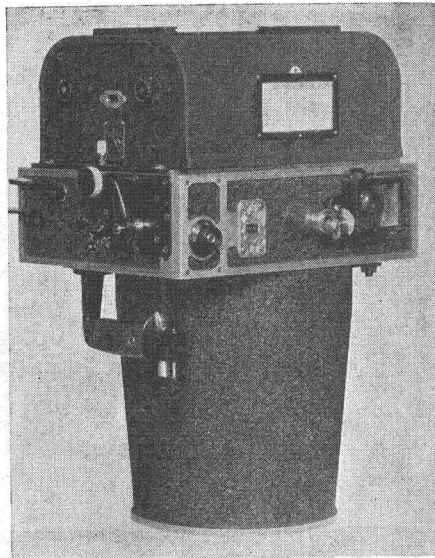
The period between 1927 and 1930 saw the appearance of several Fairchild cameras designed for various specific purposes and some of which were used in mapping photography.

The K-3 was equipped with a 20" lens cone and a new between-the-lens shutter of larger size, this version of the camera being known as the K-4.

The Army K-6 came into existence, a focal plane shutter camera designed for long distance, high altitude photography and used only for obliques. Around the K-6 was later designed the F-4, a low-priced, all-purpose instrument, es-

pecially built for commercial operators and for the new aviation units that had been started in the National Guard and which were financially unable to purchase the K-3. It was arranged for cut film and plates as well as roll film and was therefore readily adaptable for missions of an unusual nature where the special apparatus required for developing roll film was not at hand. Aerial mappers used it until the prohibition of all focal plane shutter cameras in mapping photography.

The K-7 was another high-altitude reconnaissance camera. Its 9" X 18" negative size and long focal length lens gave pictures of large scale, wide coverage and great clarity. Because of this the U. S. Coast and Geodetic Survey saw in the K-7 excellent possibilities for mapping of harbor installations. They used it in the making of a fine large-scale map of New York harbor.



Fairchild Camera and Instrument Corp.

Fairchild F-4 Aerial Camera.

In 1929 the Army expressed the need for a camera of the same type as the Navy F-1. Folmer-Graflex designed and built the K-10, which was later smoothed in line and reduced in bulk and weight in the developing of the Fairchild F-8. It was used mostly for obliques and had no mapping application except possibly on jobs where no great accuracy or coverage was needed and space was limited in the airplane. This focal plane shutter camera, considerably refined, is still being built for the Navy.

CAMERAS, MULTIPLE LENS

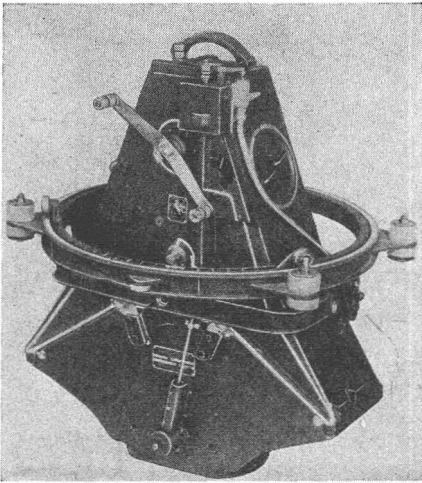
The basic principles of the multi-lens cameras of recent years were contained in the eight-lens instrument built by Capt. Theodore Scheimpflug of the Austrian Army in 1904. In 1918 Maj. James W. Bagley's tri-lens T-1 showed such promise that a number were constructed by the Army and used in connection with various government operations.

Military considerations made it necessary to extend the air base, which was accomplished by the addition of a fourth lens in the developing of the T-2A in

1927. This camera operated with satisfactory results under such widely varying climatic and topographic conditions as exist in Alaska, the Philippine Islands, Hawaii, Panama and in practically all portions of the continental U. S.

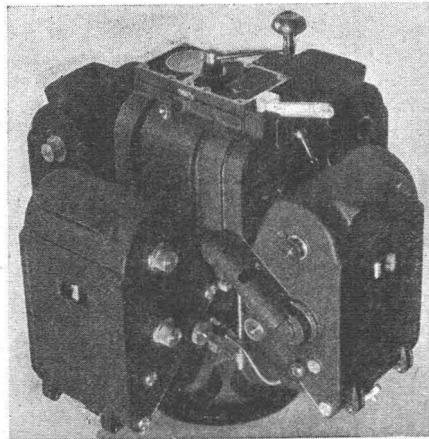
The five-lens T-3A, developed around 1933, was also designed primarily for military use. However, a group headed by Col. J. F. Phillips of the Corps of Engineers saw more general possibilities: an American system of mapping through use of the T-type cameras and simple reconnaissance type maps. Civil agencies could not fail to recognize the great saving in ground control surveys and compilation costs and they brought these cameras into action for the making of high-grade planimetric maps. Aero Service Corporation of Philadelphia, for instance, used the T-3A in its survey work for TVA in 1936 and 1937.

Purely civilian work in the development of photogrammetric equipment during the twenties was, as has been said before, limited.



Fairchild Camera and Instrument Corp.

Fairchild T-2A Aerial Camera.



Fairchild Camera and Instrument Corp.

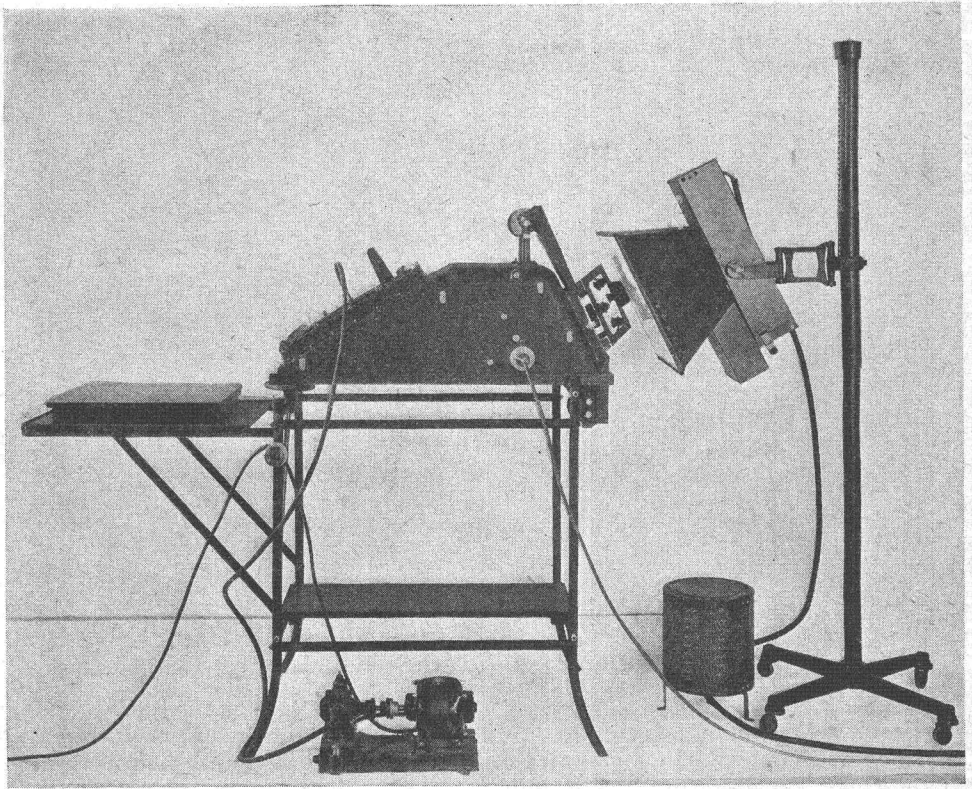
Fairchild T-3A Five-Lens Camera.

Brock & Weymouth started to develop their own cameras and their own system of stereoscopic plotting, closely paralleling the work accomplished in Europe at the time. The resulting topographic maps were highly accurate but could be made only to small scales and at great expense. The company went out of business in the early thirties, but their system, taken over with the accompanying equipment by Aero Service, formed the basis for a modified plotting system much better adapted to the needs of this country than any of the European methods.

The Geological Surveys purchased a Zeiss aerocartograph and camera and started limited exploration of its possibilities. From this organization, in 1929, a group broke away, headed by Col. Q. H. Birdseye and T. P. Pendleton, and formed the Aerotopograph Corporation of America. Using the aerocartograph and Zeiss camera they made precise maps, both planimetric and topographic, for the Government and private enterprise. But here again ambitious men ran into inertia and general refusal to accept, in this country, the use of the more advanced phases of photogrammetry. The Aerotopograph Corporation lasted only three years, due to lack of business.

So photogrammetric development during the twenties adds up to a fairly simple story: the satisfying of purely military needs interspersed with a few attempts at transplanting to our soil elaborate foreign equipment and systems unsuited to our problems.

In the minds of the men who formed the American Society of Photogrammetry in 1934, was the basic thought, and one which has proved highly successful, that the art of photogrammetry in this country could hit a happy medium between the two extremes: wartime surveys that lacked refinement of technique and elaborate methods that required so much time and cost. They started in de-



Fairchild Camera and Instrument Corp.

B-7 Transformer for use in conjunction with Fairchild
T-3A Aerial Camera.

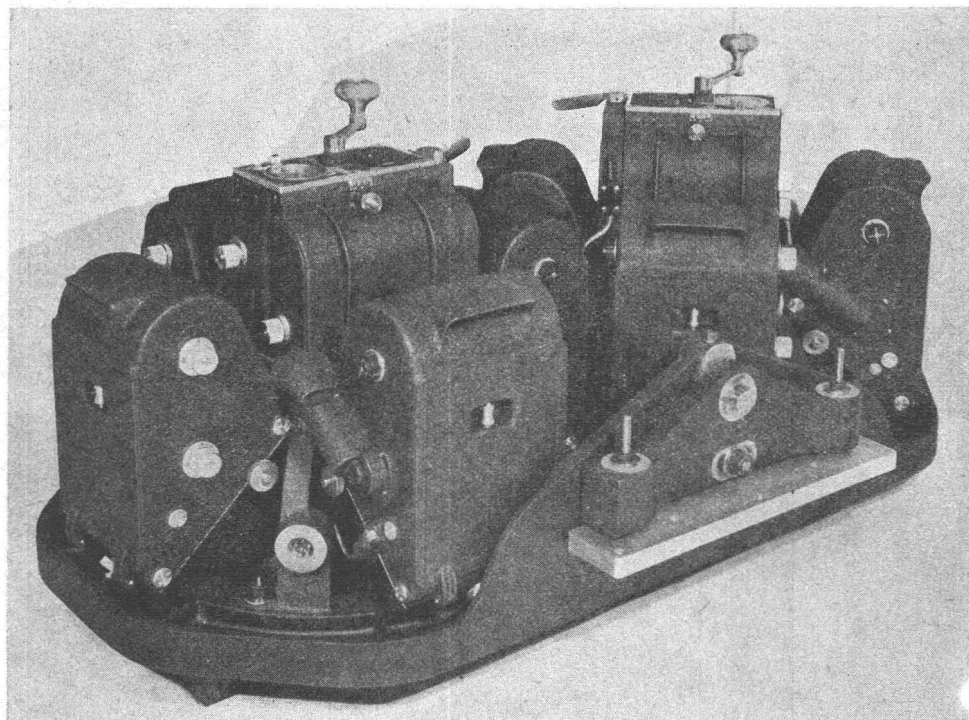
vising a technique that was simple, practical, economical and yet with accuracy given due consideration. Current events helped provide them with a field for experimentation and an opportunity to bring the problem into the light of public attention. Programs such as the Soil Conservation Service, flood control, development of waterways, reforestation, the AAA, the TVA and the development of CCC camps, brought the realization of how inadequately this country was mapped. Increased mapping needs, coupled with the resourcefulness of the minds that set to work devising ways to meet them, gave air surveying its first real spurt since the military emergency of World War I.

Charles Collier, formerly of the Forest Service, did much work for the AAA

program and, in cooperation with Leon T. Eliel of Fairchild Aerial Surveys, Inc., developed the slotted template method of plotting.

In the Soil Conservation program, Fairchild Surveys, faced with the vast job of mapping the hitherto uncharted dust bowl, devised the tandem T-3A method for greater coverage per exposure.

In 1935 the U. S. Coast and Geodetic Survey appropriated additional funds for photogrammetric equipment and requested the building of a nine-lens camera to meet their special problem: the covering of large areas of coastline and surrounding waters where there was particular difficulty in securing con-



Fairchild Camera and Instrument Corp.

Fairchild Tandem T-3A Camera in Mount.

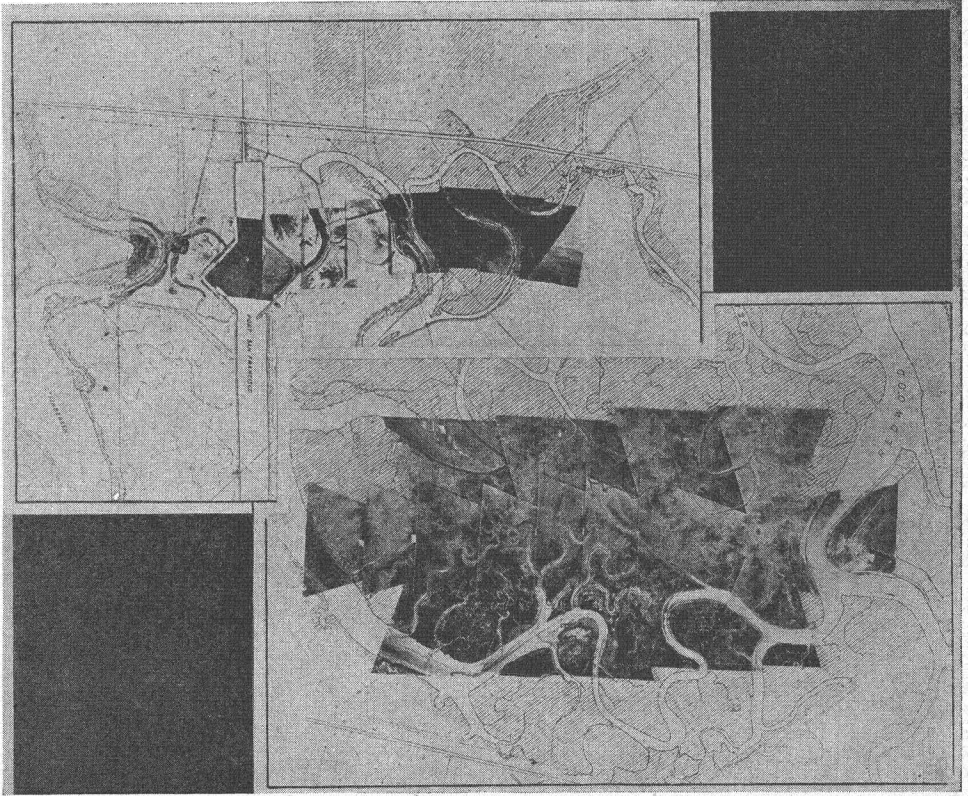
trol points. The camera, designed by Commander O. S. Reading and built by Fairchild, is the only one of its kind in existence. Its lenses are placed in a compact group, all pointed vertically to save space. The ground image is brought into the 8 side lenses at the proper angle of obliquity by a stainless steel mount equipped with 8 stainless steel mirrors—mount and mirrors machined from the same ingot to prevent any warping or distortion caused by differences of coefficient of expansion.

During this decade, the K-3 blossomed successively into the K-3B, K-3C, K-17 and K-17B. The K-17B came into existence at the time Bausch & Lomb developed the 6" wide angle lens from a German formula. The Corps of Engineers asked that a special camera be built to incorporate this lens. In the meanwhile it was placed in the K-17 which was modified to contain it. This camera started out as a makeshift but gained in importance when it became the stand-

ard instrument used in the tri-metrogon system which was developed at that time upon request of the War Department.

Tri-metrogon photography has contributed more to the war effort than any other existing photogrammetric method. It was developed by several men, but it is to Lt. Col. Gerald FitzGerald that credit goes for being the man who, with the aid of wide knowledge and long experience, brought it to its full growth as a valuable tool for carrying the war to the enemy.

From the K-7 were developed the K-7A, K-7C and finally the K-18, currently in use by the Army. The latter is an electrified version of the manually-



Fairchild Camera and Instrument Corp.

Width of territory covered by each strip of Fairchild T-3A photographs compared to strip of single-lens camera photographs.

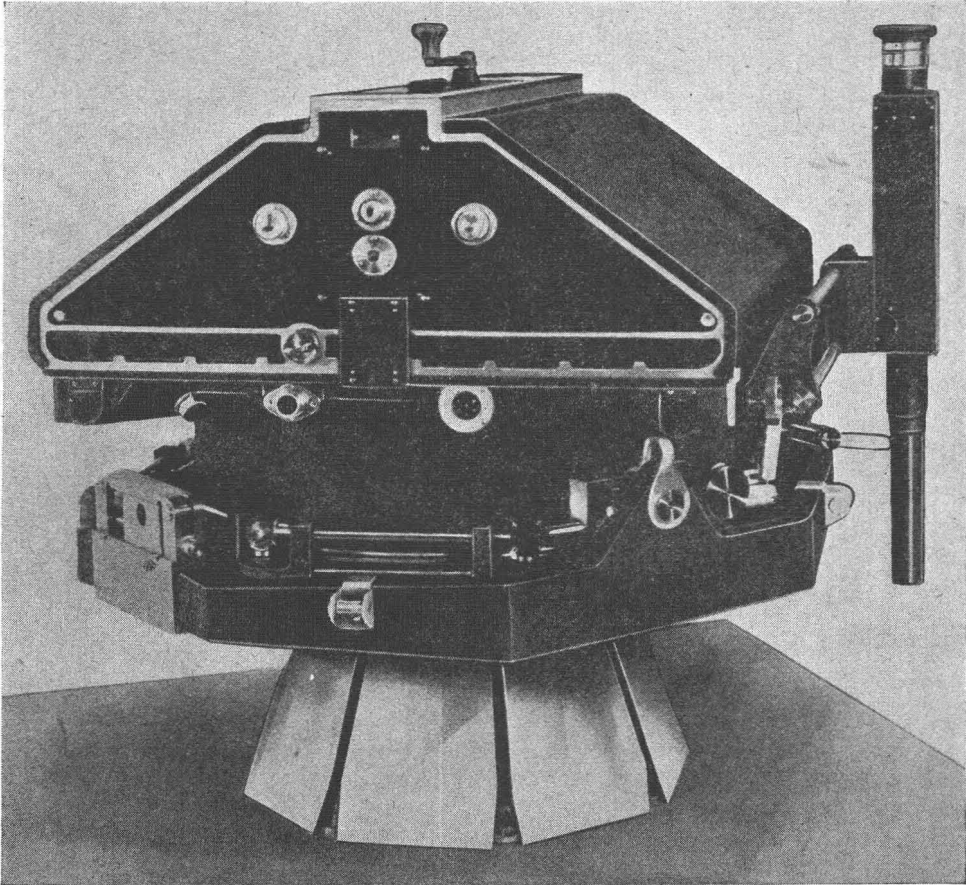
operated K-7C. Its winding speed is 6 seconds, which has been stepped up, in the K-18A, to 3 seconds. Cone and body are made in one piece for greater accuracy.

In 1938, the American Society of Photogrammetry, through its committee on precision cameras, established specifications on those used for mapping purposes, stating that they had to be equipped with the between-the-lens shutter, have the magazine built into the body and use only lenses that had been calibrated by the U. S. Bureau of Standards. Mapping agencies, for the most part, accepted these specifications and incorporated them in their programs, thereby making them official. Cameras were subsequently developed to meet the requirements by

such operating aerial survey companies as Aero Service, Abrams Aerial Surveys, Mark Hurd and Park.

Aero Service' photogrammetric camera furnishes 9" X 9" negatives and accommodates a comparatively large roll of film. Enlargements can be made up to several times the size of the negative and still give sharp details. This camera was used extensively by the Corporation to carry out contracts for furnishing photographs to Federal agencies for use in standard mapping.

The Brock aerial plate, fully automatic camera is the only one employing



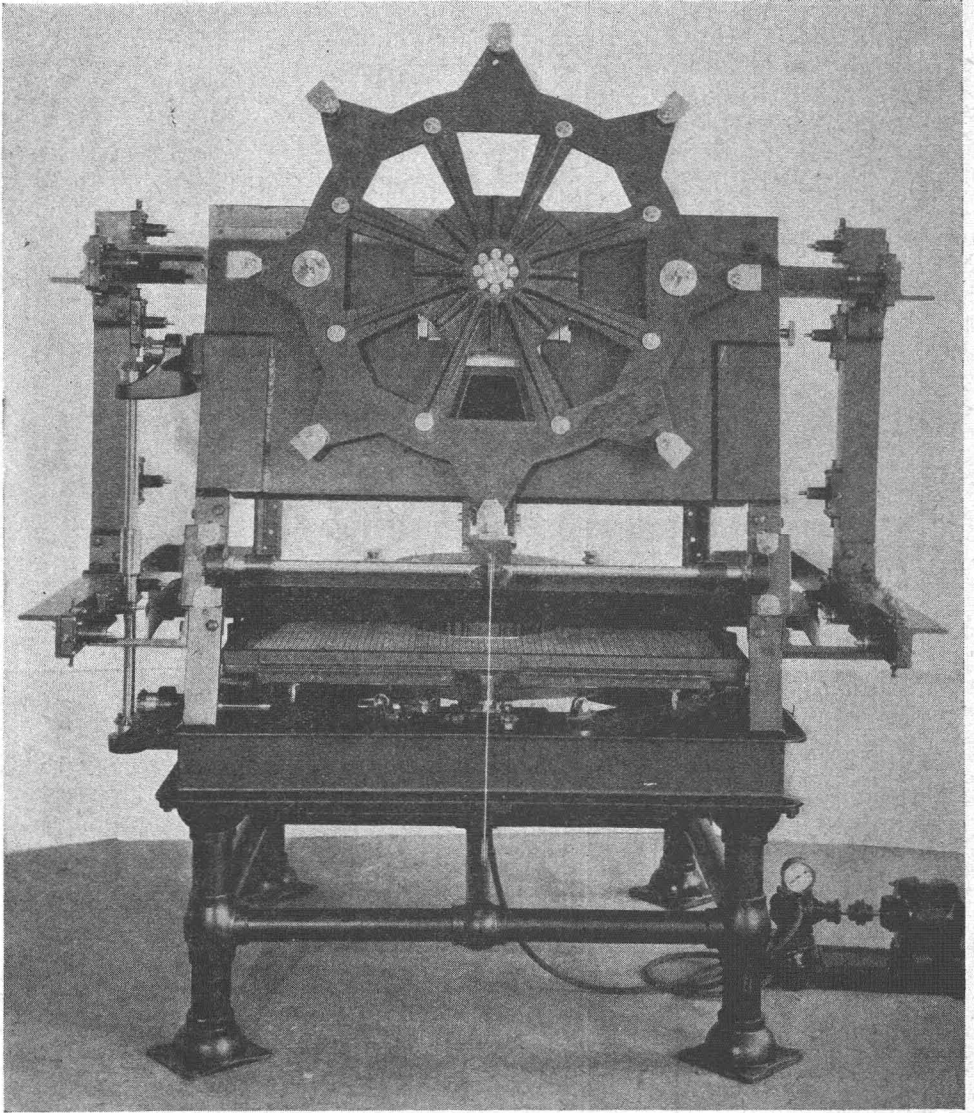
Fairchild Camera and Instrument Corp.

Fairchild Nine-Lens Camera.

glass plates to have been made and used systematically in the United States. Its plates are moved into the focal plane by a system which prevents any deviation from the optical axis. It is suspended in the plane by a gimbal mount, the oscillation of which is damped by hydraulic dashpots.

The Abrams photogrammetric camera is distinctive in appearance, presenting a smooth and rounded exterior. It holds enough film for 650 exposures—negative size being 9" X 9½". The design and construction assure that neither the focal length of the camera nor the size of the focal-plane frame will be changed by low temperatures or changes in the other parts.

In the Mark Hurd camera the cone is equipped with a special between-the-lens shutter, a focusing device to compensate for differences in temperature, a shutter-tripping mechanism and registration marks in the focal plane to furnish



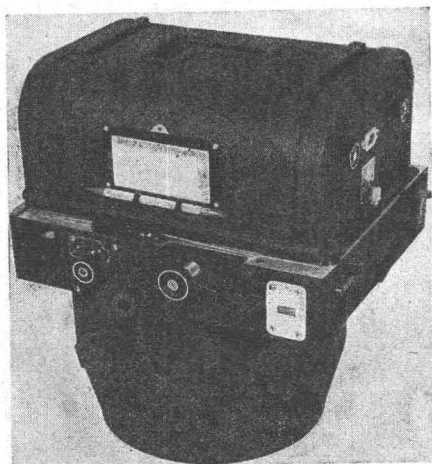
Fairchild Camera and Instrument Corp.

Restitutional Printer for Fairchild Nine-Lens Aerial Camera.

the principal point of every photograph. One of its distinctive features is that it provides for using protective film containers so that it may be unloaded and reloaded with film in daylight and during flights. Its mount not only permits it to be rotated round the optical axis, to overcome the crab of the airplane, and tilted in all directions for leveling, but also furnishes the view-finder elements necessary to determine the amount of required rotation and the interval between ex-

posures. In this mount the camera may be tilted as much as 25° , which makes it possible to find out if an object some distance ahead is centered under the line of flight and thereby to determine if the ship is set satisfactorily on the line along which it is intended to take the photographs.

The Park camera consists of two principal parts, a cone and a magazine. The cone carries the lens in a between-the-lens shutter, the shutter-resetting mechanism and the focal plane frame, which is equipped with marginal marks to indicate the principal points of photographs and to provide for accurate setting in photogrammetric instruments. A special feature of the magazine is its division into two compartments by a light-proof partition, with a door for each compartment, so that the opening of one door admits no light to the other side. This arrangement permits a loaded magazine, having part of the film exposed, to be removed, the film clipped and a leader attached to the unexposed end.



Fairchild Camera and Instrument Corp.

Fairchild K-3B Camera with $8\frac{1}{4}$ " focal length lens.

To meet the new specifications, Fairchild designed the F-51 camera. It could be equipped with lenses to match those in different types of plotting machines: the stereoplanigraph, aerocartograph and multiplex projector. The magazine, which could accommodate enough film for 600 exposures, had one simple feature: while a picture was being taken on one section of the film, another full nine inch section was standing free within the camera to become adjusted to the condition of temperature existing at the altitude at which the airplane was working. The entire magazine was removable from the cone for the purpose of collimating and adjusting, which made it extremely easy to calibrate. The auto-collimated lens was seated inside the cone in such a way that perfect centering was made possible.

This camera never reached full development for, with the approach of war, Fairchild turned its attention almost wholly to satisfying military needs. However, the F-51 had one military outgrowth, the current Fairchild T-5.

Development of this camera started in 1938, when the Army requested a photogrammetric camera based on its own design, allowing that specifications

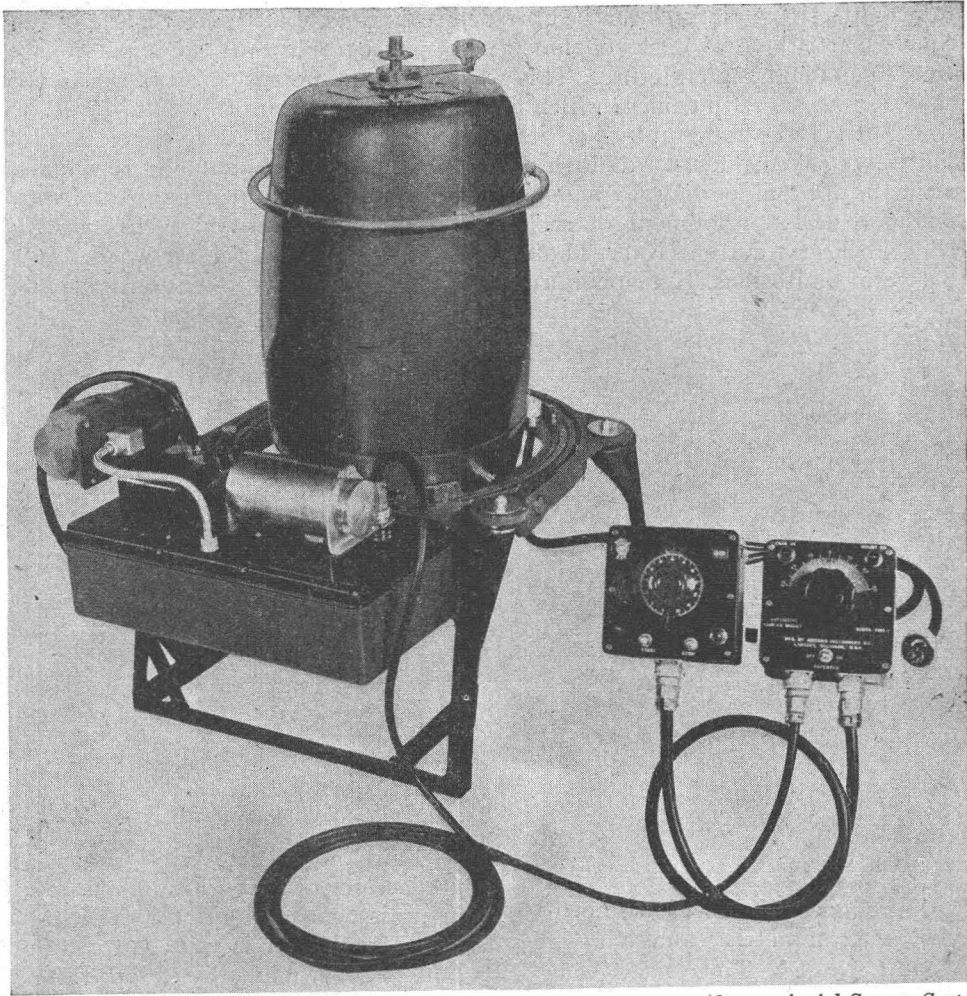


Abrams Aerial Survey Corp.

Abrams Precision "Explorer" Aerial Camera.

could be written around the manufacturers' design as long as they displayed initiative, speed and a good lay-out of what they proposed to furnish.

The T-5 is machined to close tolerances to avoid variations in the relationship between the lens and focal plane. The magazine is interchangeable, but this does not impair the accuracy because the lens is tied directly into the focal plane and its relationship with the film cannot therefore be disturbed. The Bausch &



Abrams Aerial Survey Corp.

Abrams "Automatic Camera Mount." By use of a combination of photo electric cells, light beams and a level bubble, the mount is automatically leveled to obtain at all times a truly horizontal condition.

Lomb wide-angle Metrogon lens insures a coverage of over 90° . The T-5 is almost entirely self-contained, its intervalometer, vertical viewfinder and light-meter having been built right into the camera. A reflector brings the light to a small lens which operates a recording system, giving the angle at which the picture was taken and the altitude and speed of the airplane. It is recommended particularly for mapping in conjunction with the multiplex type of plotting instrument.

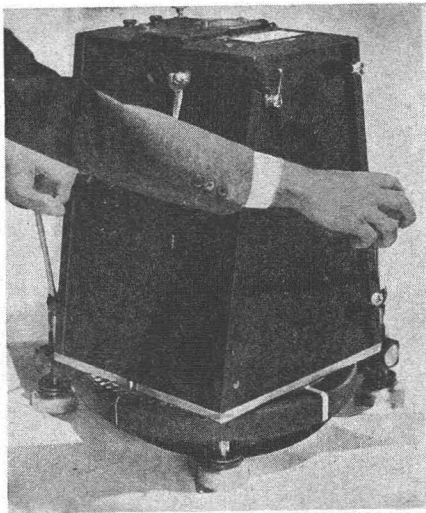
The Fairchild F-56 came along in 1939. It is now the Navy's most important general purpose and mapping camera.

During this time, also, an interesting strip camera, generally known as the Sonne camera, was designed and built by the Chicago Aerial Surveys. This instrument is so arranged that film moves continuously in synchronism with the image movement of the ground past a narrow slit in an otherwise opaque focal

plane. Thus sharp pictures can be obtained regardless of altitude or speed of the plane. One of the drawbacks of that type of photography was the impossibility of getting stereoscopic pictures. This was overcome, however, by the development of a stereo-strip camera which has had excellent results.

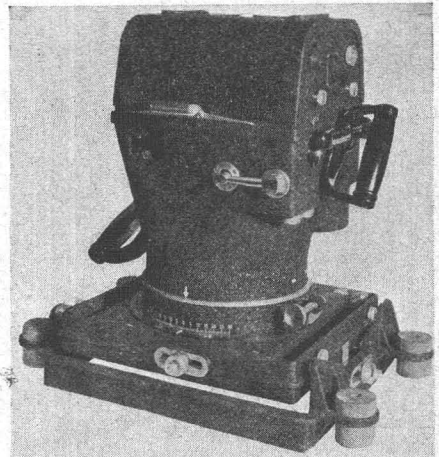
Night aerial photography had its start back in 1925. It was developed by Col. George W. Goddard to a high degree of perfection. Its value in reconnaissance and for making mosaic maps has made it an important part of total war.

Before the development of the photo-electrically operated K-12 camera, followed by the current K-19, photography at night from the air was subject to several limitations. If a slow-burning flare were used, its low intensity made



Fairchild Camera and Instrument Corp.

Fairchild F-51 Precision Photo-grammetric Camera.



Fairchild Camera and Instrument Corp.

Fairchild F-14 Aerial Camera, predecessor of Navy F-56, mounted in nose-type mount for Vertical Photography. It is fully automatic but can be manually tripped for obliques.

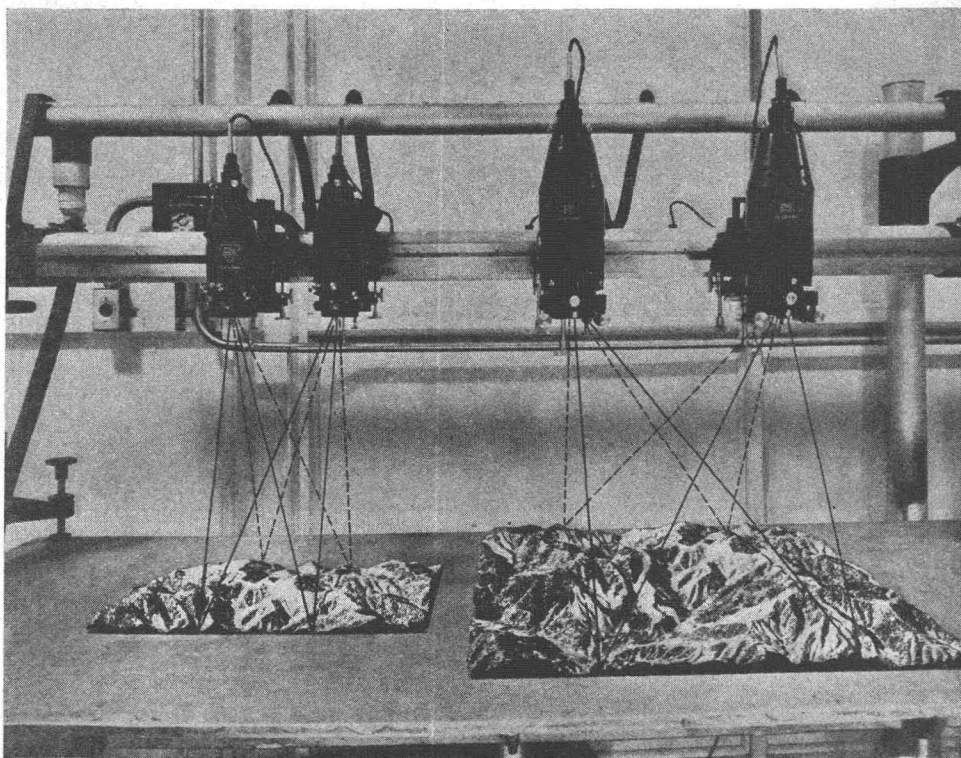
necessary exposures at large lens apertures and slow shutter speeds, with consequent lack of definition in the result. If an instantaneous bomb were used, the operator had to be certain to get the camera shutter open just prior to the flash. Any lights on the ground then burned paths across the negative.

The K-19, used in connection with the M-46 flash bomb, incorporates a photoelectric unit which is mounted in the slip-stream and actuates the shutter at the peak light intensity of the bomb. The bomb is timed to explode when it reaches a position that will insure its lighting up the ground area and yet staying out of range of the lens. The sensitivity of the photo-cell has been increased so that only 1/10th foot candle of light is needed to make it trip the shutter.

PLOTTING DEVICES

As has been seen, we have imported some of the German and Swiss plotting devices for use in this country. For years the Germans, in particular, had been manufacturing elaborate instruments to be used in conjunction with elaborate methods of plotting and had indoctrinated most nations into believing that photogrammetry was a highly complex art that could never become a practical

engineering tool within the reach of everyone. Through untiring efforts of the American Society of Photogrammetry, the United States has convinced the world otherwise. We did not cease altogether to acquire foreign equipment but we simplified it and re-adapted it to meet the mapping demands in this country which differed so sharply from those in Europe. Through its practical outlook and the flexibility of application of methods and equipment it fostered, the Society soon brought about mapping techniques which applied not only to our country but to a major portion of the surface of the Earth.

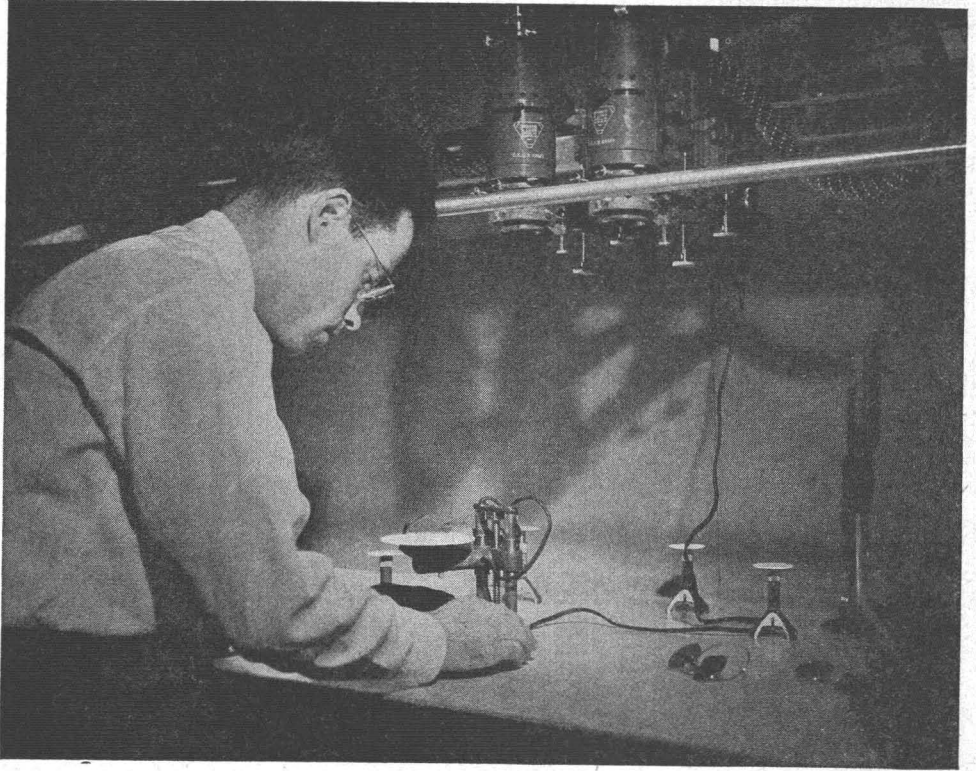


Army Air Forces Photo.

Model showing the overlap of the projected images in the Bausch & Lomb Multiplex.

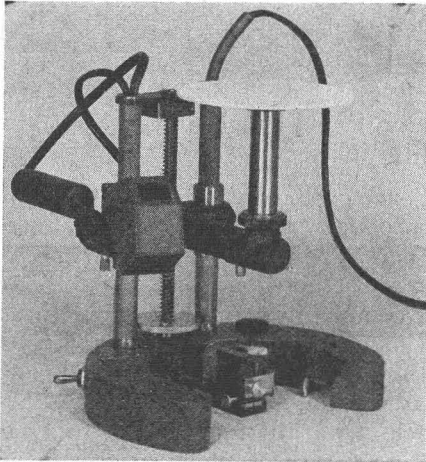
Fairchild had bought up the equipment once owned by the Aerotopograph Corporation and with it the agency for Zeiss products. They acquired the stereoplanigraph and rebuilt it to meet demands here. Leon Eliel supervised the redesign to increase its adaptability and range of usefulness.

The Zeiss company itself took heed of the complaints from the United States and other nations (notably Great Britain) who were engaged in the mapping of colonial territories and sought to simplify their equipment. They brought out the multiplex, two of which were purchased by the Geological Survey. The Corps of Engineers, conscious of the approach of war, here took steps to avoid dependency on Germany for the more advanced type of plotting equipment. Working through the American Society of Photogrammetry, they wrote specifications for a multiplex to be built in this country. Bausch & Lomb have since been its manufacturers.



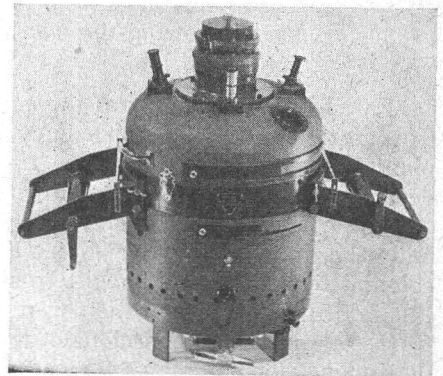
Bausch & Lomb Optical Co.

Bausch & Lomb Multiplex Projector in use.



Bausch & Lomb Optical Co.

Bausch & Lomb Multiplex
Mapping Tracing Table.

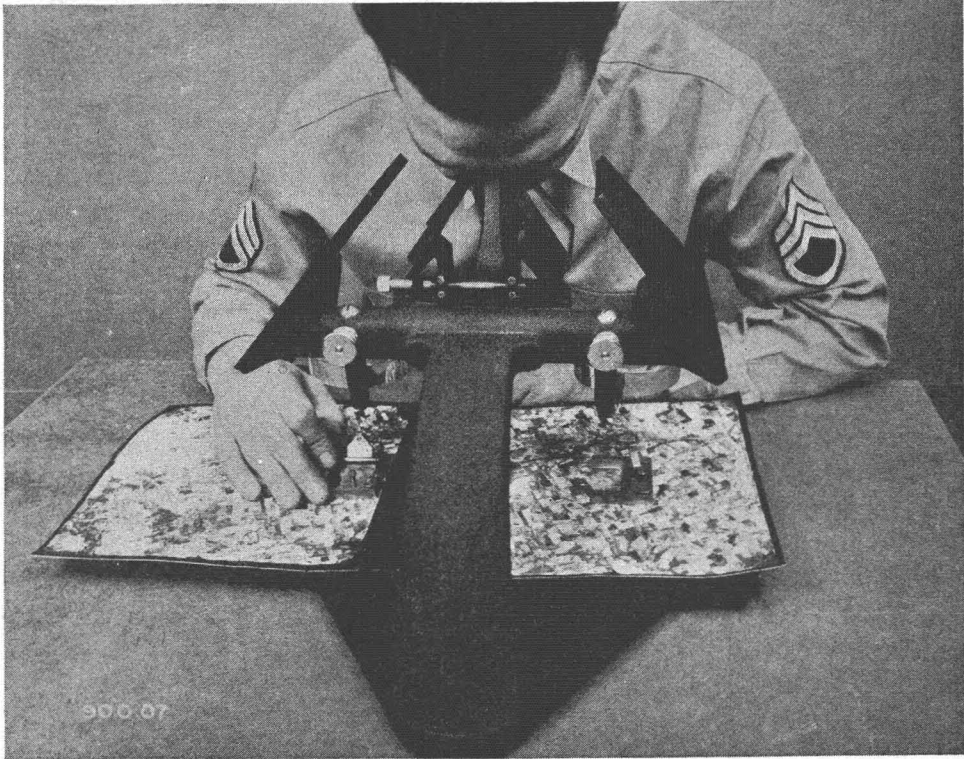


Bausch & Lomb Optical Co.

Bausch & Lomb Projection
Printer.

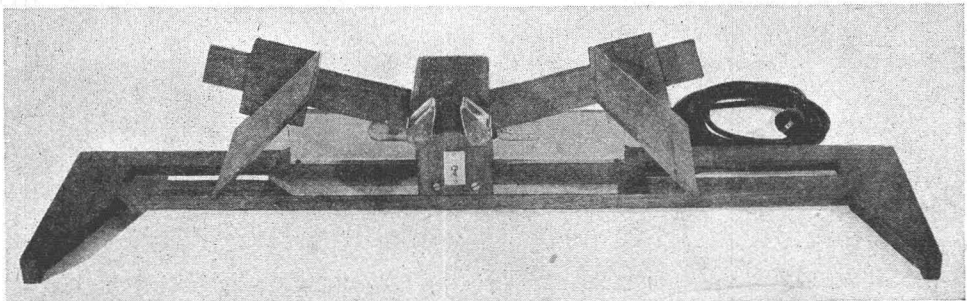
However, the use of these instruments in the United States has been limited compared to that of the simplest type of equipment. We have laid emphasis on the compilation of maps by graphic and inexpensive methods, with the aid of the stereoscope, stereo-comparagraph, contour finder, parallax bar, etc.

Up to 1937 the procurement of stereoscopes had been very erratic. There was no standard design and there existed as many stereoscopes as users. Members of the American Society of Photogrammetry deplored this situation and



U. S. Army Air Forces Photo.

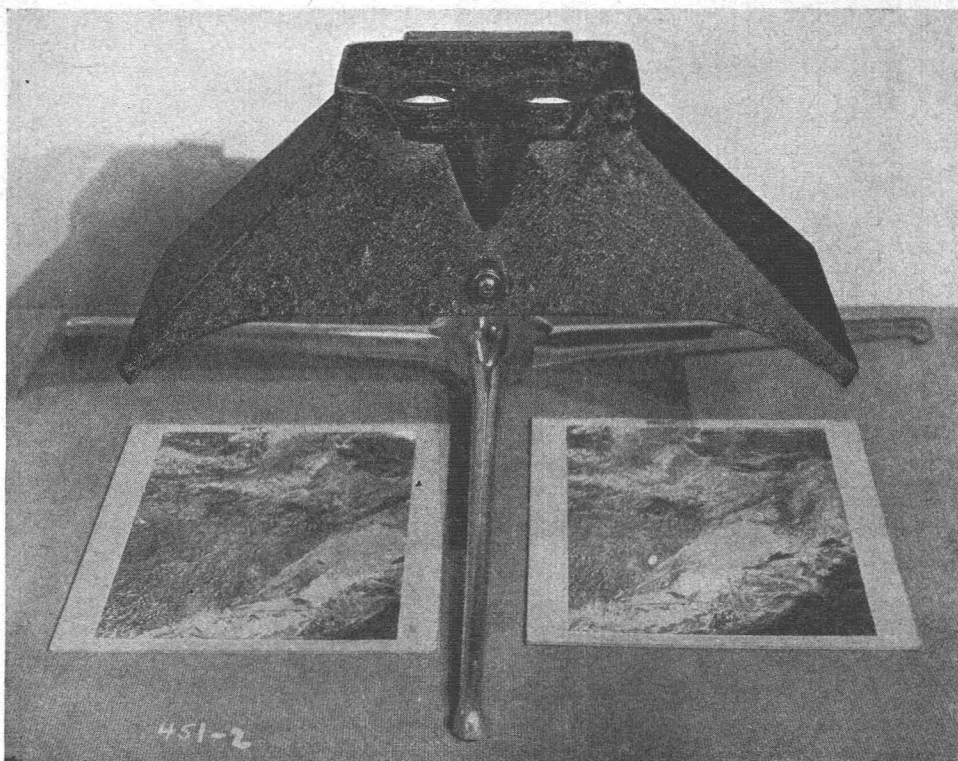
Bausch & Lomb Stereo Viewer.



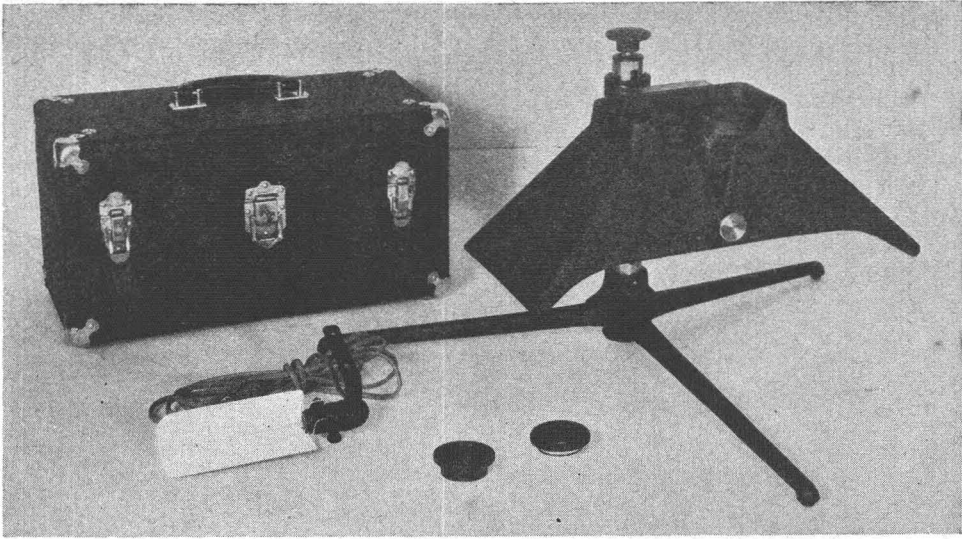
Stereoscope built for Tennessee Valley Authority Project; designed primarily for viewing T-3A photographs.



Fairchild Camera and Instrument Corp.
Fairchild F-2 Stereoscope.

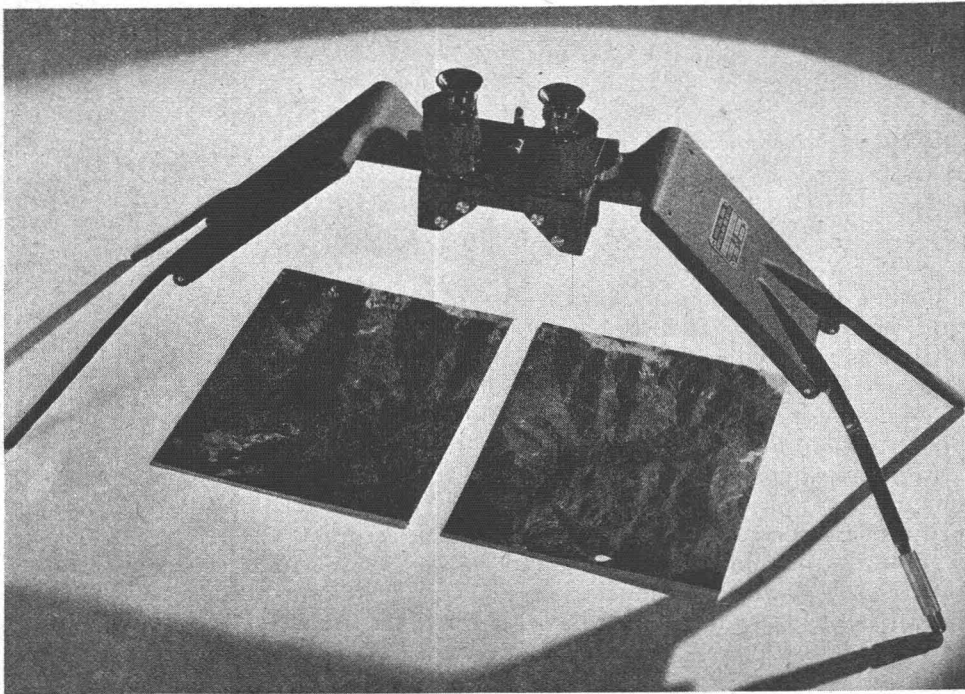


Fairchild Camera and Instrument Corp.
Fairchild T-4 Stereoscope.



Fairchild Camera and Instrument Corp.

Fairchild T-5 Tele-Stereoscope.



Fairchild Camera and Instrument Corp.

Fairchild F-71 Stereoscope.

advocated the development of a stereoscope which could be standardized upon by large numbers of users and would include desirable features necessary for use in mapping.

An early stereoscope was the Fairchild F-2. It was an improvement over the old parlor model in that it did not require that the pictures be mounted in pairs on cards before they could be properly viewed. The reflecting mirror system made it possible to view the pictures by simply placing them on the table and



Abrams Aerial Survey Corp.

Abrams Contour Finder.

adjusting their positions to suit the eyes of the spectator. It had the disadvantage, however, of being heavy and unwieldy.

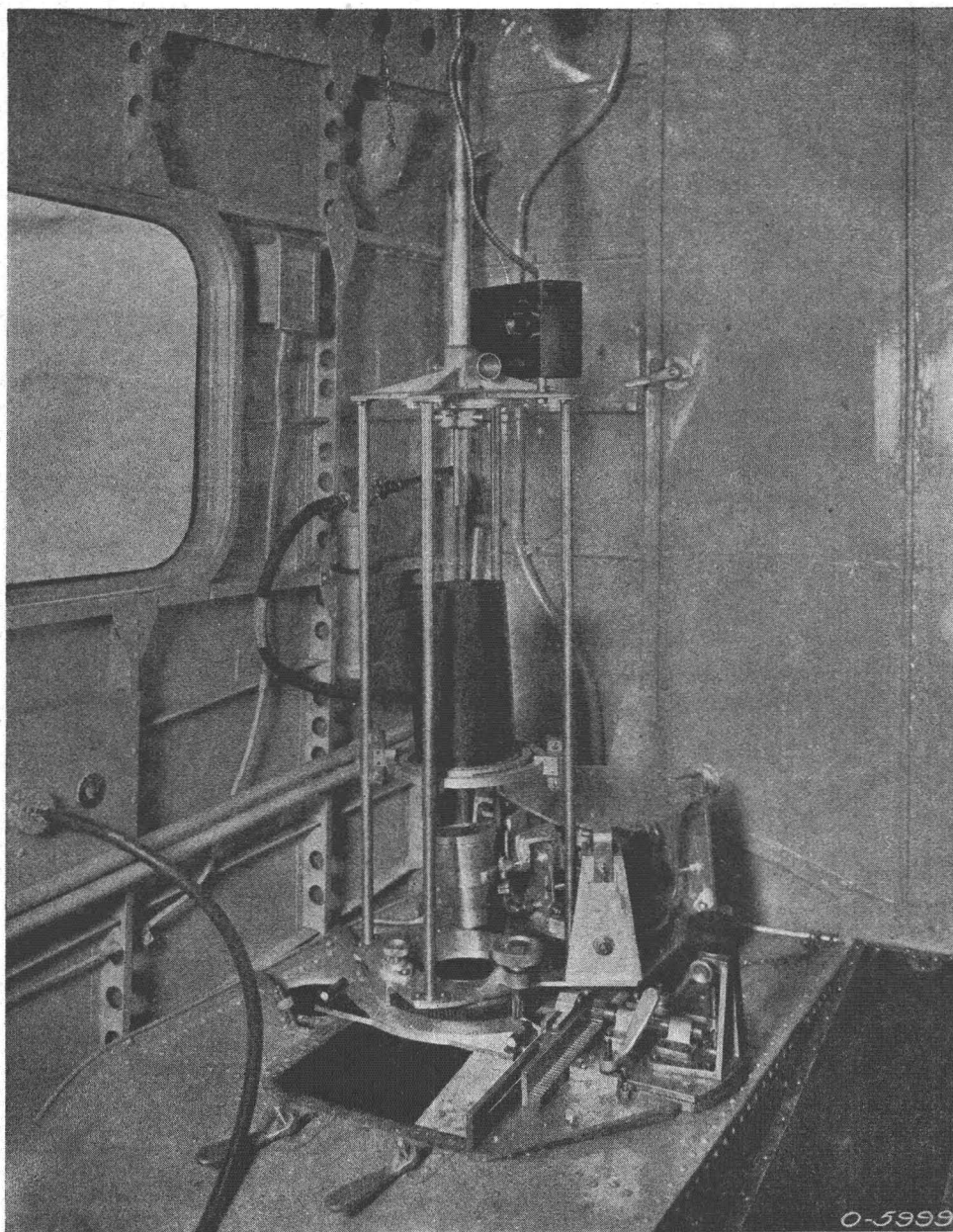
It was followed, in 1936 and 1937, by the T-4 and T-5 model stereoscopes of Fairchild Aerial Surveys and finally, in 1939, by the current F-71. Its users showed a desire to be able to measure elevation now and then and this brought about the development of the parallax bar.

For use where an instrument is needed continuously for the purpose of determining elevations or delineating form lines, Lt. (now Col.) B. B. Talley of the Corps of Engineers designed the stereo-comparagraph.

The contour finder, manufactured by the Abrams Aerial Survey Corporation, is a light weight, compact instrument, all the integral parts of which are fixed together, so that it may be set up in a few seconds over a pair of overlapping photographs.

ACCESSORIES

One of the many steps that were taken ahead during the thirties was the improvement of photographic flying, through the development of the solar

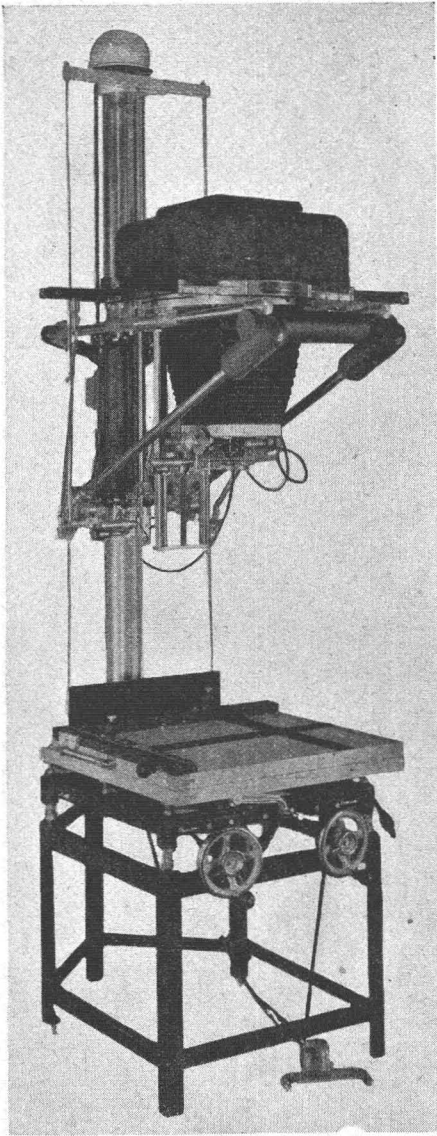


Fairchild Aerial Surveys, Inc.

Fairchild Solar Navigator.

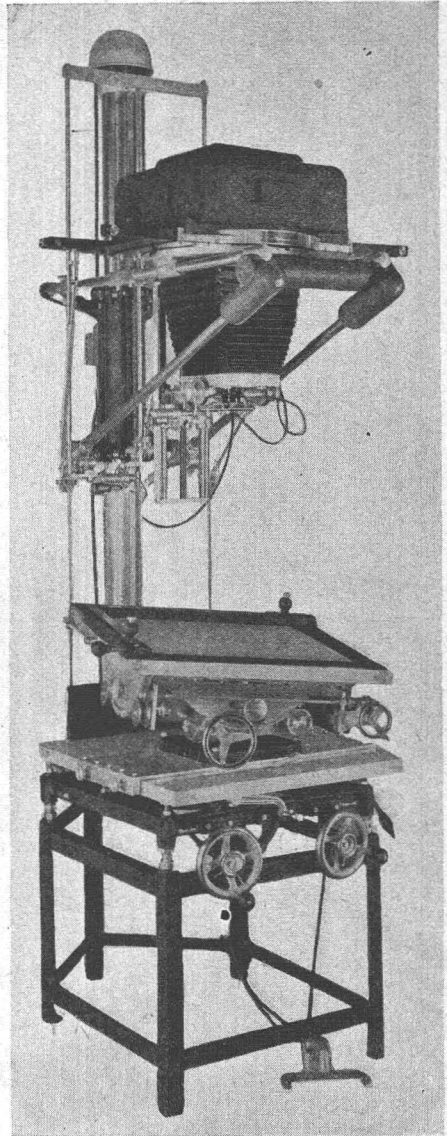
navigator by Fairchild Aerial Surveys, with consequent reduction in the number of gaps between strips of pictures and necessity of reflights.

During this same period, J. G. Saltzman, Inc., expanded its line of precision enlargers and concentrated particularly upon requirements in the photogrammetric field. This company now supplies the bulk of apparatus of this type. Other accessories to accuracy, light filters to take care of varying light conditions



J. G. Saltzman, Inc.

Saltzman Precision Ratio Enlarger.



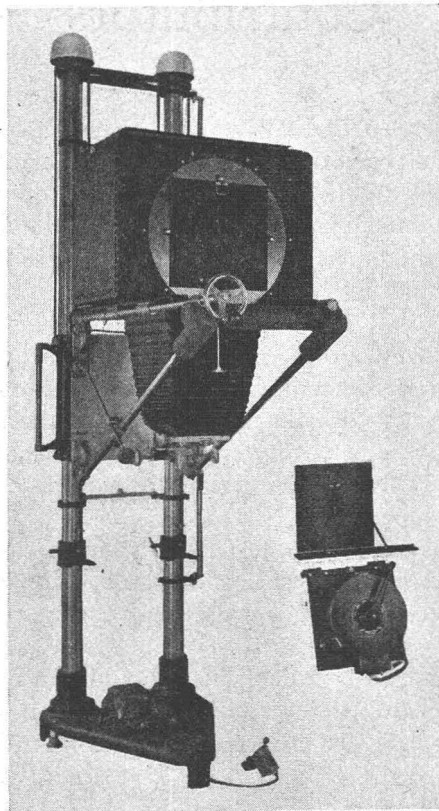
J. G. Saltzman, Inc.

Saltzman Precision Ratio Enlarger with tilting table for Restitutive Printing.

and haze, have been perfected by Bausch & Lomb and they are furnishing an ample and varied line of these.

Just as in other fields, want has accelerated improvements in the photogrammetric line. Some of the advances may still be unknown to most of us, but when the smoke clears away it is certain we will find there have been a great many very outstanding ones. Behind the improvements the influence of the

American Society of Photogrammetry will have stood as a great motive power, due to the fact that many ranking officers of the Army and Navy have been active members and through that association became conscious of certain factors in design of cameras and associated equipment for mapping purposes.



J. G. Saltzman, Inc.

Saltzman Vertical Map-making
Projector.

Partly through increased air-mindedness and partly through the influence of accounts of military and naval strategic events, the public is conscious as never before of the great importance of the air-borne method. With the return of peace and the pressing need that will arise for reconstruction and for development of areas whose growth was momentarily arrested by the world conflict, there is little doubt that the civilian aerial surveyor will come very much into his own and enjoy the use of equipment well fitted to his needs.