

The following cameras are used for stereophotogrammetry:

1. Zeiss H.M.K. 21. This is a small hand operated camera with Zeiss Tessar lens of 1/4.5 aperture and between the lens shutter. The camera uses plate negatives with a magazine capacity of six plates. The camera is used for vertical or oblique photography.

2. Zeiss R.M.K. c/3 camera and the Zeiss R.M.K.P. 21. Both of these are fully automatic cameras, using film negatives 13×18 cm. (5×7 inches) with magazine capacities of 300 exposures. Both cameras have between the lens shutters, and use the Zeiss filters B.D.E. The R.M.K. c/3 camera is equipped with a Zeiss lens with 1/4.5 aperture and the R.M.K.P. 21 with Zeiss orthometer lens of 1/4.5 aperture.

### PLATES, FILM, AND PAPER

Agfa aeropan and aerochrom, and Perutz plates and film are used. The processing of the aerochrom has been found to be much simpler than the processing of the aeropan material.

The E.G.C. II arrangement for developing films has been very satisfactory.

The shrinkage of paper prints while drying is controlled by mounting the wet prints with a moist paste and stretching the paper to correct size during the drying.

### AIRCRAFT AND ACCESSORY EQUIPMENT

Hungary has no aircraft designed especially for air photography.

The Hungarian Cartographic Institute owns a Väisälä statoscope.

### OPERATION OF PHOTOGRAPHIC PROJECTS

Single lens photography for general mapping is usually done at 1:15,000 scale with 60% overlap fore and aft, and 30% side lap. In some cases the side lap is increased to 40%. Flight lines are generally laid out on a 1:75,000 scale map.

The flight lines for stereophotogrammetry are laid out on 1/25,000 scale maps. The photographs for stereophotogrammetry are taken in pairs with the camera tilted 32° from the vertical for one picture forward and for one picture aft along the line of flight.

Only the compass and map are used for navigation. No special instruments are used for this purpose.

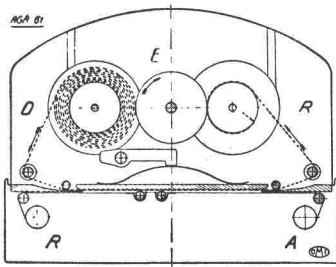
## Italy

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### AIR CAMERAS

#### *Single Lens Air Cameras for General Planimetric Use*

Italy has endeavored to adopt her photographic equipment for general use, particularly for rapid surveying and military purposes. Due to the high speed and lack of space in military aircraft it is necessary that this equipment be small in bulk and weight, and simple to operate. A standardization of equipment, as existing in other countries, has been avoided in order to have available several cameras suitable for various types of work. Thus, for example, the advantages and disadvantages of lens shutters and focal plane shutters have



Scambio di pellicola nella macchina modello A.G.R. 61

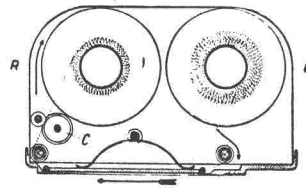
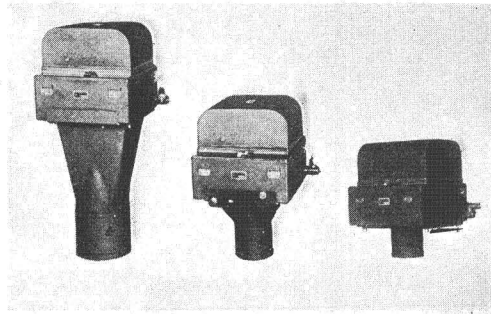
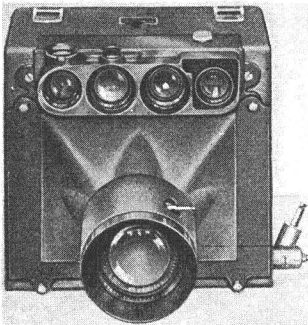


Fig. 1

Scambio pellicola nei magazzini delle macchine mod. A.P. 66 B. - A.G.R. 90 - A.F.P. 72



Macchina modello A.P. 66 B. con diversi coni portaobiettivi  
Fig. 2

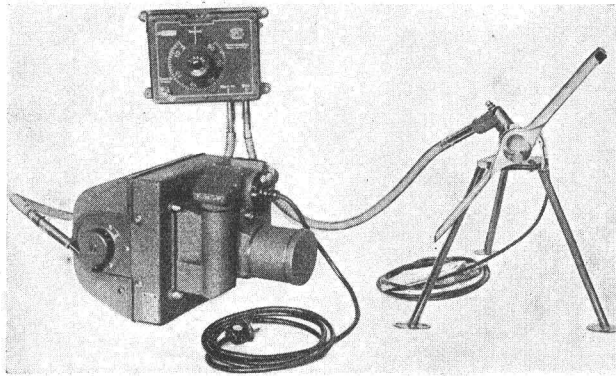


Fig. 3 - Macchina modello A.C. 81

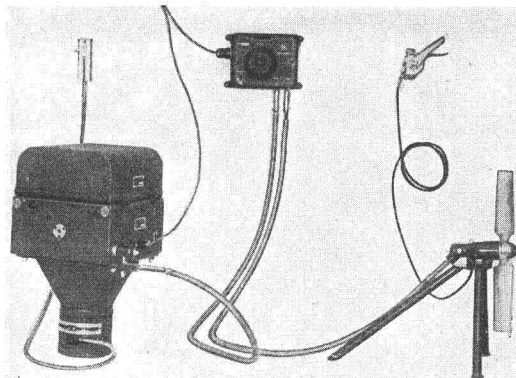


Fig. 4 - Macchina modello A.G.R. 90

been combined by keeping the latter only in those cases in which it alone can provide sufficient rapidity and illuminating power. The image deformation resulting from the use of a focal plane shutter is not serious in the graphic plotting of rapid military surveys on scales smaller than 1:50,000.

The cameras for general use constructed in Italy during the past four years are of the "Nistri" type, automatic in operation, and using film with negative size varying from  $9 \times 12$  cm. ( $3.5 \times 4.7$  inches) to  $18 \times 24$  cm. ( $7.1 \times 9.4$  inches). The device for flattening the film is either mechanical or pneumatic.

Cameras with the mechanical film flattening device are provided with a focal plane shutter. Along the edges of this shutter are two metal gliding rollers supported by an opposite frame which is pushed by means of a spring against the focal plane at the instant of exposure. The most representative cameras of this type are: Model "A.P. 66-b" (Fig. 2), Model "A.C. 81" (Fig. 3) and Model "A.G.R. 90" (Fig. 4).

Model "A.P. 66-b" (Fig. 2) has interchangeable magazines for 200 exposures  $18 \times 24$  cm. ( $7.1 \times 9.4$  inches) or  $13 \times 18$  cm. ( $5.1 \times 7.1$  inches). Interchangeable cones are available for lenses of 21, 30 and 50 cm. (8.3, 11.8 and 19.7 inches). The focal plane shutter has a fixed opening, the speed being varied from  $1/100$  to  $1/200$  of a second by changing the spring tension. A group of recording instruments, namely: compass, altimeter, watch, and level are built within the camera. These instruments are daylight illuminated.

Model "A.C. 81" (Fig. 3) is similar to Fig. 2 except it has a negative size of  $9 \times 12$  cm. ( $3.5 \times 4.7$  inches) and a lens of 165 mm. (6.5 inch) focal length and  $f/3.5$  aperture. The two recording instruments, compass and watch, are illuminated by electricity.

Model "A.G.R. 90" (Fig. 4) is similar to Fig. 2 but is much lighter and has interchangeable magazines for 200 to 400 exposures of size  $13 \times 16$  cm. ( $5.1 \times 7.1$  inches). The recording instruments are illuminated by electricity.

Also may be mentioned Model "A.G.R. 61" (Figs. 1 and 7). This is a small camera with a fixed capacity of 120 exposures  $13 \times 18$  cm. ( $5.1 \times 7.1$  inches). It has interchangeable cones for lenses of 21, 30, and 50 cm. (8.3, 11.8 and 19.7 inches) and is used for both vertical and oblique photography.

Cameras with the pneumatic film flattening device have a lens shutter and a perforated focal plane plate. At the instant of exposure a vacuum is created in a chamber actuated by a spring plunger which in turn is linked with the same mechanism that changes the film and winds the shutter. Among cameras of this type may be mentioned the "A.F.P. 72" (Fig. 5). Although it has similar characteristics to Model "A.G.R. 90" as regards size and power, it is provided with lens shutter and has interchangeable cones for lenses of 12 cm. (4.7 inches) and 20 cm. (7.9 inches).

#### *Precision Single Lens Air Cameras*

Besides Model "A.F.P. 72," which we have already described, Model "A.F.L. 92" (Fig. 6) is worthy of mention. This camera was recently constructed by Nistri for high precision topographic surveying. Of special interest are the interchangeable magazines holding 168 glass negatives  $18 \times 18$  cm. ( $7.1 \times 7.1$  inches), arranged so as to make it possible for the negatives contained in special solid frames to be alternately transported on to the focal plane. The lenses used are either Galileo or Zeiss Tessars, 21 and 30 cm. ( $8.3 \times 11.8$  inch) focal length and  $f/4.5$  aperture. The lenses are independent of the lens shutter the speed of which is  $1/150$  of a second with a 70% efficiency. The collimating marks consist of small notches in a frame against which the plate is pressed at the instant of exposure.

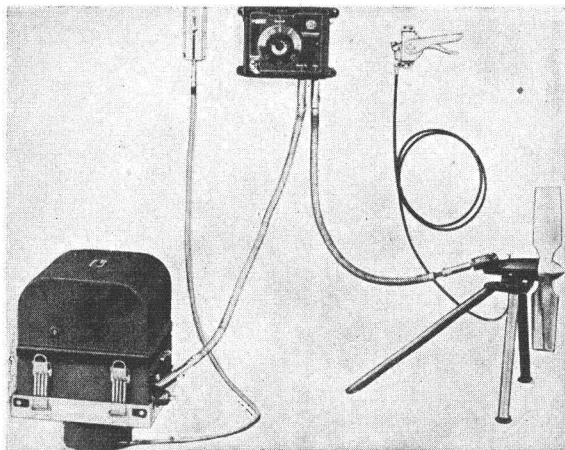
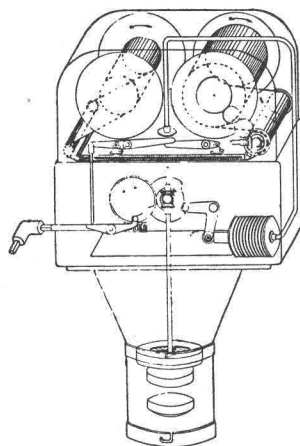


Fig. 5 - Macchina fotogrammetrica modello A.F.P.72



Schema del funzionamento pneumatico della macchina modello A.F.P.72

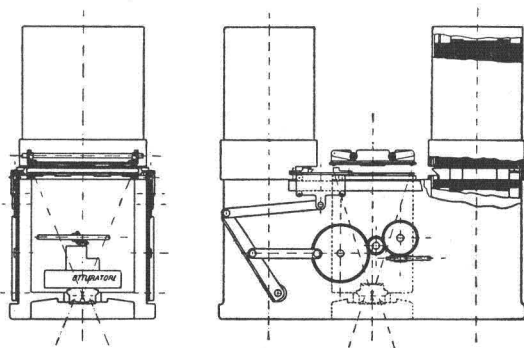


Fig. 6 - Schema della macchina fotogrammetrica modello A.F.L.92 1937

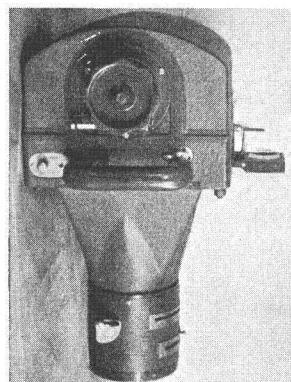


Fig. 7 - Macchina planimetrica e panoramica modello A.G.R.61

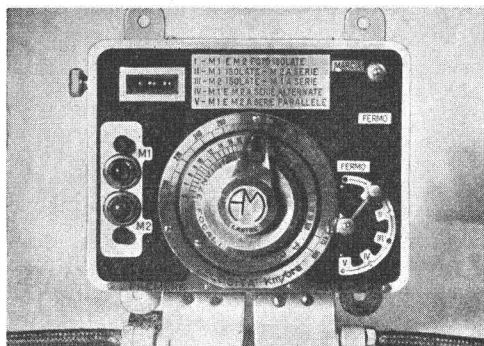


Fig. 8 - Comando elettrico A.M.

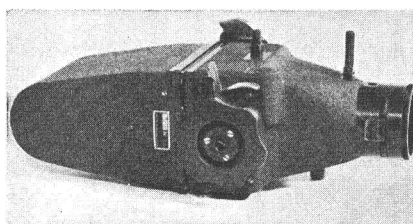


Fig. 9 Macchina panoramica modello A.P.R. 87.-

### *Multiple Lens Cameras*

The more important Italian multiple lens cameras will now be described.

Camera Santoni Model I (Fig. 11). This consists of two cameras arranged like a "V" in a direction transverse to the line of flight, the angle between the axes of the two cameras being about  $30^\circ$ . Features: Interchangeable magazines each holding 60 glass plates  $13 \times 18$  cm. ( $5.1 \times 7.1$  inches); lenses used are either Zeiss Tessar  $f/4.5$  or Galileo Aerostigmatic  $f/5.0$ , focal length 21 cm. (8.3 inches); central five-lamellae shutter; collimating marks carried over in contact on the plate in the form of small circles; angular field of image, transversal  $64^\circ 20'$ , longitudinal  $46^\circ 20'$ .

Camera Santoni Model II (Fig. 10). This consists of two cameras arranged as in Model I. Features: Size  $10 \times 15$  cm. ( $3.9 \times 5.9$  inches); rolling cylindrical magazines holding 200 plates each and interchangeable during flight; lens used is a Galileo Aerostigmatic  $f/5.0$ , focal length 168 mm. (6.6 inches); central five-lamellae shutter; four optical collimating marks; angular field of image, transversal  $64^\circ 00'$ , longitudinal  $46^\circ 20'$ .

Quadruple camera Santoni for colonial survey (Fig. 12). This consists of two Model II cameras rigidly connected with each other so that the axes of the four cameras are arranged like a fan and contained in a plane normal to the course of the aircraft. The quadruple camera can be used in a fixed mount or it can be fitted with a swinging movement of about  $30^\circ$  in order to further increase the transverse field by extending it from  $117^\circ$  to  $145^\circ$ .

Santoni's decision to use cylindrical plate carriers in Model II followed his experience in using the Model I type in which some difficulty arose from small deformations in the carriers.

During the military operations in Italian East Africa, over 40,000 photographs were taken with one of these cameras in the time from May 1935 to June 1936 without any material inconveniences.

Another type of multiple lens camera is illustrated in Fig. 14. This consists of three Nistri cameras of the type used in the military air force. This arrangement gives a large field of view. The oblique negatives are rectified by transforming apparatus of fixed angle, according to Scheimpflug's condition.

### *Plate Changing Devices*

The plate carriers in the Nistri "A.F.L. 92" have been made considerably lighter and now consist of a small steel bar running along the longer side of the plate and of two light steel guides holding the plate on the shorter side. The bar extends on either side of the plate so as to enable the mechanism to grasp and carry it on to the focal plane. After the plate is on the focal plane a metal frame presses against it at the instant of exposure (see Fig. 6).

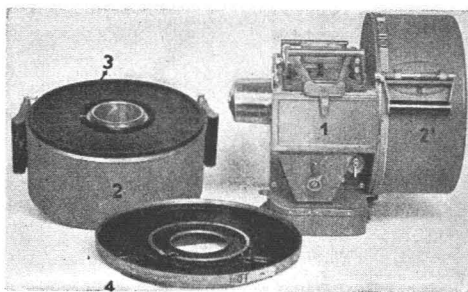
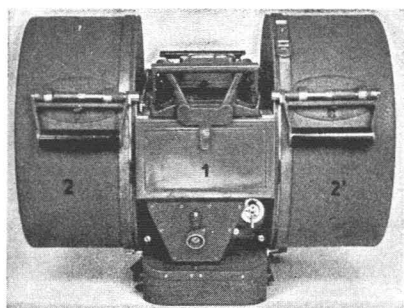
### *Film Cameras "Nistri"*

In these cameras (see Fig. 1) the film magazines are of two types: (1) simplified type, without recovery clutch, for small capacity cameras (camera "A.G.R. 61" with 120 exposure magazine, and camera "A.G.R. 90" when equipped with the 200 exposure magazine); (2) type for large capacity cameras (400 exposure magazine of "A.G.R. 90" and magazines of "A.P. 66-b" and "A.F.P. 62").

### *Plate Cameras Santoni Model II*

The system of plate supply is very remarkable, consisting of two cylindrical magazines each supplying one camera. In each magazine the plates (200 in





Macchina aerofotogrammetrica "Santoni" Modello 11.-1 Corpo principale macchina comprendente camera e dispositivi vari di comando - 2,2' Involucri esterni magazzini portastre - 3 Lastre disposte nel senso radiale nella scatola interna girevole - 4 Coperchio magazzino.-

(Fig. 10)

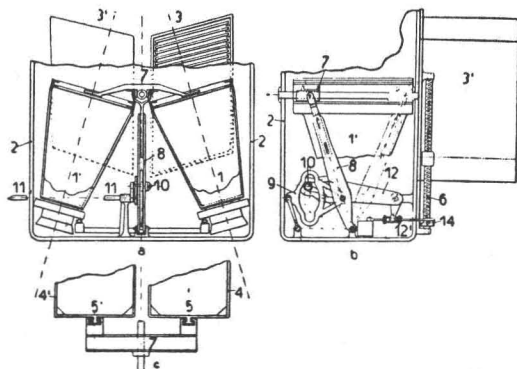


Fig. 11 Schema camera "Santoni" modello I.- 1,1' Camera 2 Scatola principale - 3,3' Magazzino - 4,4' Telaio porta lastre - 5,5' Ganci impegno estrattore - 6 Vite comando discesa magazzino - 7 Estrattore - 8 Leva comando estrattore - 10 Perno di comando - 11 Albero comando dall'esterno - 12 12' Leva azionamento otturatore e vite 6 - 14 Cricchetta comando della vite 6.-

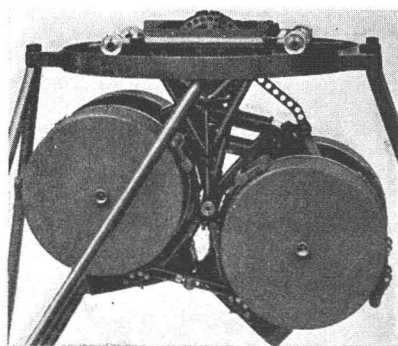


Fig. 12 Macchina aerofotogrammetrica quadrupla oscillante per rilievi coloniali "Santoni".

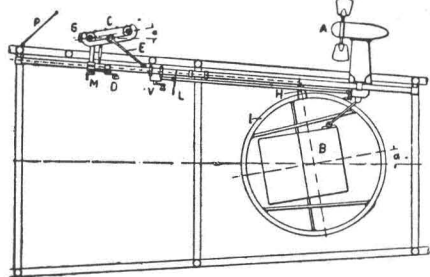


Fig. 13 Dispositivo automatico per correzione deriva e regolazione intervallo scatto.

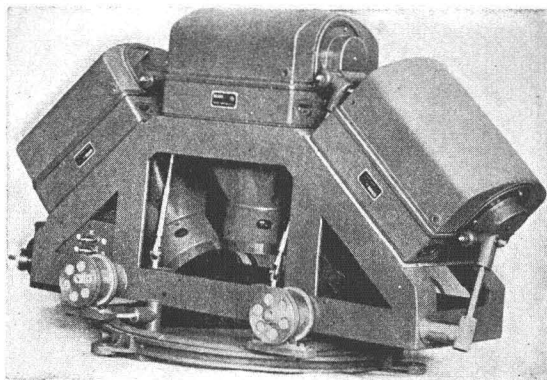


Fig. 14 Castello di macchine aerofotografiche per prese multiple.

number) are arranged radially (Fig. 10) and have no frame. The extractors extend between the plates and grasp them at the rear border in order to carry them into the camera, and also at the fore border in order to push them into the magazine after the exposure.

The magazine consists of an outer fixed case and an inner revolving box, the wall of which is provided with small steel tongues (0.2 mm. thick) used for seating the plates.

## AIRCRAFT AND ACCESSORY EQUIPMENT

Italy does not find it necessary to design special aircraft for photogrammetry. Since Italian photographic equipment possesses both lightness and minimum bulk, we may say, generally speaking, that any aircraft is suitable for taking photographs if it has those characteristics that are necessary for the photographic flight either for quick survey or for precision air survey. Geographic as well as hydrographic official or semi-official bodies and also private firms producing airphotogrammetric maps avail themselves of aircraft belonging to the Air Force. The type of plane chosen depends on the photogrammetric equipment which has to be installed and upon the atmospheric and economic conditions under which the impending work is carried out.

The quantity and nature of the accessory equipment depend not only on the type of installation but also on the system of camera operation employed. The orientation of flight lines on precision photographic projects are referred to the meridians. In order to keep the correct course, compass or directional gyroscopes are used. Good results have also been obtained by using two small solar gnomons reciprocally connected, one being placed over the pilot's instrument board and the other over the observer's seat. Since electric control systems are becoming general, the usual accessory equipment consists of small electric motors for operating the camera, various control dials, and a signalling system. For work at high altitudes, the importance of which is steadily increasing, special heating systems for the film can also be provided.

## OPERATION OF CAMERAS

The automatic functioning of Nistri cameras is accomplished by an independent motor, by energy supplies from the aircraft's storage battery, or by a small propeller. The time interval between successive photographs is obtained by means of a Nistri electric autochronometer or electric guide (Fig. 8). The photo-navigation of Nistri cameras is accomplished by means of a cine drift indicator equipped with artificial horizon. An indicating lamp near the pilot's seat informs him of the instant of exposure. The cine drift indicator gives the photographer the immediate vision of the field embraced; it permits him to calculate with precision the exposure interval; it informs him when this interval should be changed due to variation in speed of the aircraft; it enables him, with the aid of the artificial horizon, to level the camera at the instant of exposure.

The automatic operation of Santoni cameras is accomplished by means of a special device which corrects the drift and regulates the exposure interval. It has movable sights and is powered by a variable speed propeller. Fig. 13 shows a horizontal schematic section of the arrangement of the various parts of said device in the body of the aircraft. The small variable speed propeller "A" transmits a movement to camera "B" and to chain "C" of the drift indicator through rigid transmission gear. The eyepiece with free sighting line (a plain rubber ring) is carried by arm "E." Its height from the plane of chain "C" can be regulated according to the required overlap between the successive photographs. The speed of the propeller is controlled by handle "V." Handle "D" serves to determine the orientation of chain "C" according to the effective course of the aircraft and therefore the value of drift. At the same time handle "D" also rotates the camera to correct for the angle of drift. The value of the drift angle " $\alpha$ " can be read on graduation "G." The drift having been corrected and the exposure interval regulated, the camera is then started by moving lever "L." The outer arrangement of the drift indicator and interval regulator

in respect to the aircraft makes it possible for a single operator (besides the pilot) to perform the various regulations without leaving his seat. A small deflector "P" of transparent material protects the operator from the air stream when he has to lean out of the window for controlling the course.

### SUPPLY BASES

The question of supply bases becomes very important when work is performed in countries not yet organized with respect to air navigation needs, military as well as civilian, as is still the case in colonial countries. The increased autonomy of the aircraft permits the keeping of bases at great distances from one another, but under certain conditions the problem cannot be easily solved on account of the peculiarities of terrain and climate. In Europe this question does not present any difficulty, but a study should be made of each project as regards extent of the tracts to be surveyed, their position with respect to the permanent supply bases, and the conditions of accessibility of areas which seem suitable for establishing temporary bases. The equipment of these temporary bases has been considerably simplified lately through the use of movable photographic laboratories drawn by motor cars and by tent laboratories.

As to the Italian organization of photogrammetric flights in the colonies, communications will be made during the sessions of the congress.

### SENSITIVE MATERIALS FOR AIR PHOTOGRAPHY

The characteristics of "Ferrania" national emulsions for air photography, which in the last two years have been remarkably perfected, are as follows: high chromatic and general sensitivity, fine grain with resolving power of 1/50 mm., decided brilliancy, and a gelatin sufficiently hard to resist crumbling and deformation during treatment in hot climates.

## Latvia

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### AIR CAMERAS

Only vertical air photographs are used in Latvia. These are taken with the French Planiphot camera. This camera is operated automatically and uses film with negative size 18×24 cm. (7×9 inches). The lenses are double anastigmats with aperture ratio of 1/4.5 and focal length of 30 cm. (12 inches). Exposure intervals are from 1/80 to 1/120 second. The magazine capacity of the camera is 200 photographs.

Filters are not always used because of unfavorable light conditions. Experiments are being made with faint yellow filters.

### FILMS AND PAPER

Films in use for air photography are the Imperial Aero, Ilford Aero, Agfa Aero and Orthochromatic. Dimensional changes have not been tested.

The paper used for mosaic work is quite thin so that photographs may be copied on planchets. This paper is manufactured by our factory.

Experiments on photographic paper show that the shrinkage is about 1.3% after processing.