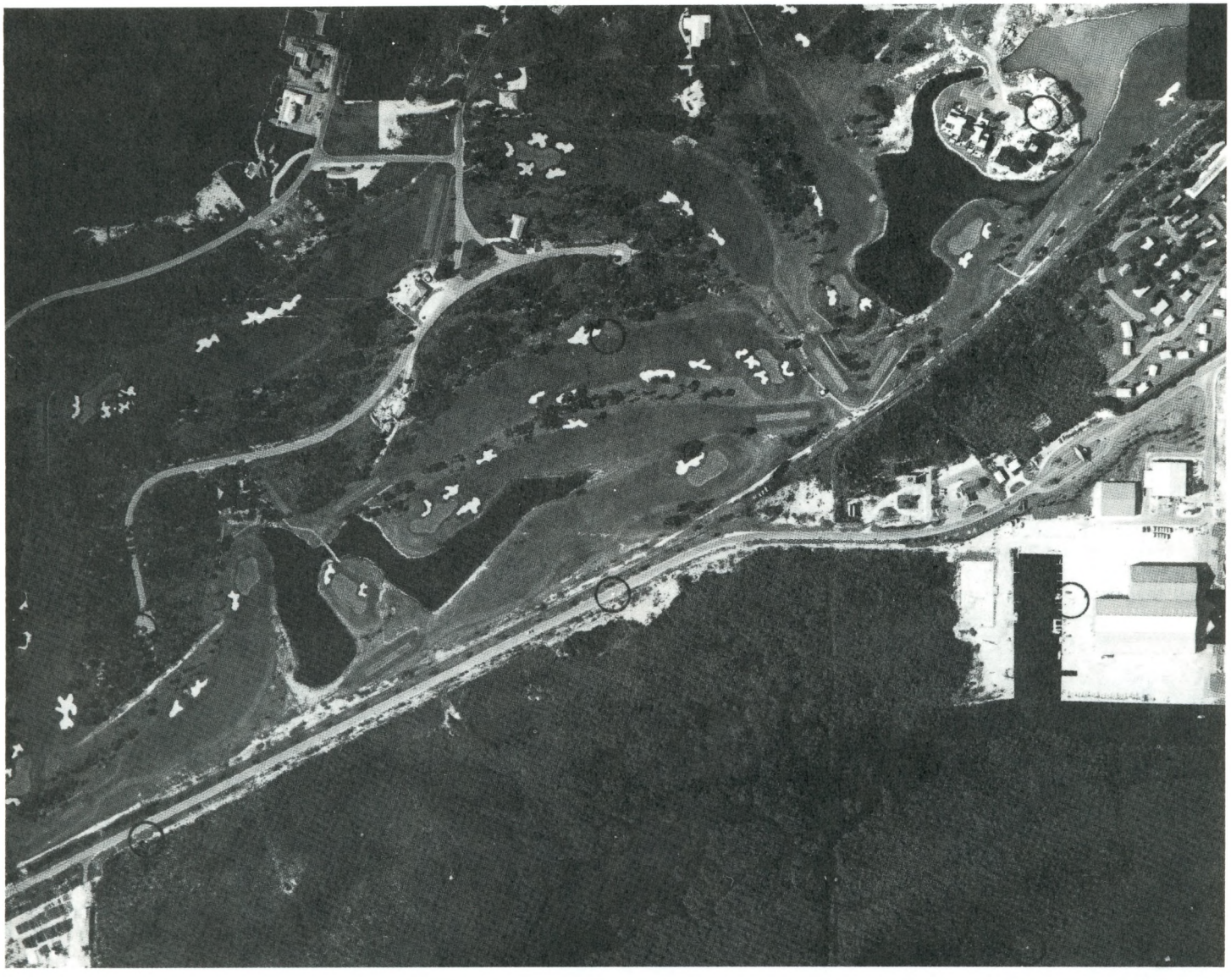
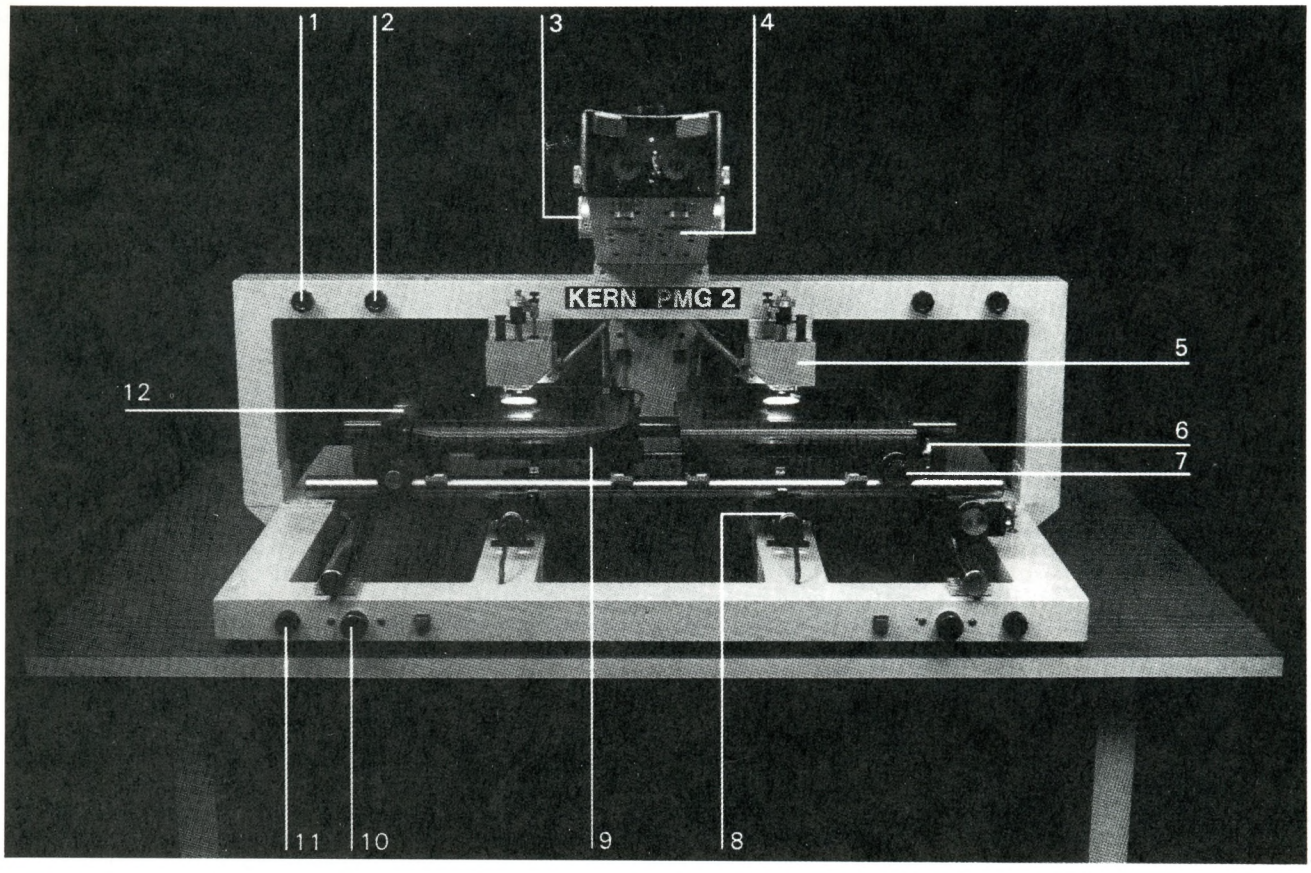
Kern PMG 2 Zoom Point-Transfer Instrument MK2 MONOCOMPARATOR

BY TUDOR JONES





1 Drill speed adjustment
2 Drill rate of descent adjustment
3 Zoom knob, left plate
4 Image rotation, right plate
5 Drill spindle head
6 Δx motion
7 Clamp, Δx motion
8 Measuring mark adjustment
9 Cross-slide system
10 Fiber-optics light-intensity adjustment
11 Measuring mark illumination adjustment
12 $\varkappa_1$ motion

The above instruments are products of Kern and Co. Ltd. of Aarau, Switzerland, and are distributed in this country by Kern Instruments of Canada Ltd.

They are used in the analytical method of photogrammetric control extension procedures, or bridging, as it is sometimes called.

With today's large computers and their accompanying sophisticated software, analytical aerial triangulation is the most important and most precise method for control extension.

Analytical techniques eliminate systematic errors such as film shrinkage, atmospheric refraction distortions, camera lens distortions, etc. very effectively. Analytical methods are not restrained by the mechanical or optical limitations imposed by the stereoplotters in the analogical procedures involving manual relative orientation and measurement of model co-ordinates.

The accuracy and economy of fully analytical aerotriangulation depends primarily on the accuracy and speed with which control and pass points can be located, transferred, marked and measured.

The Kern PMG2 has been especially designed to carry out the first three of these four functions; the MK2 does the measuring.

The PMG2 is equipped with two photocarriers, which can accommodate photographs up to 230mm square. These carriers are fitted with grooves which are connected to a vacuum pump. The diapositives are therefore held perfectly flat without the need for clamps or weights which might otherwise disturb the image or the drills.

The diapositives are viewed stereoscopically from below through the binocular viewing system. For illumination, light is projected onto opaque background discs above the plate carriers. The high power lamps are located on the rear panel underneath the table support. Their light is projected onto the background discs through fibre optics so that the effects of heat radiation are eliminated. The light intensity can be adjusted for each image separately.

After both pictures have been roughly aligned, the carrier plates can be moved simultaneously to any position in the model, and corresponding images will generally be in the field of view at all times. This is important in featureless terrain, as identification difficulties are reduced, and there is less chance of losing stereoscopy as would be the case if each picture had to be individually shifted by hand.

Optical magnification by means of the zoom system is infinitely variable between 5X and 25X, and each image may be enlarged or reduced in size independently of the other. This means that stereoscopic point transfer and point marking is possible using different photo scales. For example, points from smaller scale photographs used for aerotriangulation can be transferred and marked onto larger scale photographs which are to be used for plotting.

Another advantage of the zoom feature is that the optimum magnifica-

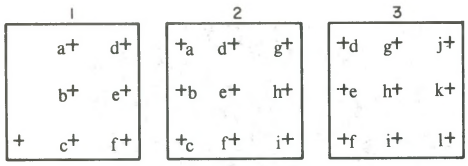
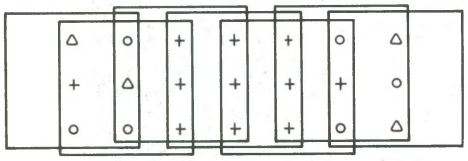


FIG. 1



△ Horizontal Control ○ Vertical Control
+ Pass Points

FIG. 2

tion can be set according to the quality of the photographs.

The floating marks consist of illuminated dots which can be varied in size for each image. This is necessary when point transfer is done on photographs with different scales.

High speed drills, which are collinear with the floating marks, are used to mark the points on the photographs. Small circular holes are made in the emulsion by the drills.

The drill head assemblies are stationary. The drill spindles are electrically driven and move in precision ball bearings. The rotational speed of the drills and their rate of descent are both adjustable to obtain the best result for the given emulsion characteristics. Drills are supplied with diameters of 0.04mm, 0.06mm and 0.10mm.

The opaque background discs previously referred to, are swung out of the way when the drills come down for marking.

Pass points may be images of natural well-defined objects that appear in the required photo areas, or if no such points are available, pass points may be artificially marked.

Even though satisfactory natural points may exist in the photographs, many operators prefer to mark pass points artificially. They point out that a more discrete point is obtained so that more accurate measurements of its position can be obtained, and the likelihood of misidentification is greatly reduced.

Upon making the holes, the emulsion in those spots is destroyed. Thus no further refinement in the identification of the image position can be made, and any error in positioning is fixed. This part of the operation, therefore, has to be carried out with extreme caution.

The MK2 Monocomparator makes measurements on one photograph at a time, of course, and is used to obtain the precise photo-coordinates necessary for analytical photogrammetry.

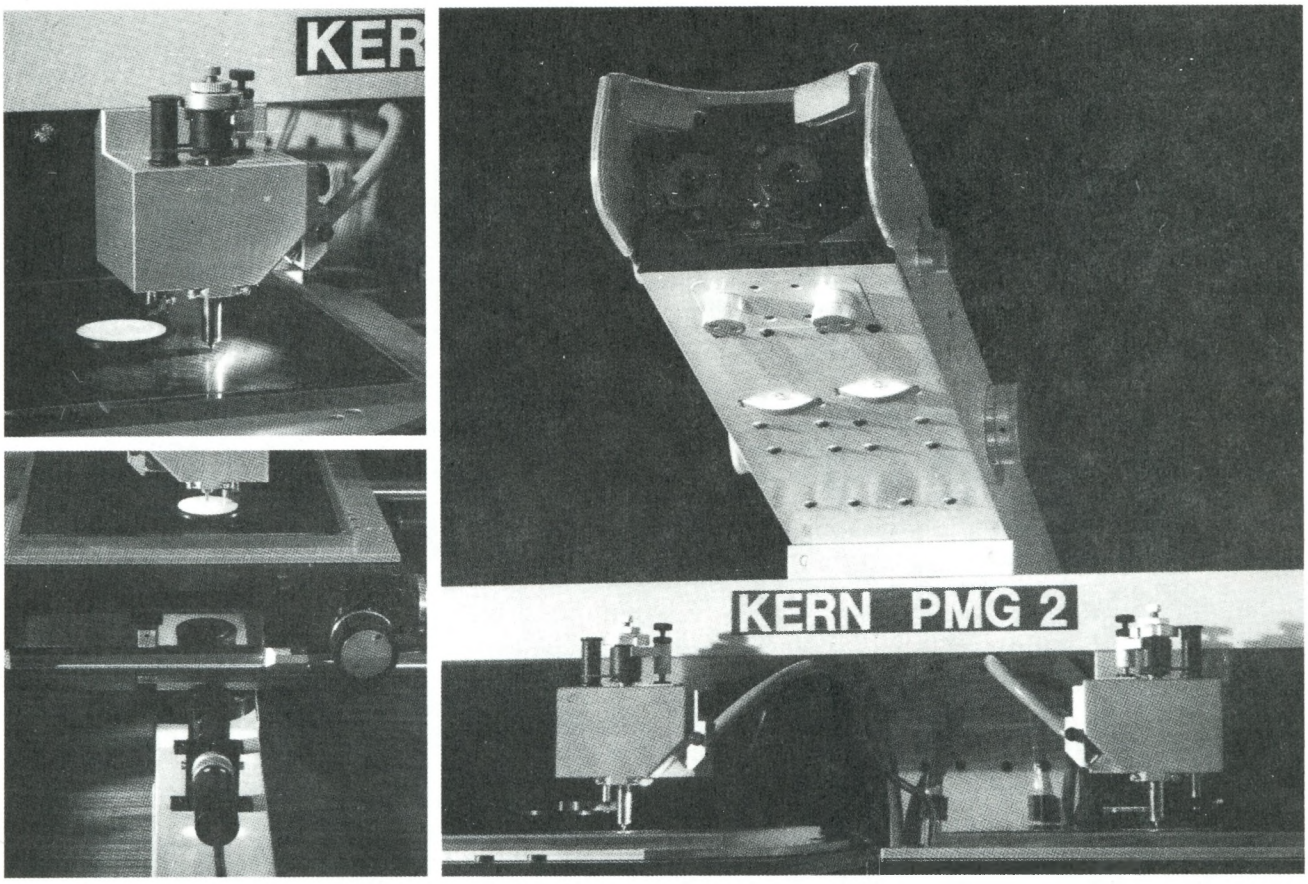
The plate carrier on the instrument is illuminated like a light table. No special care is needed to position the diapositive. It is simply placed on the stage plate and pushed against the stops. Two leaf spring clamps hold it in place.

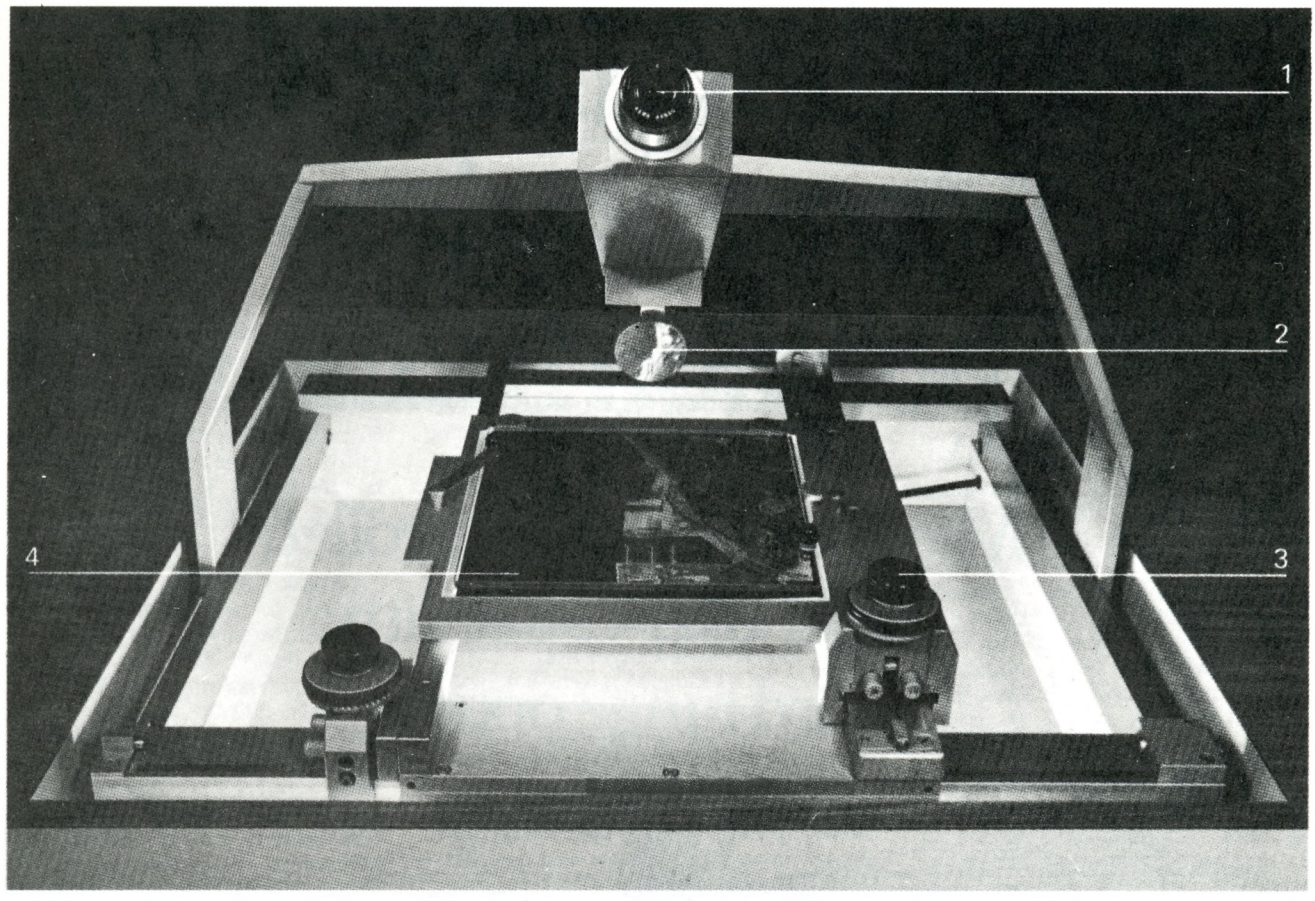
The monocular observing microscope is claimed to be advantageous, as it allows the operator to change between direct and optically aided observation of the diapositive quickly and easily.

Coaxial clamping and slow-motion knobs are located so that the operator never removes his hands from the X and Y freehand drives during the measuring process. A slight rotation locks the disc clamps; the slow-motion knobs are immediately above the clamping knobs.

It is equipped with linear, incremental glass scale encoders, reading directly to 0.001mm, or one micron. The instrument is designed to operate in a controlled environment, at 22°C, plus or minus two degrees.

It may also feature an electronic





1 Monocular microscope for quick change between direct and optically-aided viewing
2 Finder sight for rapid placement of marked points within field of view of microscope
3 Coaxial clamp and slow motion for maximum operator comfort
4 Illuminated plate carrier for immediate recognition of fiducials and marked points

console for computer compatible recording of the measured data on teletype, punched cards or paper tape.

Measurements are taken to all fiducials and all image points whose co-ordinates are desired. The co-ordinates are later reduced numerically from the comparator measurement system to an arbitrary system suitable for subsequent processing.

Briefly, each stereopair in a strip of photos may now be relatively oriented. Analytical relative orientation of a stereopair is achieved by enforcing the condition that corresponding rays intersect at a point. For example, the measurements obtained from the left photo may be held fixed in position within the computer, and the data for the right photo is then adjusted by applying rotations and translations until orientation is achieved.

The overall result of this is a series of independent models, each having its own co-ordinate system. Three-dimensional co-ordinate transformations may then be successively performed to join adjacent models and to form a continuous model strip.

By comparing strip co-ordinates of horizontal and vertical control points to their corresponding field-surveyed values, corrections are applied to pass point co-ordinates and their final adjusted values become available for subsequent photogrammetric purposes.

NOTICE

NEW EXAMINATION REGULATIONS FOR CANADA LANDS SURVEYORS

New regulations for the examination of Canada Lands Surveyors became effective September 13, 1979.

Under the new regulations, anyone who has five years of professional experience in surveying in Canada may apply to the Board of Examiners for a special examination for a commission. This will provide commissions to those who are engaged in and have extensive and responsible experience in surveying (Cadastral, geodetic, hydrographic or photogrammetric), but who might not possess the formal qualifications normally required for such a commission. This provision will expire September 13, 1981.

Those wishing to apply for the special examination should request an application form from:

Mr. R. O. Semper, Secretary
Board of Examiners
for Canada Lands Surveyors
Department of Energy
Mines and Resources
Ottawa, Ontario K1A 0E9
Telephone: (613) 995-4368

Copies of the new regulations are also available from Mr. Semper.