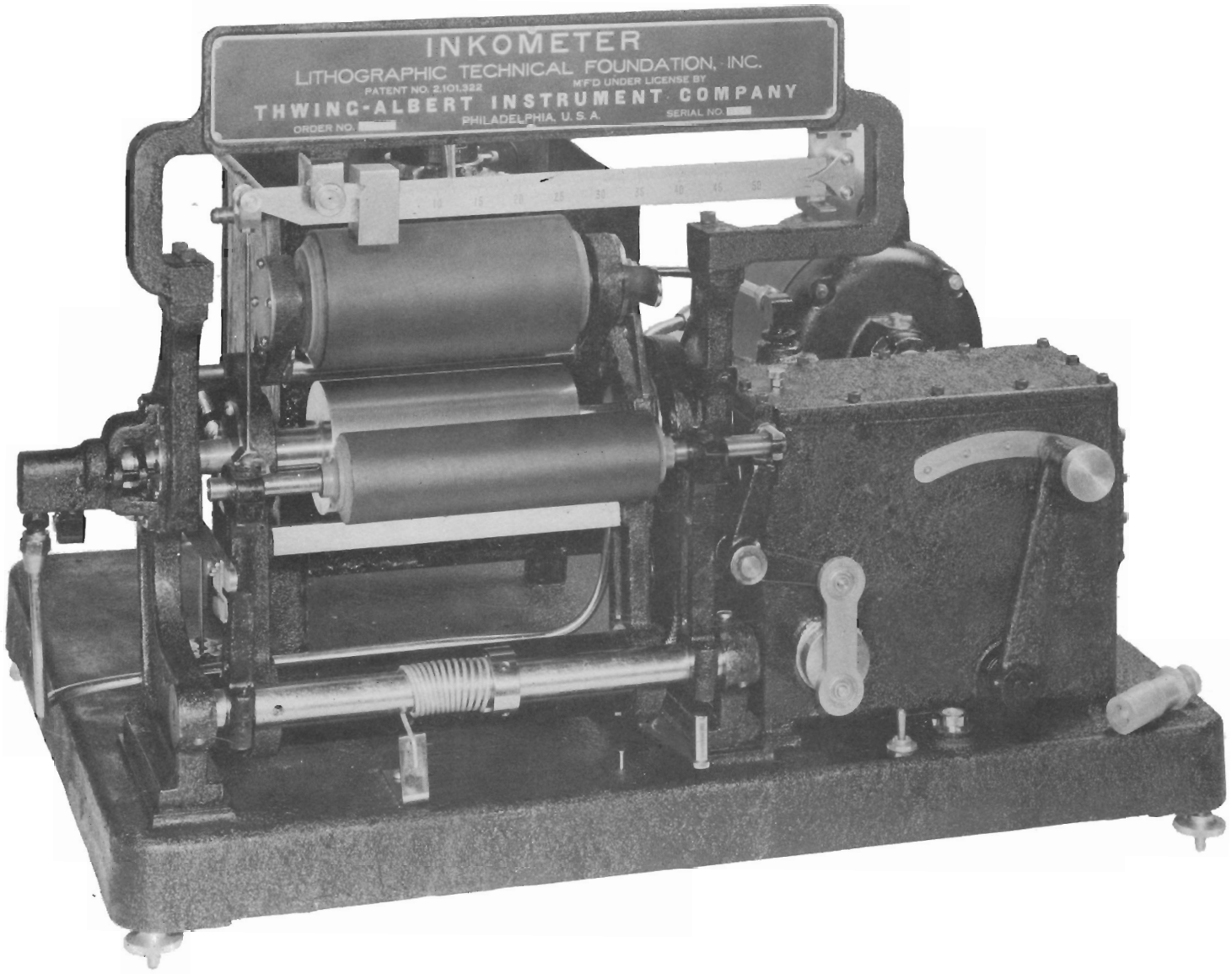
INKOMETER



THE INKOMETER IS THE INSTRUMENT WHICH MEASURES BEST THE INTEGRATED FORCES INVOLVED IN FILM SPLITTING AND THE EFFECTS OF SPEED, FILM THICKNESS, TEMPERATURE, AND SOLVENT EVAPORATION ON THESE FORCES.

THWING-ALBERT INKOMETER

Since the earliest attempts of man to print by transferring ink from one surface to another, the characteristics of printing ink have been an important factor in the quality of the printed product. Blocks can be cut, type can be cast and set, plates can be engraved or etched, with consummate skill, but good printing cannot be done unless the ink is adapted to the printing and printed surfaces, and to the method of producing the impression.

Standardization of ink consistency was hindered by a lack of knowledge and of adequate testing methods. Various terms were used to describe the manifestations of consistency; such as viscosity, body, stiffness or softness, length or shortness, lifting properties, and tack, but the actual characteristics which determine the printing quality of an ink were not understood. Methods of testing were extremely empirical and involved the human element to a large extent. What standardization was accomplished depended on the maintenance of so-called standard samples, but it is well known that ink consistency varies both reversibly and irreversibly with age, and that the ink maker must depend largely on experience and judgment in adjusting the consistencies of successive batches of any given ink.

Obviously, the logical solution of the problem of consistency standardization depended on the development of means whereby ink consistency could be accurately measured and represented by numerical values. Also, since inks are thixotropic plastic materials subject to reversible changes in consistency with mechanical agitation, consistency measurements should be taken while the inks are in a state of agitation comparable to that which takes place during actual printing.

After a most exhaustive study of the whole subject extending over a period of years, the Lithographic Technical Foundation found it was necessary to develop a totally new method in which the printing conditions were closely approximated during measurement. This study resulted in the development of an instrument called **THE INKOMETER** which is of outstanding value to manufacturers and users of printing inks.

The Inkometer is an instrument designed to measure the effective consistency of lithographic and printing inks under conditions in which the degree of working of the ink closely approximates that which takes place during printing. Previously it was the practice to maintain "shelf standards," or samples of inks set aside from satisfactory batches and to compare new lots of ink with these samples by means of "finger" tests for tack and length. Such tests have serious disadvantages, the principal of which are:

1. The tests are relatively static, and in many cases inks which they indicate to be the same are quite different after they have been subjected to the breaking-down action of the ink rollers on the press.

2. The results depend to a large degree on the experience and judgment of the operator.

3. There is no means whereby length and tack can be recorded in numerical terms. Thus, since the "shelf standards" change in consistence with age, there is no basis for standardization.

The Inkometer overcomes these difficulties. Tests are made under dynamic conditions approaching closely the conditions which exist on the ink-distributing system of the press during printing. Results are obtained in numerical values for the torque required to "work" the ink film at known rates, with predetermined film thickness and temperature. Records can be made either in the form of consistency curves, or of numerical values for tack and length.

The Inkometer is suitable for testing all lithographic or printing inks having definite plastic properties, and which contain no volatile thinners.

An outstanding expert has stated:

"The INKOMETER *is the instrument which at present measures best the integrated forces involved in film splitting and the effects of speed, film thickness, temperature, and solvent evaporation on these forces."*

We will be glad to supply complete data.

INSTRUCTIONS FOR OPERATING THE THWING-ALBERT INKOMETER

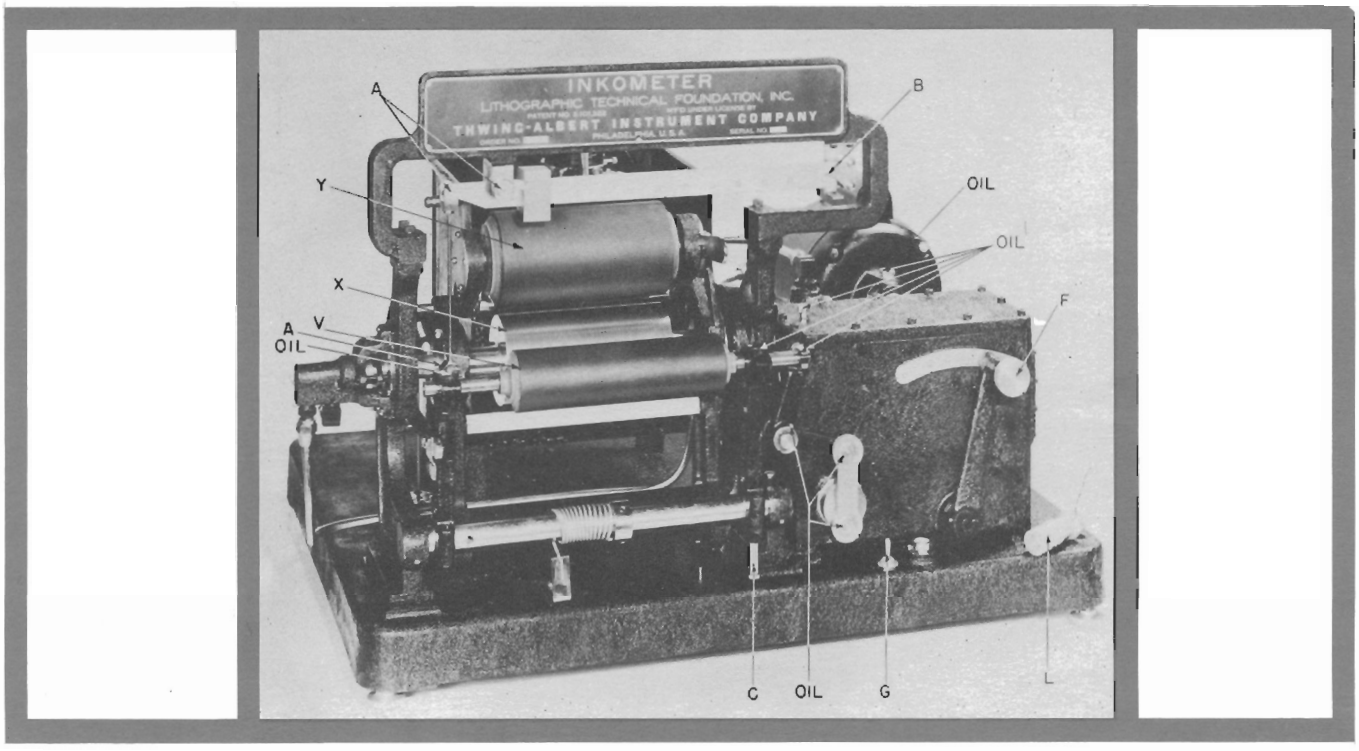


FIGURE I INKOMETER — FRONT VIEW

There are two models of the Inkometer, the B-45 model made to operate at speeds of 314, 628 and 942 feet per minute (400, 800 and 1200 revolutions per minute) and the C-46 model which operates at speeds of 314, 942 and 1570 feet per minute (400, 1200 and 2000 revolutions per minute.

Both models can be operated with vulcanized oil rollers, synthetic rubber rollers or any composition covered rollers. The general trend is to operate with the new synthetic rollers which maintain the same degree of hardness over a longer period of time. For heat-set inks synthetic rollers are necessary. THWING-ALBERT INSTRUMENT COMPANY can supply the roller cores which may be covered as desired by the customer, or furnish the cores covered ready to use.

SETTING UP

The Inkometer should be set up in a room where temperature and humidity can be controlled. Otherwise it should be located where variations in these conditions and air drafts are at a minimum. Locations near windows or doorways are unsatisfactory as drafts will cause variations in readings. The instrument should be set on a heavy bench, mounted so it will not absorb building vibrations. It is important to level the Inkometer carefully, guided by the circular level mounted at the right front of the instrument.

The delicate pivot bearings of the scale beam, connecting link and dashpot (A, Fig 1) may be damaged in moving the Inkometer, or may become loose through constant use of the Inkometer. It is very important that they be kept in good adjustment for accurate readings. The bearings should have a minimum of play and yet be free. When the bearings are properly adjusted, and with the swinging frame locked (lever C to the right, Fig. 1), the index (B) located to the right of the scale beam should point to the middle line on the end of the beam. Alignment of the beam may be accompanied by loosening the lock nut on the connecting link, turning the rod, and retightening the nut. (See drawing #101 - 106A).

Fill the dashpot (H, Fig. 2) with light (SAE #20) motor oil. It is recommended that the oil be allowed to enter the dashpot by running down the piston shaft while the piston is moved up and down, to eliminate air pockets. The cover of the dashpot then does not need to be removed.

TEMPERATURE CONTROL

The thermostatic bath (D, Fig. 2) should be filled with water containing a small amount of potassium bichromate to a point above the pump intake. The bichromate acts to prevent corrosion; sufficient should be present to color the water yellow.

The heating element in the water bath is turned on by a switch at the top of the relay box mounted to the bath, back of the instrument.

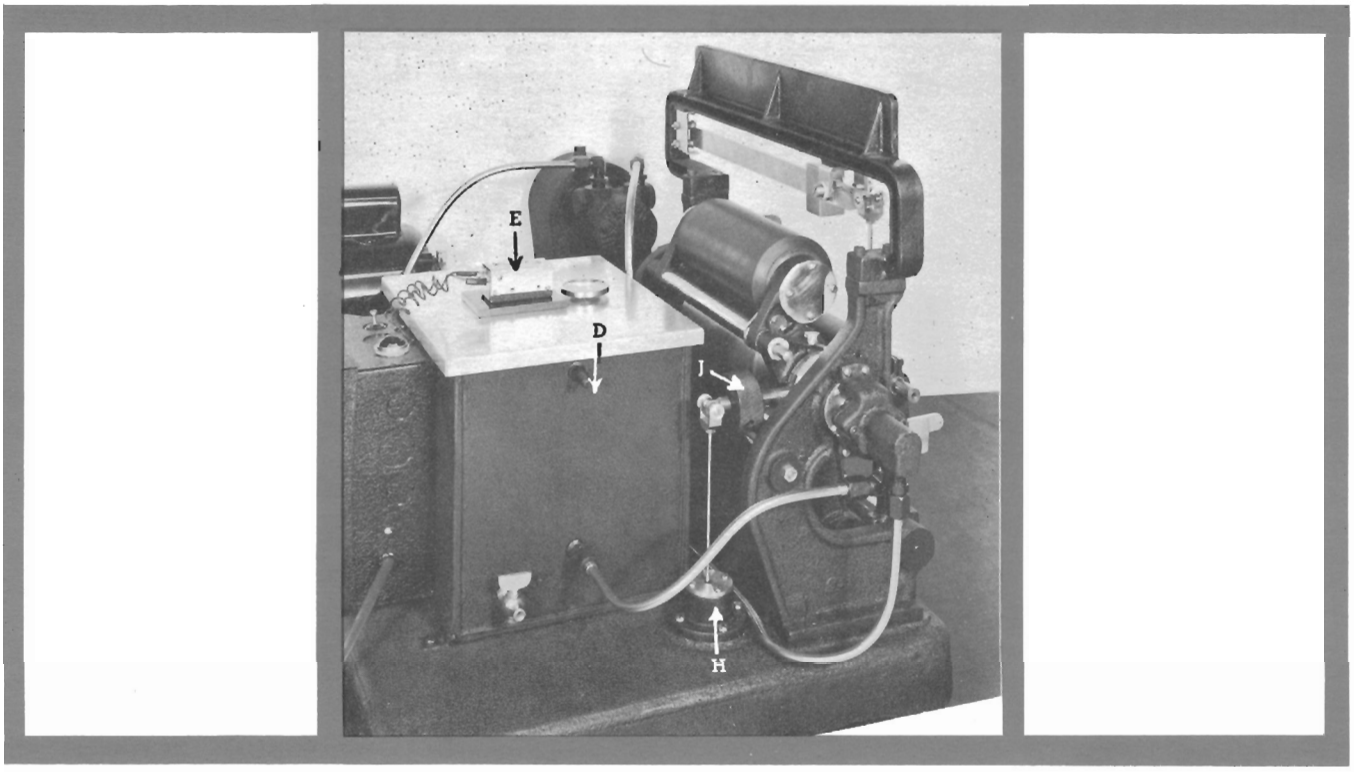


FIGURE 2 INKOMETER — LEFT SIDE

A pilot light in the rear lights whenever the heating element is operating. The heater is controlled by a bimetallic thermoregulator suspended in the bath. Adjustments in the bath temperature are made by a knob on the side of the thermoregulator. Turn this to raise or to lower the temperature. When the thermometer mounted in the bath shows the proper temperature, the light should alternate off and on. A temperature of 90° Fahr. is specified for general ink testing purposes. The bath will reach this temperature from 70° Fahr. in about twenty minutes. Extreme care should be used in adjusting the temperature as close to 90° Fahr. as possible.

When a temperature change occurs in either room or bath temperature, at least fifteen minutes of running dry must be allowed for the rollers to reach equilibrium. It is also necessary to rebalance the Inkometer.

It is difficult to maintain a water bath temperature less than ten degrees above room temperature, especially when humidity is high, unless special arrangements are made for cooling. Ice may be added at frequent intervals or tap water may be piped into the tank. However, the recommended 90° Fahr. temperature is normally very easy to maintain.

LUBRICATION

Daily lubrication consists of applying a few drops of good lathe point center oil to the shafts of the vibrator roller, and on the swinging frame bearings; as well as on the moving parts of the vibrator crank. The miniature ball bearings in the weighing mechanism require no lubrication.

The transmission of Model B-45 has two gear cases requiring lubrication from separate points. The Model C-46 has one case. A lubricant similar to Houghton's Hydro Drive MIH 30 (SAE #30) is recommended.

Motor bearings should be given several drops of lubricating oil at least once each week.

The ball bearings supporting the top roller need not be oiled. However, a light film of a very light oil may be applied occasionally when changing rollers. A large quantity, or a heavy oil, will affect readings adversely.

ADJUSTMENTS

When run dry, the Inkometer should balance with sliding weight set at zero. Balance may be obtained as follows: Lower the top roller (Y, Fig. 1) and release the vibrator roller (V) so that both bear on the metal roller (X). If the Inkometer has not been in use for several hours see "Measurement of Consistency" for special precautions to be taken at this point. Then, after allowing the rollers to run clean and dry to warm up, adjust the counterweight (J, Fig. 2) at the rear of the left end of the swinging frame so that the beam exactly balances with the sliding weight set at zero. The beam is released for balancing by moving the locking lever (C) to the left.

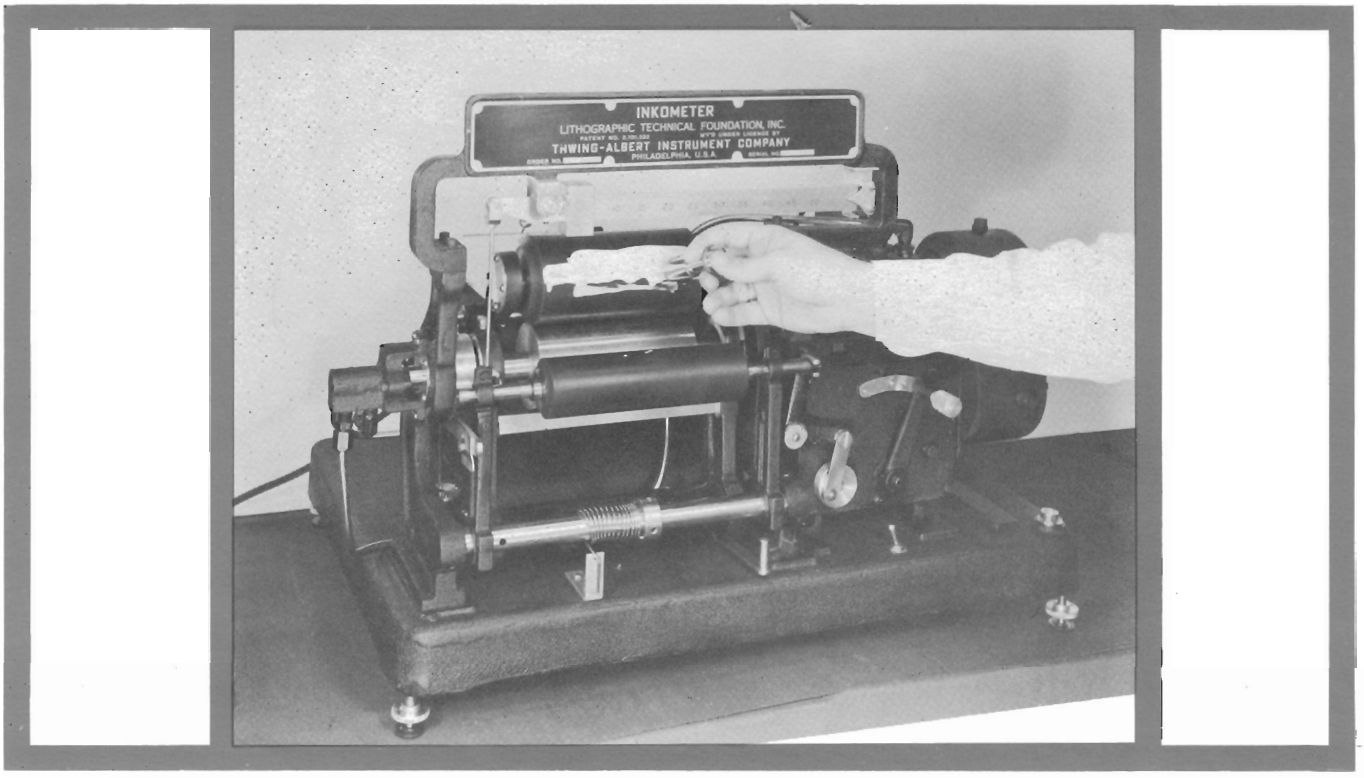


FIGURE 3 APPLICATION OF INK TO ROLLERS

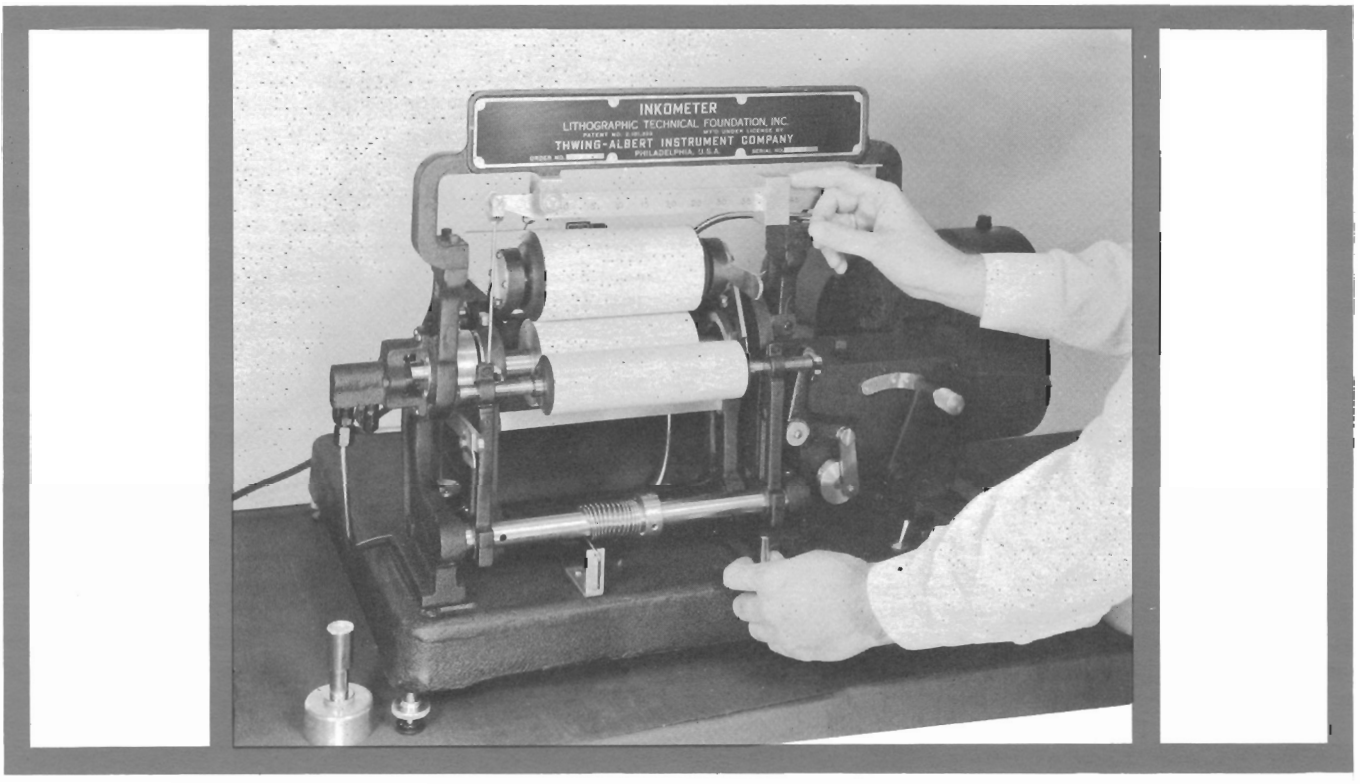


FIGURE 4 MEASUREMENT OF TACK

With composition covered rollers, the beam will not balance at the same point at all three speeds. Normally it should be balanced at the speed used for testing inks. However, when it is desired to take readings at all three speeds on one sample of ink using such rollers, it will be necessary to apply corrections to readings taken at the two speeds at which the machine is not in balance. These corrections are additive and are constant for a given set of rollers and a given operating temperature. When either of these is changed, new corrections should be computed as indicated below.

With the instrument adjusted to balance at low speed, as described above, shift to medium speed and slide the weight along the beam to obtain balance. Record the scale reading. Repeat this operation at high speed. These readings for average rollers on the B-45 Inkometer will be in the neighborhood of 1.2 and 1.8 units respectively, depending on temperature. Then, if the Inkometer remains balanced at low speed, the corrected tack readings at medium and high speeds will be 1.2 and 1.8 units LESS than the actual scale readings. It is sometimes simpler to rebalance the Inkometer at high speed when testing inks and then ADD corrections (0.6 and 1.8 in the above case) to the scale readings at medium and low speeds.

Vulcanized oil rollers do not exhibit the above spread in balancing points between the three speeds, and when once balanced at the medium speed, the Inkometer should be in approximate balance at all three speeds, provided the roller surfaces are clean and dry, and the temperature is constant.

The vibrator roller is mounted on two supports attached to a heavy rod, under spring tension to produce a bearing force of 8 pounds between the vibrator and the metal roller. The two ends of the vibrator roller bear equally on the metal roller when the Inkometer leaves the manufacturer, but should adjustments be required later they can be accomplished easily by adjusting the spring tension. The lower part of each vibrator support is pinned rigidly to the rod. The pressure can be determined by using strips of tissue paper as is done in setting rollers on a press. When the two ends are adjusted to bear equally on the metal roller, the vibrator roller should turn freely.

To prevent unnecessary strain on the pivot bearings when starting and stopping the motor or changing speeds, the spring-actuated locking lever should remain at the right at all times except when readings are being taken.

The upper roller and vibrator roller should be locked out of contact with the metal roller when not in use to prevent the development of "flats."

The motor should be turned off before changing speeds (Switch G, Fig. 1). To make the teeth mesh more easily the motor coupling may be turned by hand. Speeds (F, Fig. 1) should not be changed while the motor is running, since this might cause burring of the gear teeth.

SAMPLING THE INK

When sampling inks for consistency determination, care should be taken that the sample is representative of the entire batch of ink in question. Ink which has been for some time in the container is likely to oxidize to some extent near the surface exposed to the air, and a sample taken superficially may show a different consistency from that of the main body of the ink. If possible, therefore, it is advisable either to mix the entire batch before sampling, or to take several samples from various parts of the batch and mix them thoroughly to provide a representative sample for testing. Any skin or crust which forms on the sample should be removed before testing.

MEASUREMENT OF CONSISTENCY

SPECIAL PRECAUTIONS — Since the first ink applied to an Inkometer after several hours standing is often erratic when the instrument is carefully warmed up, it is best to proceed as follows:

After the water bath reaches 90° Fahr., apply enough of any convenient ink to cover the rollers with a spatula and allow the Inkometer to run at low speed for one minute. It is not necessary to take readings on this ink since it serves only to warm up the rollers.

Clean the rollers.

Allow the Inkometer to run dry until the beam balances with the sliding weight set at zero.

Fill the ink metering device (L, Fig. 1) with the ink to be tested, by means of a spatula. Push the piston all the way out, and then allow it to return slowly, meanwhile working the ink into the cup with the spatula to eliminate air bubbles. Finally, scrape off the excess ink by passing the edge of the spatula across the end of the pipette.

Stop the Inkometer and spread the ink evenly across the upper roller as shown in Fig. 3. Wipe off any ink remaining in the pipette on the vibrator. The film thickness obtained in this manner is 0.0005 inch within plus or minus 1%.

To avoid excessive flying when the Inkometer is started, obtain initial distribution by turning the motor coupling by hand. This procedure should be standardized and take no longer than ten seconds.

Start the Inkometer and an accurate timer together. The Kodak Interval Timer has been found superior to a stop watch for use with the Inkometer.

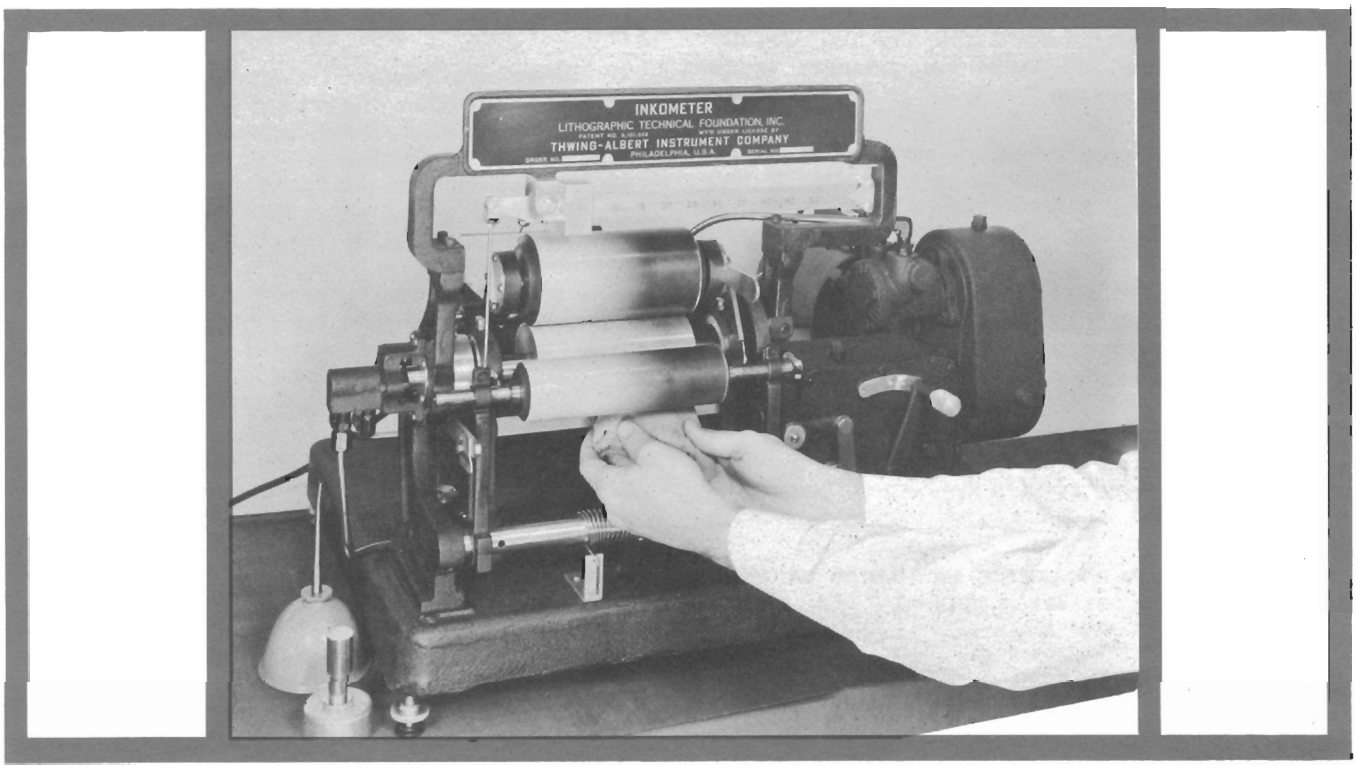


FIGURE 5 CLEANING OF ROLLERS

Readings may be taken in several ways, two of which will be described here. In one method, the ink is allowed to distribute one minute at medium speed, then the machine is shifted to high speed and the beam balanced as shown in Fig. 4. A second reading is taken at medium speed and a third at low speed, these two latter readings taking a total of about one minute. In all cases, readings are taken by releasing the swinging frame by moving the key lever C to the left with the left hand while adjusting the sliding weight with the right hand. This method is especially suitable for oil inks.

A second, and more popular, method of taking readings involves a careful time schedule while running at only one speed. This method is useful in testing heat-set inks, and lends itself well to routine control work. Readings are taken at twenty seconds, forty seconds, one minute and two minutes after starting the Inkometer. Practice is necessary to adhere rigorously to this schedule, but for inks with volatile solvents it is very important to do so. The twenty second reading corresponds roughly with the tack on a press in continuous operation.

Interesting results can often be obtained by continuing the test for longer periods, taking readings at one minute intervals.

For control work when it is not always known by the operator in advance whether a sample is oil or heat set, it has been found that using the lowest of the three readings in the first minute as a single measure of consistency gives reasonably satisfactory results with both types of inks.

These two methods may be combined as desired for special problems.

Check readings on any ink should be made on fresh samples after the usual ten minute waiting period. When all the necessary precautions are taken, successive tack readings on any given ink have been found to check within 1.0%, except when solvents are present which are either very volatile or absorbed rapidly by the rollers.

CLEANING

With the Inkometer running at low speed, put enough solvent on the rollers to soften the ink to a very liquid consistency. Use kerosene for oil and heat set inks; use a convenient glycol for glycol type inks. The use of too volatile solvents tends to chill the rollers, and gives erratic results. The use of too strong solvents will deteriorate the rollers, and also cause erratic results. Solvents may be kept conveniently in ordinary oil cans.

A large amount of the ink-solvent mixture can be removed with a straight edge of stiff paper applied to the water cooled roller underneath.

Fold a rag in the form of a pad, leaving no loose strings to get caught on the roller, and continue cleaning by holding this against the lower side of the water roller (Fig. 5), moving it from side to side and using a fresh surface occasionally until the rollers become practically free from ink and solvent.

Clean the sides of the water roller with the rag and lightly touch the edges of the two elastic rollers if necessary, to clean the ridge which often forms there.

Add smaller amounts of solvent and repeat until the rag shows no color from the ink. Usually three applications are sufficient, cleaning being complete in two minutes.

If synthetic rubber rollers develop a glazed appearance which is difficult to remove, use a few drops of a 5% caustic solution followed by a regular cleaning with a glycol solvent.

The bar behind the upper roller must be cleaned occasionally by scraping to prevent buildup of ink, which would eventually transfer to the brass roller and cause incorrect readings.

The beam should be kept clean to enable the sliding weight to move freely. The weight may be removed from the right end of the beam for cleaning, if the index is removed.

The Inkometer should run until beam balances at zero before the next ink is applied.

CHANGING ROLLERS

The Inkometer is designed to make replacement of rollers a quick and simple operation. The upper roller operates in ball bearings which are housed in two bearing supports hinged on a shaft which serves to connect and align them.

The shaft is locked in place by a hollow-head set screw in the left side frame of the swinging frame. After this screw is backed out the shaft may be withdrawn. The upper roller with support is then rolled forward over the brass roller, care being taken not to jar the beam. Another set screw at the right end of the hollow shaft connecting the bearing supports must now be backed out, after which the supports with the bearings may be pulled off the shaft ends of the roller. These should fit snugly without play, but should not require undue force for their removal. The reverse procedure is followed to replace the top roller assembly.

The vibrator roller is removed by simply unscrewing the set screw in the front of the vibrator roller support. Remove the nylon bearing assembly.

After changing rollers it is a wise precaution to turn the entire mechanism several revolutions by hand before starting the motor. Any undue stiffness or binding should be traced to its source and the cause removed.

It is advisable to save at least one ink of an inert type for use in standardizing new rollers. If rollers vary much in hardness, oil resistance or surface smoothness, readings will not check, and it will be necessary to make adjustments when such changes are made.

TABULATION OF RESULTS

When readings are taken in three speeds on oil inks it is often convenient to tabulate all the readings, as well as the difference between the high and low speed readings. Tack may be taken as the reading either at the speed most nearly approximating press speed, or at any arbitrarily selected speed for purposes of simplicity. The difference between the high and low speed readings is indicative of "length" or "shortness", although not in all cases synonymous with the common conceptions of those terms.

Inks with volatile solvents are best tested by taking readings on a time schedule, and can be studied easily by plotting Inkometer readings against time, either on linear or on semilog paper. These graphs indicate the volatility of the solvent as well as the original tack of the ink.. When it is desired to compare readings at the three speeds for special purposes, it is recommended that seperate tests be run at each speed, and that approximate readings from each of the three tests be compared.

A numerical measure of press stability can be derived by noting the percentage increase in tack during a given time.

FLYING TESTS

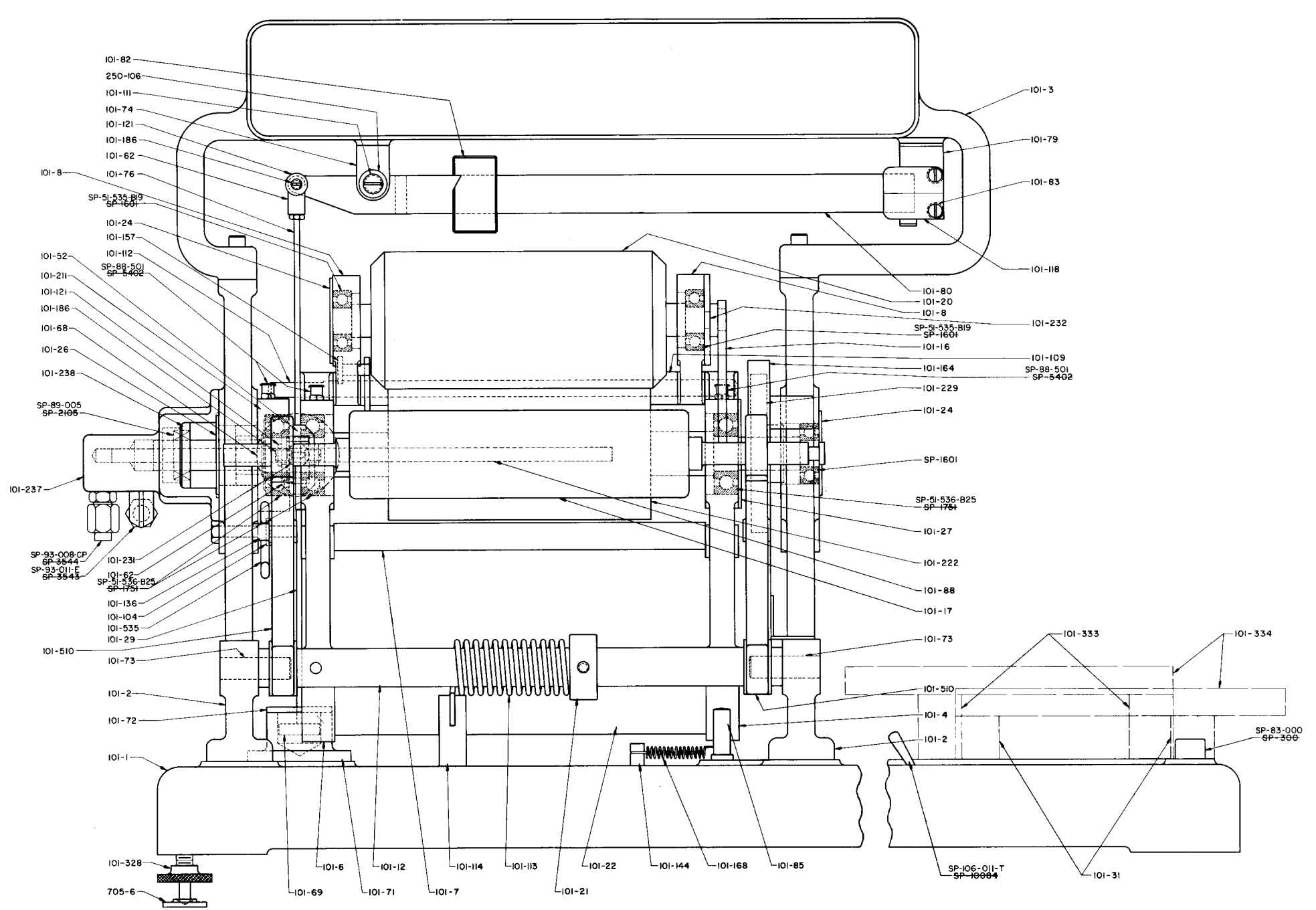
The degree of flying of an ink may be made a matter of record by use of the Inkometer. If desired, the flying may be measured during an ordinary tack determination without losing any time. This test has the advantages of controlled speed, temperature, film thickness and roller contact pressure. The test may be conducted by inserting a piece of paper under the rollers, supported in such a way that it does not interfere with the movement of the swinging frame. If the paper is inserted a few seconds after starting the machine, the uneven and abnormally heavy flying during initial ink distribution will be avoided. At the end of one minute the paper may be withdrawn. Partially covering the sheet with a strip of metal during the test provides a white background for ease in estimating the density of the flying.

SPECIFICATIONS FOR COVERING ROLLERS

Rollers are ground to a true cylindrical surface on the journals, with a diametric tolerance of plus or minus 0.002" and a total runout of 0.002". Length is held to within plus or minus 0.020".

Standard sizes are:

Top roller—3.125" FD x 6.125" long
Vibrator—2.000" FD x 7.250" long



THWING - ALBERT
INKOMETER B-45, C-46

ROLLERS & SIDES
FRAMES ASSEMBLY

DRAWING
101-10-C