BRITISH STANDARD

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Methods for measuring the rub resistance of print

Co-operating organizations

The Printing, Stationery and Allied Trades Standards Committee under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Association of British Manufacturers of Printers' Machinery
British Federation of Master Printers*
British Paper and Board Makers' Association*
Electrotyping and Stereotyping Employers' Federation
Envelope Makers' and Manufacturing Stationers' Association
Federation of Master Process Engravers
Her Majesty's Stationery Office
National Association of Paper Merchants
Newspaper Society
Office Appliance and Business Equipment Trades Association
Printing, Packaging and Allied Trades Research Association*
Society of British Printing Ink Manufacturers*
Stationers' Association of Great Britian and Ireland

The scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the Committee entrusted with the preparation of this British Standard:

Association of British Pharmaceutical Industry
British Aluminium Foil Rollers Association
British Carton Association
British Engineers Association
British Paper Bag Federation
British Paper Box Federation
British Plastics Federation
Cocoa, Chocolate and Confectionery Alliance Ltd.
Incorporated Society of British Advertisers
Institute of Practitioners in Advertising
Society of British Soap Makers
Technical Section of the British Paper and Board Makers' Association

This British Standard, having been approved by the Printing, Stationery and Allied Trades Standards Committee, was published under the authority of the General Council on 23rd March, 1959

The following BSI references relate to the work on this standard:
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Contents

Foreword

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 3000, indexed and cross-indexed for reference, together with an abstract of each standard, will be found in the Institution's Yearbook.

Difficulties and misunderstanding have arisen in the past from the lack of a generally accepted standard method for measuring the resistance of prints to rubbing. For example, if it is desired to supply a printed carton or wrapper of a particular level of rubfastness, the absence of generally accepted test methods results in much inconvenience and confusion.

The Printing, Stationery and Allied Trades Standards Committee therefore gave its authority for work to be undertaken on the development of a standard test in the hope that details of a single method could be published as a British Standard.

After a considerable period of investigation and experimental work, during which many tests were considered, the Committee responsible for the preparation of this standard decided that three of the instruments they had studied were useful, but on the basis of the evidence available, none of them was sufficiently superior to the others to warrant recommending it as the sole standard method. This British Standard, therefore, gives details of all three instruments, since the urgent need for some guidance both to the consumer and the producer has necessitated publishing the standard before completely conclusive test results were possible. While the correlation of results obtained by any one of them with those obtained by the other methods is not completely possible, experience with any one should enable users to relate test results to the probable practical performance of prints reasonably well.

The Committee will continue to meet at regular intervals in order to keep developments under review. The Institution would, therefore, welcome comments arising from practical experience with all or any of the instruments as well as information concerning new methods that may be developed. It is hoped that, in the course of time, it may prove possible to revise this standard and to specify a single method only.

NOTE Where metric equivalents have been given, the figures in British units are to be regarded as the standard. The metric conversions are approximate. More accurate conversions should be based on the tables in BS 350, "Conversion factors and tables".

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 6 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Introduction

One of the principal reasons for users being interested in the extent to which prints will withstand rubbing, is in order to know whether the appearance of a printed wrapper or container will suffer, either during its passage through filling and packing machines, or during transit. In the one case, the rubbing is usually caused by a metal surface and affects only a small area of the package, in the other, it is usually caused by the rubbing together of two similarly printed surfaces and greater areas are liable to be affected.

None of the instruments described in this standard completely simulates both conditions, all three do so to some extent, and all three can be used to rub print against print, or print against a selected test material. The abradant used should be that normally encountered in practice.

It is recommended that tests with all three instruments should be carried out in a standard atmosphere, namely, 65 ± 2 per cent relative humidity and 20 ± 1.7 °C.

The decision on an acceptable degree of rub resistance is an arbitrary one, and will vary with the purpose for which the printed matter is designed. However, the assessment of results will be more accurate in all cases if at least three tests are made wherever possible.

In all three methods it will be necessary first to determine a suitable number of strokes. The results obtained from this can be assessed by comparison with those from an acceptable print. The number of strokes required to produce the first perceptible mark is of value when studied in relation to the full test.

With multi-colour prints, visual examination will indicate the relative rub resistance of individual colour inks.

Method 2 lends itself to measurement by the photo-electric cell and the production of a series of standard disks to which any subsequent tests can be related.

Care should be taken when evaluating the results of tests that the age of the print is taken into consideration. Generally, the fresher the print, the less stable will be the ink, and the more readily it will rub. To obtain the most accurately reproducible results, it is desirable that prints should not be tested for rubfastness until they are at least a week old, and have been conditioned in the standard atmosphere for at least 24 hours.

Method 1 Reciprocating arc instrument[1)]

Principle. This method attempts to simulate rubbing conditions met with in practice whereby one surface is rubbed by another backwards and forwards.

Apparatus. The apparatus consists of a motor-driven instrument, in which a weighted block, to which the test strip is attached, is moved over a print sample through an arc of 2¼ in. (55 mm) by an arm that is 9 in. (230 mm) from the centre of its pivot to the centre of the block. The weighted block has a base area of 4 × 2 in. (100 × 50 mm) and at each end are mounted 2 × 1 in. (50 × 25 mm) rubber pads, so that the effective rubbing area is 4 sq. in. (26 cm^2). The weight of the block is 2 lb (0.9 kg), providing a contact pressure of ½ lb/sq. in. (0.035 kg/cm^2). If double the pressure is required, a 2-lb (0.9 kg) weight is provided to fit over the 2 lb (0.9 kg) rubbing block.

The movement is fixed at a rate of 47 strokes per minute, i.e. complete to and fro cycles, and the machine automatically resets itself to give exactly the same number of strokes on repeat tests.

The test requires a print test specimen and a test strip which is usually unprinted. The test specimen is cut to approximately 8 × 3 in. (200 × 75 mm) and the rubbing strip cut to 4¾ × 2 in. (120 × 50 mm) and folded so that the test area is free from folds or creases, and the ends gripped by the clips on the rubbing block. Normally the longest side of the strip is cut parallel to the cross direction of the paper. Where the test specimen is smaller than 8 × 2½ in. (200 ×65 mm), but larger than 4¾ × 2 in. (120 × 50 mm), it can be mounted on the rubbing block instead of the base.

A suitable arrangement is shown in Figure 1.

Test conditions. The number of strokes to be used will vary quite widely with the age of the print and the stock on which it is printed. Since the instrument will normally be used for control, the number of strokes a particular print should withstand will be known, but in the case of an unknown print it is usual to set the instrument for 20 strokes with the 4 lb (1.8 kg) weight. From the result of this test the most useful number to use can be determined. It is seldom of any advantage to continue the test beyond 100 strokes.

[1)] Such an instrument is available commercially from Ault & Wiborg Ltd., London.

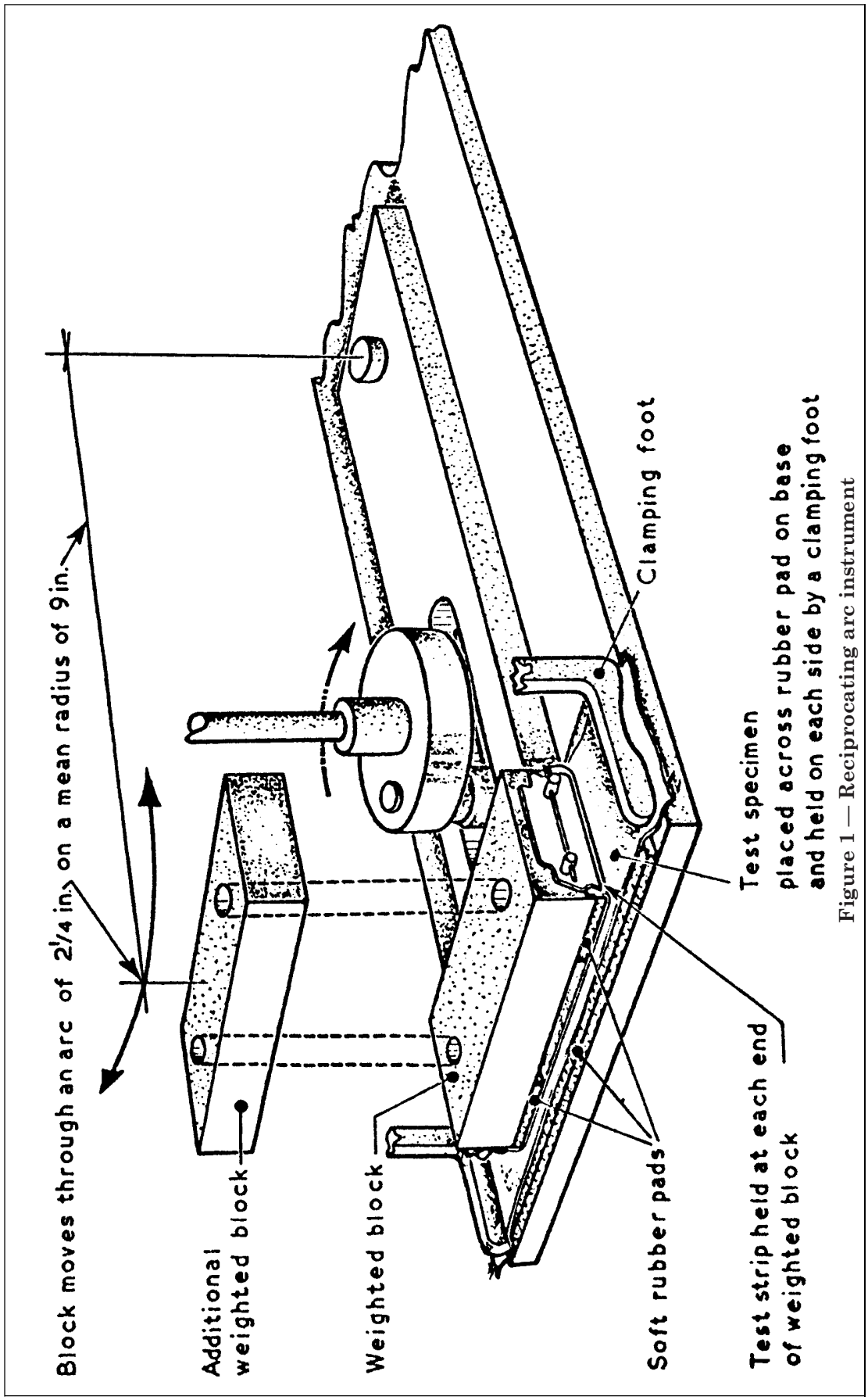

Figure 1 — Reciprocating arc instrument

Procedure. Wipe both the test strip and the specimen with cotton wool to ensure that they are free from any dust or foreign particles, and place the specimen, print side up, on the rubber pad of the base plate of the tester, clip the test strip to the rubbing block with the face of the board or paper away from the rubber pad, and place the rubbing block with the test strip in the machine, so that it makes even contact with the test specimen.

Preset the instrument to the number of strokes required, and at the finish of the test it will automatically reset itself to precisely the same setting so that subsequent tests are carried out with an identical number of strokes.

When the strokes have been completed, examine both the test specimen and the test strip for signs of marking. A further useful reference is the number of strokes needed to give the first perceptible marking.

Method 2 Rotary instrument[2)]

Principle. Two specimen-carrying disks of different diameter are rotated in contact in a horizontal plane, at the same angular velocity. The upper, smaller, disk is normally disposed so that its circumference passes through the centre of the larger disk and is wholly within the circumference of the latter. The motion of the two disks, rotating at the same angular velocity, is equivalent to the revolution, without rotation, of the one about the centre of the other. The smaller specimen is thus uniformly soiled or abraded by the larger specimen provided the latter is uniform over its surface in abrasion resistance or abrasiveness, as the case may be.

Apparatus. The instrument consists essentially of the two specimen-carrying disks, of 2 in. (50 mm) and 4½ in. (115 mm) diameter respectively, mounted on vertical shafts provided with a constant speed drive rotating both disks at approximately 60 rev/min; a weight platform for loading the upper disks, and an air blast for removing detritus and for maintaining the temperature and/or moisture content of the specimens.

Both the specimen-carrying disks carry a layer of low density polyurethane ⅛ in. (3 mm) thick in order to cushion the effects of any surface or thickness irregularities in the test specimens and to provide sufficient friction to drive the specimens in the rubbing operation. A removable ring is fitted to the lower disk and this serves to position the cushion and the specimen in use.

A suitable arrangement is shown in Figure 2.

Procedure. Cut circular specimens of 2 in. (50 mm) and 4½ in. (115 mm) diameter from the materials which are to be rubbed against each other. In rubbing a print against an unprinted surface, the print will normally be the 2 in. (50 mm) diameter specimen. A pair of suitable cutter dies is an advantage if a large volume of testing has to be done.

Both the specimens are placed on the appropriate carrying disks so that the machine direction of each is parallel to that of the other, and loaded in contact by weights applied to the upper disk.

After the desired number of revolutions, which may be in the region of 50, switch off the motor and remove the specimens.

A single standard rubbing procedure cannot be specified because of the great differences in rub-resistance acceptable in prints for different applications. From experience with the test it appears that three standard pressures (½, 1, and 2 lb/sq. in., 0.035, 0.07, and 0.14 kg/cm^2) cover the range of resistance in normal prints reasonably well.

[2)] Details of such an instrument are available from the Printing, Packaging and Allied Trades Research Association, and the instrument is available commercially from H. W. Wallace & Co., Ltd., Croydon.

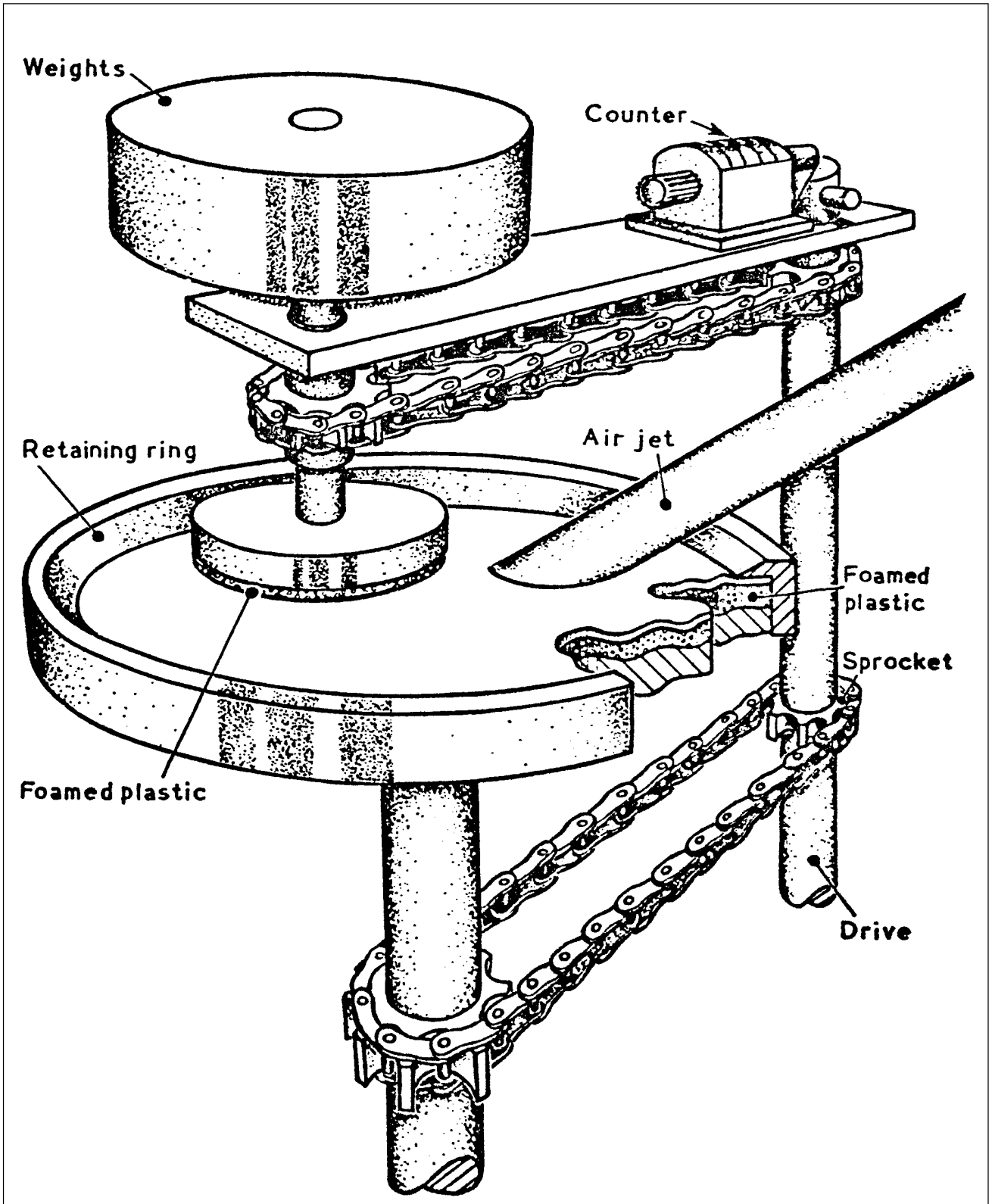

Figure 2 — Rotary instrument

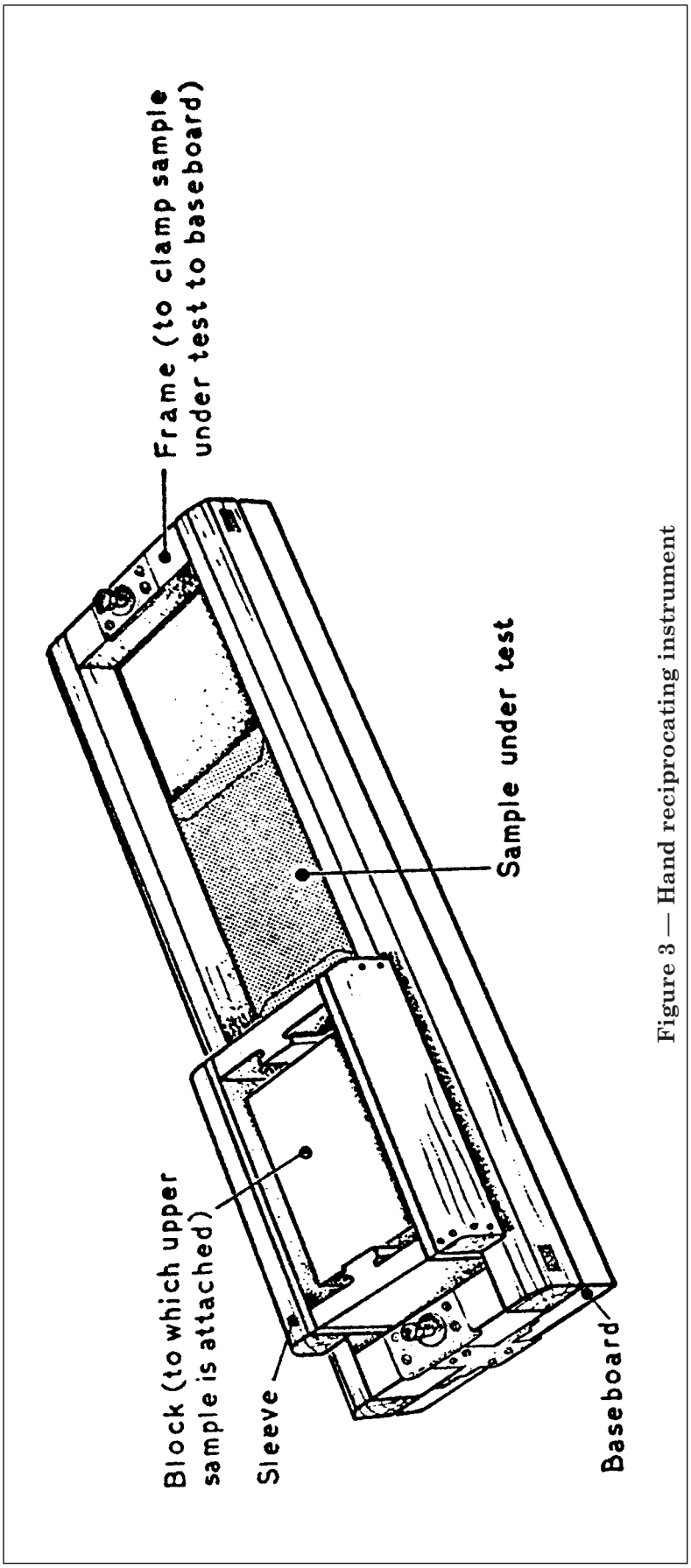

Figure 3 — Hand reciprocating instrument

Method 3 Hand reciprocating instrument[3)]

Principle. The sample of print to be tested is rubbed forwards and backwards in a straight line by a second sample of print. The latter is of a standard size and under a standard loading. Samples are orientated so that rubbing occurs at right angles to the machine direction on both.

Apparatus. The instrument comprises, essentially, a baseboard measuring 18 × 6 in. (460 × 150 mm) on which the test sample is positioned, print upwards, and a block measuring 4 × 3 × 2 in. high (100 × 75 × 50 mm high) to the base of which the second sample is attached, print downwards. The gross weight of the block should be 22 oz (625 g).

The whole instrument is made of hickory (or equivalent hardwood) except that the base of the block is formed from a brass plate ¼ in. (6 mm) thick. This is screwed to the wood, the screw heads being completely recessed below the surface of the metal. The base of the block and the top of the baseboard shall be flat.

A frame of 1 in. (25 mm) square section hickory strip round the perimeter of the baseboard holds the test sample firmly.

A sleeve slides along the sides of the frame without touching the baseboard. The block fits loosely inside this sleeve.

The instrument has been designed primarily to test printed carton board, but may be used with paper, foil and plastics if the samples are suitably backed (e.g. 0.026 in. (0.6 mm) smooth white lined chipboard is satisfactory).

A suitable arrangement is shown in Figure 3.

Procedure. Cut one sample measuring 6 × 3 in. (150 × 75 mm) so that the longer dimension is parallel to the cross direction. Crease this about 1 in. (25 mm) from each end of the longer dimension and place print outwards on the base of the block. Use the end flaps to hold the sample firmly on the block. The test sample should measure 6 in. (150 mm) wide in the machine direction and be as long as possible up to 16 in.(400 mm) in the other direction. Place it print upwards with the 6 in. (150 mm) dimension across the width of the baseboard and clamp it to the board by the frame. Carefully remove any dust from both samples with cotton wool.

Place pencil mark between 2½ in. (65 mm) and 4 in. (100 mm) from each end of the longer dimension of the test sample. Position the block, with board sample downwards, at one end of the baseboard so that the whole space between the two pencil marks is exposed, fit the sleeve over the block. Apply motive power to this sleeve rather than to the block so that the loading on the block is not accidentally increased by hand pressure.

Pushing on the sleeve, move the block over the test sample until the pencil mark at the other end of the sample is uncovered. The movement should be even and at the rate of about one foot per second. The two samples should be in contact throughout. This movement forwards and back comprises one stroke.

Continue such strokes up to the number required, examining the surface of the test sample between the pencil marks for signs of ink marking, if the point of first marking is required. Otherwise, carry out the required number of strokes and then examine the sample. As an example only, it may be required that there should be no perceptible sign of marking on folding-box board after 10 strokes, and preferably none after 25 strokes. These figures will vary widely, however, according to circumstances.

[3)] Details of such an instrument are available from Thomas Hedley & Co., Ltd.

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