

STANDARDS
FOR
TEXTILE TESTING

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AMERICAN SOCIETY

FOR

TESTING MATERIALS

AND

FEDERAL

SPECIFICATIONS BOARD

OF THE

UNITED STATES GOVERNMENT

SCOTT TESTERS

HENRY L. SCOTT CO., PROVIDENCE, R. I.

INTRODUCTION

Greater interest than ever before is being shown in the testing of materials. We receive so many inquiries relative to test methods that we have published this pamphlet for the textile trade. Permission to use the reprints herein contained was granted by the American Society for Testing Materials and United States Government.

Greater familiarity will promote a better understanding of the value of testing and an appreciation of the *Standards of Excellence* as shown in the design and construction of *Scott Testers*.

HENRY L. SCOTT CO.

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STANDARDS *for* TEXTILE TESTING

*STANDARD METHODS of
TESTING WOVEN TEXTILE FABRICS*

*STANDARD SPECIFICATIONS for
TOLERANCES and TEST METHODS for
COTTON YARN, SINGLE and PLIED*

TEXTILE TESTING MACHINES

Prepared by

COMMITTEE D-13

ON TEXTILE MATERIALS

and

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of the

AMERICAN SOCIETY
for
TESTING MATERIALS

Extract from

UNITED STATES GOVERNMENT

MASTER SPECIFICATION No. 345

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SCOTT TESTERS

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AMERICAN SOCIETY FOR TESTING MATERIALS

COMMITTEE D-13 ON TEXTILE MATERIALS

Committee D-13 was organized in 1915 and took for its first problem the development of methods of testing cotton fabrics. It was the means of bringing together representatives of producers and users of mechanical fabrics and of greatly stimulating the development of methods of testing these materials. The methods prepared by the committee were adopted by the Society in 1920, after having had five years' trial.

The activities of the committee have been broadened greatly in the past decade and the interest in and value of its work is attested by the fact that it is one of the largest committees of the Society. Its membership of 165 is made up of representative producers and consumers of textile materials. It has developed fifteen standards which have been accepted by the Society and has nine tentative standards now pending approval. Its standards not only cover methods of test for textile materials but also tolerances within which the textile must come in order that it shall constitute a good delivery on contract. In response to a number of requests the committee has undertaken the writing of specifications of textile materials for specific uses. These cover such materials as tire cord, chafer tire fabrics, electrical tapes, etc.

The work of the committee is carried on in subgroups made up of producers and consumers in accordance with a fundamental requirement of the Society, thus insuring consideration of both sides of the question. An idea of the scope of the committee is given by the

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list of its authorized groups dealing with the following: cotton; cotton yarns and thread; light and medium cotton woven fabrics; tire fabrics; hose, belt and numbered duck; narrow fabrics; osnaburg cement bags; rayon; rayon fabrics; wool; asbestos textiles; jute, ramie and linen; rope fibers; methods; machines; humidity; nomenclature and definitions; knit goods; bleaching, dyeing and finishing.

OFFICERS OF COMMITTEE D-13

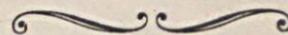
Chairman: H. J. Ball, Professor Textile Engineering, Lowell Textile Institute, Lowell, Mass.

First Vice-Chairman: K. B. Cook, Technical Manager, Manville - Jenckes Co., Pawtucket, R. I.

Second Vice-Chairman: R. H. Adams, Manager Testing Laboratory, Cason J. Callaway Mills, Inc., LaGrange, Ga.

Secretary: W. H. Whitcomb, Henry L. Scott Co., Box 963, Providence, R. I.

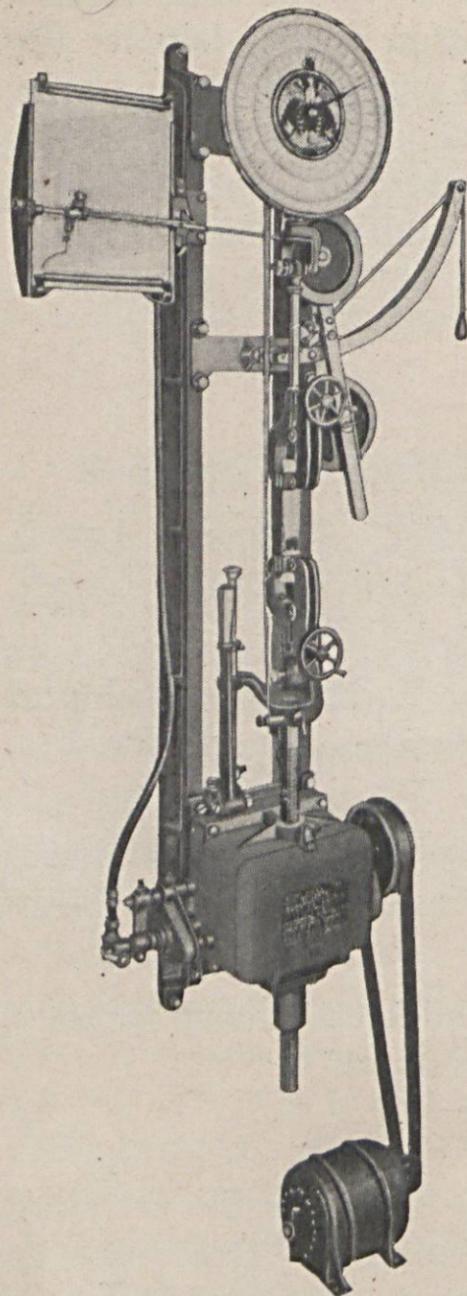
Further information regarding the activities of the Society and Committee D-13 may be obtained by addressing an officer of the committee or the Society at its headquarters, 1315 Spruce Street, Philadelphia, Pa.



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SCOTT TESTERS

MODEL J



MODEL J-2

The Combination Power Yarn and Cloth Tester or Serigraph is the recognized standard tester for yarn and cloth in this country and abroad.

The tester is accurately built and yet of rugged construction insuring a long life under proper care. It is built in double capacities.

The changes from a yarn to a cloth tester, or vice versa, and from one capacity to another are made easily and quickly without the use of tools.

The autographic recorder is an important feature of this machine. The

test results are registered in graph form thus furnishing a permanent machine-made record of strength and elongation at every point from the start of the test to the rupture of the sample. The elongation is magnified in the ratio of 2 to 1. Magnification of 4 to 1 may be arranged when desired. This magnification is of material aid in bringing out characteristics of the material under test, as shown by the relations between strength and elongation. By the use of the cylindrical recorder magnifications of 5, 10 and 20 to 1 may be obtained. This high magnification is particularly valuable for research work. The stress-strain diagram developed by the recorder supplies, in an easily

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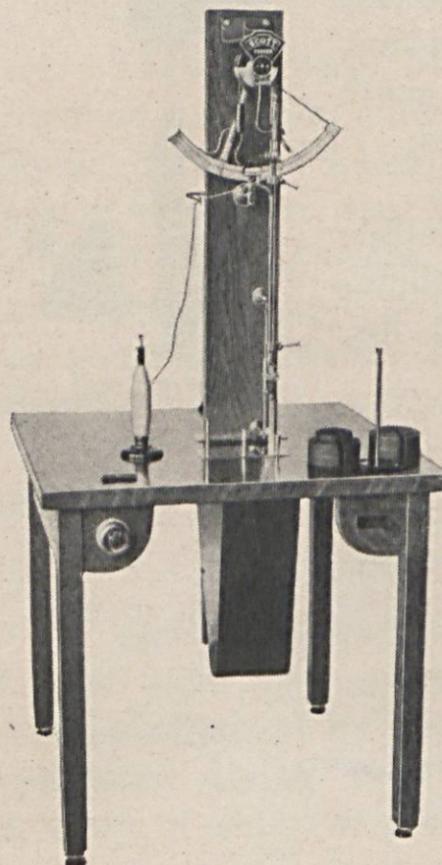
readable form, accurate information not obtainable in any other way. It is used universally for obtaining exact knowledge of the behavior of materials under stress.

Many combinations of the following capacities are available: 50, 75, 100, 150, 250, 300, 400, 500 pounds.

SCOTT TESTERS

FOR

SINGLE STRAND TESTS



MODEL X-5

This tester is designed to meet the demand for a low priced single strand tester of light capacity. It is accurately built and sufficiently sensitive to give accurate results within the range of its capacities: 0-2 lbs., 0-10 lbs.

The lower clamp is returned instantly to the proper position for the next test. The ultimate elongation may be accurately determined as the

movement of the scale is stopped at break. These features, together with the fact that the operator is seated, greatly increase the testing efficiency.

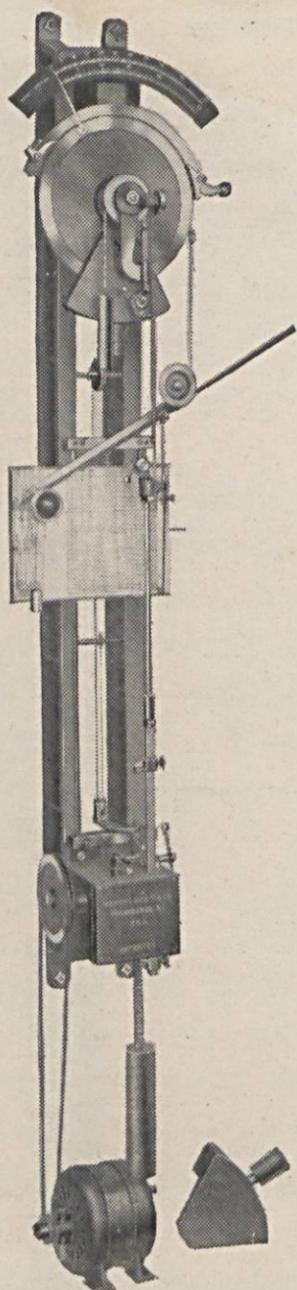
The machine is also available for wall mounting.

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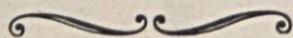
The X-3 single strand tester is the highest grade machine for recording tests on plied yarns, tire cord, paper, light wire, etc. It is accurately yet sturdily built. The dimensions are larger than the other single strand testers, permitting longer test specimens. Extension arms make it possible to set the clamps from two or three inches up to twenty inches apart.

The recorder magnifies the elongation in the ratio of 2 to 1, thus bringing out clearly the characteristics of the test piece. The design is such that the graph is drawn on a chart of rectilinear coordinates.

The machine is the double capacity type and combinations of 10, 25, 50, 75 lbs. are available.



MODEL X-3



STANDARD GENERAL METHODS¹ OF TESTING WOVEN TEXTILE FABRICS

A.S.T.M. Designation : D 39 - 27

These methods are issued under the fixed designation D 39; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Issued as Tentative, 1915 ; Adopted in Amended Form, 1920 ; Revised, 1924, 1927

GENERAL TEST METHODS

1. These General Methods of Testing are intended to be applicable for testing woven textile fabrics. Where a material requires special treatment, specific methods of test will be described applicable for that material and such special methods shall take precedence over the general methods. The cord fabric used in manufacturing tires is not considered to be a "woven" fabric within the meaning of these methods.

CONDITION

2. The dry condition of woven textile fabrics shall be understood to be absolute dryness obtained by placing the material in a ventilated drying oven maintained at a temperature of from 100 to 110° C. (212 to 230° F.) and drying to constant weight as determined by two consecutive weighings without removal from the oven, to be taken not less than ten minutes apart, and showing a further loss of not more than 0.1 per cent from the previous weighing.

¹Under the standardization procedure of the Society, these methods are under the jurisdiction of the A.S.T.M. Committee D-13 on Textile Materials.

3. The standard condition of woven textile fabric shall be understood to be the condition which it assumes on exposure for at least four hours, to an atmosphere having a relative humidity of 65 per cent at 70° F. (21.1° C.).

4. All fabrics shall be tested under standard condition as described in Section 3, unless the bone-dry condition, described in Section 2, is specified in the purchase specifications covering a particular contract.

TEST METHODS

(A) Length

5. (a) If the fabric weighs more than 6 oz. per sq. yd., the length of a roll or piece shall be determined by running the cloth over a measuring drum of known circumference, from which the yardage is registered by a dial or counter driven by a chain, or other positive or non-slip mechanism. Just enough uniform tension¹ shall be used on the cloth to keep it running flat and true.

(b) If the fabric weighs 6 oz. per sq. yd. or less, its length shall be determined by running it through a folding device which will fold a known length of the fabric at each stroke. The yardage shall be registered by a dial or counter which shall be accurately calibrated against the length of the fabric per stroke.

(B) Width

6. (a) The width of a roll or piece shall be determined at five different places uniformly distributed along the full length of the roll or piece, and may be determined at the same time as the total length.

(b) Measurements shall be made to the nearest $\frac{1}{16}$ in.

¹It has been suggested that a uniform tension of two and one-half times the weight of five running yards of the fabric will be sufficient to keep the fabric flat and preserve a proper relation for comparison of different fabrics. Invitation is extended to report the results of such tests upon different fabrics.

(c) The average of the five measurements shall be the width.

(C) Weight

7. A sample (or samples) for the weight test, containing in the aggregate not less than 20 sq. in., shall be stamped or cut from the fabric in such a way as to be fairly representative of the material. The sample (or samples) shall be conditioned as specified in Sections 2 or 3, and weighed on a balance sensitive to 0.1 per cent of the total weight.

8. The difference between the normal weight of the fabric and the dry weight is the amount of moisture present.

(a) When computed as percentage of the normal weight, this is the "Moisture Content" of the material.

(b) When computed as percentage of the dry weight, this is the "Moisture Regain" of the material.

(D) Number of Threads per Inch

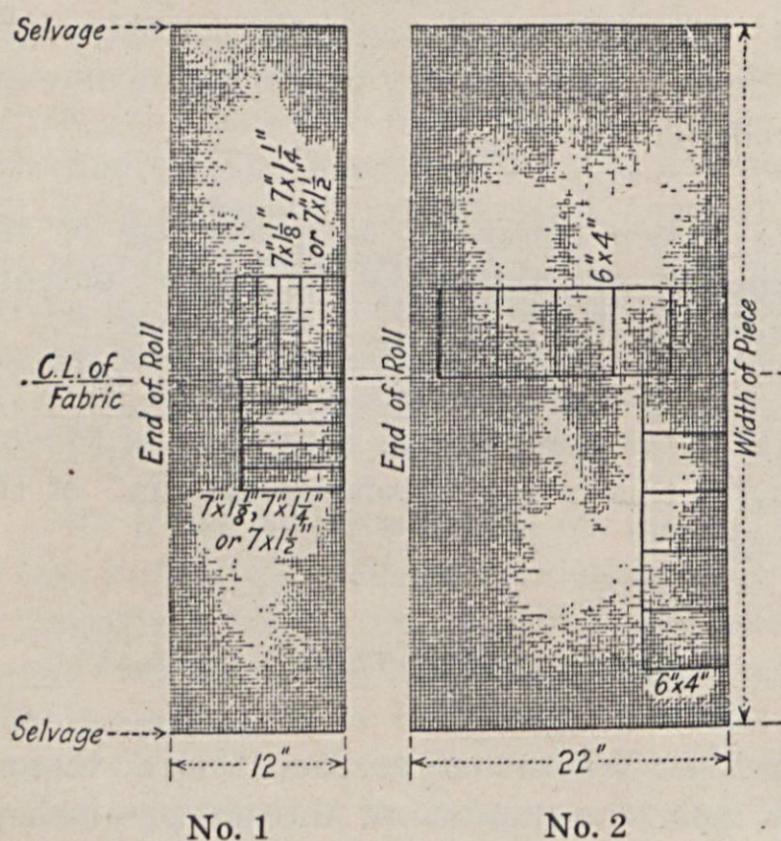
9. (a) Where there are more than 25 threads per inch, the number of threads per inch or count of the fabric shall be determined by counting a space of not less than 1 in., in at least five different places in the roll or piece. Where there are 25 or fewer threads per inch, a 3-in. gage length shall be used.

(b) For fabrics 3 in. in width or less, the entire width shall be used in counting the warp threads; for wider fabrics, the gage length for counting the warp threads shall be at least 1 in. from the selvage.

(c) The average of five determinations shall be the count.

Table I — Tensile Strength Test Methods.

Method No.	No. 1 Strip Method	No. 2 Grab Method
Length of specimens, in.	7	6
Width of specimens, in. :		
If thread count is 80 over or	1 3/8	4
If thread count is 50 to 80	1 1/4	
If thread count is less than 50	1 1/2	
Ravelled to standard or specified threads per — in.	1	---
Minimum width of bottom or back jaws, in.	1 1/2	2
Width of top or front jaws, in.	1 1/2 (min.)	1
Distance between jaws, in.	3	3
Speed of pulling jaw, in. per minute	12	12
Number of specimens each, warp and filling.	5	5



(E) Thickness

10. (a) The thickness shall be measured by an automatic micrometer which presses upon a circle 3/8 in. in diameter of the fabric with a pressure of 6 oz., and which is so mounted as to make possible measurements 6 in. from the selvage. All thickness measurements shall be exclusive of the selvage.

(b) At least five measurements at different portions of the roll or piece shall be made, and the average shall be the thickness of the fabric.

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(F) Tensile Strength

11. Tensile strength tests shall be made by one of the two methods as described in detail in Section 12. In each case the results shall be recorded separately for warp and filling.

12. For the determination of tensile strength a swatch of sufficient length as specified in Table I shall be cut the entire width of the cloth, and ten test specimens shall be cut from this swatch, five with the long dimensions in the

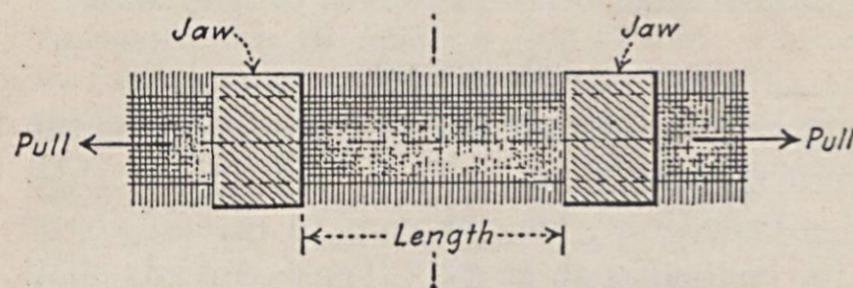


FIG. 1.—Illustration of Strip Test.

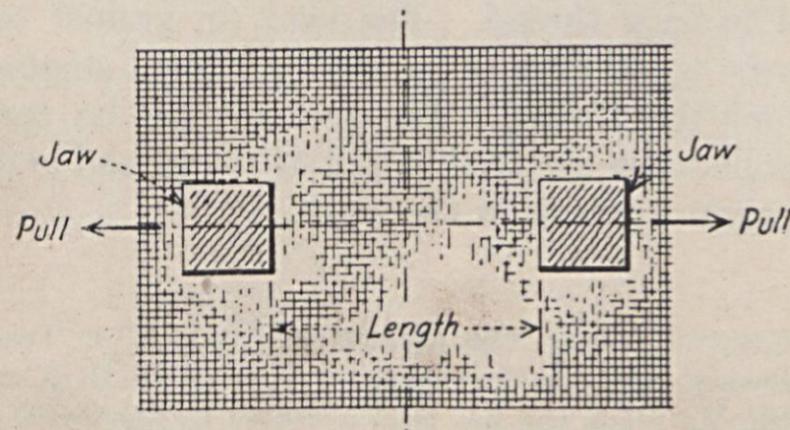


FIG. 2.—Illustration of Grab Test.

direction of the warp and five in the direction of the filling. The specimens shall be fairly representative of the material. Except in narrow fabrics (less than 3 in. in width), all specimens shall be taken at least 1 in. from the selvage.

(a) *Strip Test (Fig. 1).*—Under this method a long narrow strip of the fabric shall be clamped at each end by the jaws of the testing machine and strained to the point of rupture.

(b) *Grab Test (Fig. 2).*—Under this method the testing machine jaws, each of definite width, shall be made to reach into the body of a rectangular piece of fabric and shall be clamped a

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definite distance apart. Care shall be taken that the same set of threads are embraced by both pairs of jaws. The specimen shall then be strained to the point of rupture.

(c) All fabrics shall be tested by the grab method, Paragraph (b), unless the strip method, Paragraph (a) is specified in the purchase specifications covering a particular contract.

(d) The average of the five individual tests on the warp shall be the strength of the warp and the average of the five individual tests on the filling shall be the strength of the filling.

(G) Crimp

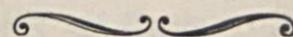
13. Two parallel lines shall be marked on the fabric at least 6 in. apart. Four threads shall be unravelled out, long enough to extend about 2 in. beyond each mark. These threads shall be straightened by a machine which applies a load to each thread. The load (in grams) to be used is 156 divided by the equivalent singles size of the thread. The crimp shall be the ratio between the final length of the thread and its original length in the cloth.

Editorial Note.—The following procedure for Tear Resistance has been developed by Committee D-13 on Textile Materials and has been accepted by the Society for publication as a tentative revision of the Standard General Methods of Testing Woven Textile Fabrics:

(H) Tear Resistance

(a) *Preferred Model.*—A specimen 3 in. in width and 8 in. in length shall be selected for test. A longitudinal cut 3 in. in length shall be made in the center of the specimen. One of the tongues thus formed shall be placed in the upper jaw of a tensile strength testing machine, preferably with automatic recording device, and the other in the lower jaw. The machine shall then be started and the specimen torn, the speed of the pulling jaw being 12 in. per minute. The pawl on the pendulum shall be disengaged from the ratchet during the test. The average load necessary to continue the tear after it has been started shall be considered to be the tear resistance of the fabric. The average of five determinations in the warp and five in the filling directions shall be reported. The capacity of the machine should be such that the specimen tears in the range of maximum sensitivity.

(b) *Alternate Method.*—A specimen 3 in. in width and 6 in. in length shall be selected for test. An isosceles trapezoid having an altitude of 3 in. and with bases 1 in. and 4 in. in length, respectively, shall then be marked on the specimen with the aid of a template. A cut $\frac{1}{4}$ to $\frac{3}{8}$ in. in length shall then be made in the center of the 1 in. length and perpendicular to it. The specimen shall then be clamped in the jaws of the tensile strength testing machine along the nonparallel sides of the trapezoid. The initial distance between the jaws shall be 1-in., and the width of the jaws shall be 3 in. or more. One edge of the specimen shall thus be held taut while the other edge lies in folds. The machine shall then be started and the sample torn, the speed of the pulling jaw being 3 in. per minute. The pawl on the pendulum shall be disengaged from the ratchet during the test. The average load necessary to continue the tear after it has been started shall be considered as the tear resistance of the fabric. The average of five determinations in the warp and five in the filling directions shall be reported. The capacity of the machine should be such that the specimen tears in the range of maximum sensitivity.





STANDARD SPECIFICATIONS¹
FOR
TEXTILE TESTING MACHINES

A.S.T.M. Designation : D 76 - 27

These specifications are issued under the fixed designation D 76; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Issued as Tentative, 1920; Adopted in Amended Form, 1927

Tensile Testing Machines

1. Textile testing machines shall be of the inclination balance or pendulum type.

2. The maximum angle of swing of the pendulum in textile testing machines shall be 45 deg. from the vertical.

3. The minimum diameter of drum for transferring the pull on the specimen to the swinging pendulum shall be 2 in.

4. In selecting the proper capacity of a textile testing machine for a given sample of fabric or yarn, the maximum capacity of the machine shall not exceed that at which the pendulum reaches a swing of 45 deg. from the vertical. The minimum capacity of the machine when used for a given sample of fabric or yarn shall not be less than 20 per cent of the above maximum capacity.

5. (a) *Fabric Jaws.*—The clamps of textile testing machines for use upon fabrics shall consist of flat metallic jaws pressing directly against the specimen. One gripping surface shall be hinged or swiveled and the other shall be rigidly connected to the frame of the jaw.

¹Under the standardization procedure of the Society, these specifications are under the jurisdiction of the A.S.T.M. Committee D-13 on Textile Materials.

The pressure between the jaws shall be secured by any suitable mechanical device so constructed as to grip the fabric firmly before the testing load is applied and to prevent visible slippage during the progress of the test.

(b) *Skein Jaws.*—The drums of testing machines for yarn skeins shall consist of cylindrical spools not less than 1 in. in diameter and not less than 1 in. in width, so supported that at least one shall turn freely upon its axis.

(c) *Individual Strand Jaws.*—The jaws or clamps for tests upon individual strands of yarn shall be of the cylindrical or drum type, so arranged that the strands of yarn shall pass around not less than 180 deg. circumference before being clamped or fixed in the jaw. The length of the specimen shall be considered from center to center of drums. The minimum diameter of the cylinder or drum shall be $\frac{1}{2}$ in.

6. The width of jaw in a direction perpendicular to the specimen shall in no case be less than 1 in. The depth of jaw in a direction length-wise of the specimen shall in no case be less than 1 in.

7. The dial pointer of textile testing machines shall be so arranged as to be easily adjustable to a zero reading for any weight of jaw or other fixture in the testing machine. The dial pointer shall be so counter-weighted as to prevent undue fluctuations in its position due to backlash, whatever the dial reading may be.

8. Textile testing machines shall be power driven or operated in such a manner as to produce a uniform and accurate movement of 12 in. per minute for the pulling jaw.

9. In calibrating textile testing machines, dead weights of accurate amounts shall be used, but these weights shall be applied at a speed of 12 in. per minute, corresponding to the standard jaw speed. The machine shall otherwise be arranged in an entirely similar manner to that used in testing fabric.



STANDARD SPECIFICATIONS
FOR
TOLERANCES AND TEST METHODS
FOR COTTON YARNS,
SINGLE AND PLIED¹

A.S.T.M. Designation : D 180 - 27

These specifications are issued under the fixed designation D 180; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Issued as Tentative, 1923 ; Adopted in Amended Form,
1927

1. These specifications cover the tolerances and methods of testing for cotton yarn, both single and plied.

TOLERANCES

STRENGTH

2. The average tensile strength of each case, bale, chain ball or beam warp of yarn, either single or plied, as found by test shall be not less than the specified strength.

SIZE OR YARN NUMBER

3. The average size of each case, bale, chain ball or beam warp of yarn, in the singles, either carded or combed, as found by test shall not vary more than 3 per cent above or below the specified size.

Example.—No. 36 carded yarn specified; tolerance would allow 34.92 to 37.08.

TWIST

4. *Direction of Twist.*—The direction of twist shall be as defined in the Standard Definitions of Terms Relating to Textile Materials (A.S.T.M. Designation: D 123) of the American Society for Testing Materials, as follows:

¹Under the standardization procedure of the Society, these specifications are under the jurisdiction of the A.S.T.M. Committee D-13 on Textile Materials.

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Twist, Direction of.—In the case of yarn or cord, the yarn or cord has right-hand or regular twist if when it is held vertically the spirals or twists are seen to incline upward in a right-hand direction and has left-hand or reverse twist when the spirals or twists are seen to incline upward in a left-hand direction.

Note.—Attention is called to the fact that this definition of twist is opposite to that used in sewing thread manufacture.

5. The average twist of each case, bale, chain ball or beam warp of plied yarns as found by test shall not vary more than 5 per cent above or below that specified.

Example.—Twist specified is 20 twists per inch; tolerance 19 to 21.

METHODS OF TESTING

STRENGTH

Two test methods are given, the skein test for single yarn and the single strand test for single and plied yarns. A Preferred and Alternative Method for each test is given. The Alternative Method can be used where routine testing is done on a large scale. The Preferred Method should always be used in case of dispute.

6. *Skein Test (Preferred Method).*—A standard skein (120 yd.) shall be broken after conditioning of tubes or bobbins selected for test for 12 hours or of skeins for at least 3 hours in an atmosphere of 65 per cent relative humidity, 70° F. (21° C.). An automatic power yarn tester of inclination balance type, the maximum capacity of which shall be determined in accordance with a table of machine specifications, shall be used. The drums of the testing machine shall consist of cylindrical spools not less than one inch in diameter and not less than one inch in width, so supported that at least one shall turn freely upon its axis. The speed of the pulling jaw shall be 12 in. per minute. Any yarn reel having a 1½-yd. perimeter may be used in preparing the skeins. For filling-wound yarns or yarns on cones, where the yarn is drawn from the top, a speed of 100 to 300 r.p.m. of reel shall be used. For warp-wound yarns or yarn on parallel tubes where the yarn is drawn from the side, a speed of 20 to 30 r.p.m.

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of reel shall be used. On reels that have only one pigtail guide, the tension shall be applied by making one full wrap of the yarn around the guide. On reels using two or more guides, the yarn shall pass straight through the guides onto the reel, the angles of the guides supplying the necessary tension. Judgment must be used in regard to the amount of tension required on yarns having little or a large amount of twist. Three tests from each of four bobbins from every case of yarn shall be made.

7. *Strength Yarn on Beams (Skein Test for Yarn on Beams).*—Yarn received on beams shall be given the skein test and skeins shall be prepared in the following manner: Place the beam containing the yarn to be tested on two bearings sufficiently high from the floor so that the beam can be turned easily. Directly in front of the beam and at least 15 ft. from the beam, a small table shall be placed, the top of which will be approximately the same height as the top of the beam of yarn. On this table a standard yarn reel shall be placed directly in front of the beam. A small crank arm shall be attached to one end of the beam shaft. Four ends of yarn, taken from the beam, shall be attached to the yarn reel in the regular manner, such as is done when testing yarn from bobbins. One operative shall turn the beam slowly in the proper direction so that the yarn will unwind, and the second operative shall turn the reel fast enough to take up the yarn as it comes off the beam. This operation shall be continued until 120 yd. or the desired length for testing has been taken from the beam. The four skeins shall then be taken from the reel and tested in the regular manner. If it should be necessary to test more ends, the same method of testing shall be followed.

Note.—In using these beams after these ends have been taken off, a set of spools containing the same kind of yarn as is on the beam can be placed in behind the beam on a small creel, to fill out the number of ends that have been used for testing. When the ends come up on the beams that have been used for testing, the auxiliary spools in back of the beams can be broken out.

8. *Single Strand Test (Preferred Method).*—Single strands shall be broken after conditioning the tubes or bobbins for 12 hours in an atmosphere of 65 per cent relative humidity, 70° F. (21° C.). A single strand tester of proper capacity with the jaws set 10 in. between grips and having a speed of pulling jaw of 12 in. per minute shall be used. The average of 4 breaks from each of 10 bobbins shall be the average strength.

9. *Plied Yarns (Preferred Method).*—Plied yarns, except standard tire cord, shall be subjected to the single strand break after conditioning for 12 hours on spools or tubes selected for test, in an atmosphere of 65 per cent relative humidity and 70° F. (21° C.). Standard tire cord shall be tested under dry conditions in accordance with the Standard General Methods of Testing Woven Textile Fabrics (A.S.T.M. Designation: D 39) of the American Society for Testing Materials.¹ A single strand tester of proper capacity with the jaws set 10 in. between grips and having a speed of pulling jaw of 12 in. per minute shall be used. The average of 4 breaks from each of 10 spools or tubes shall be reported as the average strength.

10. *Skein and Single Strand (Alternate Method).*—Skeins or single strands of yarn either single or plied, prepared in accordance with Sections 6, 7, 8 and 9, shall be broken under natural humidity conditions at time of test. The results thus obtained shall be reduced to a common basis of standard moisture regain equal to 7 per cent of the bone-dry weight.

11. To determine moisture regain present in samples, the several skeins shall be weighed collectively, immediately after testing, under natural moisture conditions which obtain at the time of test. The skeins shall then be placed in the basket of an oven at a temperature of 105 to 110° C. (221 to 230° F.) and dried to constant weight. The moisture regain is then computed as the percentage of the dry weight.

¹See p. 6

12. (a) The following formula shall then be applied, based on the assumption that the standard moisture regain of cotton yarns is 7 per cent of the dry weight, that the actual percentage regain is between the limits of 3 and 7 per cent of the dry weight and that for 1 per cent of moisture regain there is an increase of 6 per cent in the tensile strength of the yarn.

$$\text{Tensile strength corrected to standard moisture regain} = \frac{(\text{Tensile strength from machine reading}) \times 142}{100 + (6 \times \text{actual percentage regain})}$$

Example.—With a skein of yarn broken under natural conditions showing a tensile strength of 120 lb. as read from the machine dial, and which by weighing before and after drying the skein was found to contain a moisture regain equal to 5 per cent of the bone-dry weight, the tensile strength corrected to a common basis of 7 per cent moisture regain would be:

$$\text{Corrected tensile strength} = \frac{120 \times 142}{100 + (6 \times 5)} = 131 \text{ lbs.}$$

(b) Moisture regain tests shall be made periodically during the hours of testing as the natural humidity conditions are found to vary.

13. The average tensile strength shall be corrected to the specified size as determined in accordance with Sections 14, 15 and 16, by the following formula:

$$\text{Corrected tensile strength} = \text{Actual average strength} \times \frac{\text{Actual average size}}{\text{Specified size}}$$

SIZE OR YARN NUMBER

14. The size of all standard skeins used in the skein strength test described in Section 6 shall be determined immediately after being broken. In case the single strand test is made, the standard skein shall be prepared for the size determination at the time of the break and the size determined immediately. The size of 60-yd. bundles prepared from beams as described in Section 7 shall be determined as soon as possible after conditioning and one test from each beam shall be reported as the average size. The balance to be used in this test shall be accurate to 0.25 per cent of the standard size of the yarn. When the balance does not

indicate the size directly, the yarn number or size may be calculated from the formula:

$$\text{Yarn No. or size} = \frac{\text{Length in yards of single yarn}}{\text{Weight in grains}} \times \frac{7000 \text{ (grains in 1 lb.)}}{840 \text{ (yards of No. 1 cotton yarn per lb.)}}$$

15. In determining the size of plied yarns, the skein shall be prepared in accordance with Table I, and the size shall be determined after conditioning of tubes or spools selected for test for 12 hours or of skeins for at least 3 hours, in an atmosphere of 65 per cent relative humidity, and 70° F. (21° C.). Any yarn reel having a 1½-yd. perimeter may be used in preparing the skeins. For filling-wound yarns or yarn on cones, a speed of 100 to 300 r.p.m. of reel shall be used. For warp-wound yarns or yarn on parallel tubes, a speed of 20 to 30 r.p.m. of reel shall be used. On reels that have only one

Table I.

Equivalent Singles Size	Yards for Test	Conversion Formula	No. of Tests Per Case of Yarn
20's and above	60	$\frac{\text{Size}}{2} = \text{Ply size}$	3 from each of 4 spools or tubes
3's to 20's	24	$\frac{\text{Size}}{5} = \text{Ply size}$	3 from each of 4 spools or tubes
Below 3's	12	$\frac{\text{Size}}{10} = \text{Ply size}$	3 from each of 4 spools or tubes

pigtail guide, the tension shall be applied by making one full wrap of the yarn around the guide. On reels using two or more guides, the yarn shall pass straight through the guides onto the reel, the angles of the guides supplying the necessary tension.

16. All yarns used in the alternative method of testing for strength (Section 10) shall be sized under natural humidity conditions at the time of test. Plied yarns shall be prepared in skeins in accordance with Table I. The moisture regain shall then be determined as specified in Section 11, and results corrected to a common basis of standard moisture regain equal to 7 per cent of the bone-dry weight by means of the formula:

$$\text{Size corrected to standard moisture regain} = \frac{\text{Size} \times (100 + \text{actual percentage regain})}{107}$$

The average of these tests shall be the average size of case, bale, ball chain or beam warp of yarn.

TWIST

17. No precision method for determining the twist of single yarns has been developed.

18. The ply twist in yarns of 2 or more ply shall be determined on any standard twist counter with jaws set 10 in. apart. The strands shall be clamped in jaws under a definite tension by attaching weights.

The tension to be used shall be determined from the formula:

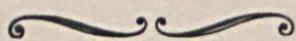
$$\text{Tension, in grams} = \frac{156 \text{ (Constant)}}{\text{Equivalent singles size}}$$

Example. — The weight for 23/11 would be as follows:

$$\frac{156}{2.09} = 76 \text{ g.}$$

Note.—The constant of 156 represents a tension (basis yarn No. 1) which should be placed on yarn or cord to hold it sufficiently taut and still not remove any stretch.

19. Three twist tests on each of 4 packages of yarn from each case shall be made, and the average of these 12 tests shall be the average of the case.



EXTRACT FROM
UNITED STATES GOVERNMENT
GENERAL SPECIFICATION

No. 345 *of the filli*

BREAKING STRENGTH, GRAB METHOD
(1 by 1 by 3 inches)

Six test specimens 6 inches long by 4 inches wide shall be cut, three in the direction of the warp and three in the direction of the filling, respectively, as shown in Figure 1. Care shall be taken that no two test specimens include the same threads, except for retest as specified below. No specimen for testing should be taken at less than 8 inches from either selvage.

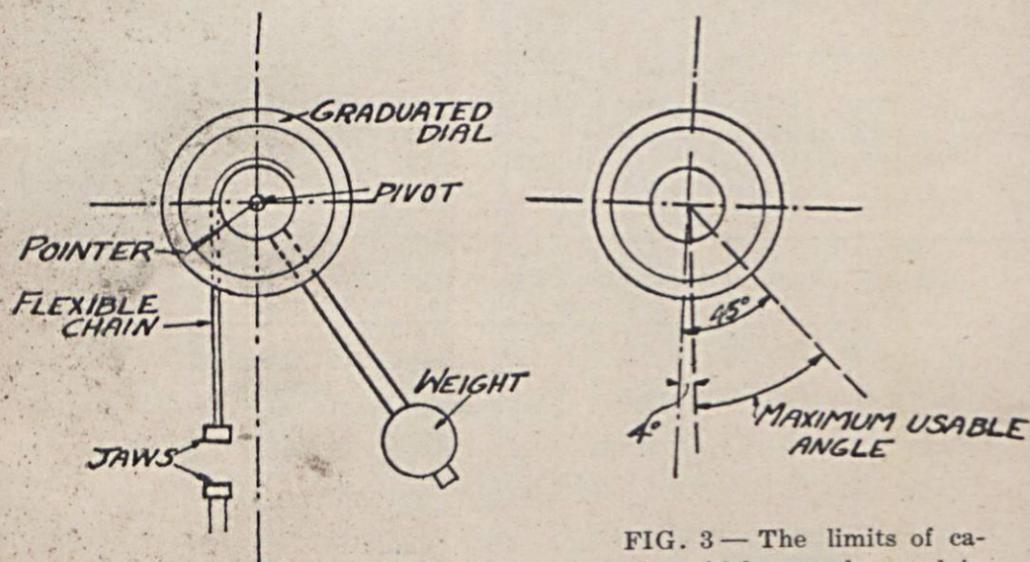


FIG. 2 — Essential features of the inclination balance type of breaking-strength machine.

FIG. 3 — The limits of capacity which may be used in testing in accordance with these methods. Minimum angle, 4°; Maximum angle, 45°.

The machine used shall be of the inclination balance type, as shown in Figure 2. The maximum capacity of the machine shall be such that no break shall occur beyond the limits as shown in Figure 3. The lower or pulling jaw shall travel at a uniform rate of 12 inches per minute under no load. The distance between jaws shall be 3 inches at start of test. The

inside or back half of each jaw shall be 2 inches or more in width; the other half shall be 1 inch in width. Jaws shall have a smooth and flat surface with edges slightly rounded to prevent cutting. The results of the tests in each direction shall be averaged. If a specimen slips in the jaw, breaks in the jaw, breaks at the edge of the jaw, or for any reason due to faulty operation, the result falls markedly below the general average, the result shall be disregarded, another specimen taken from the same threads, and the result of this break included in the average.

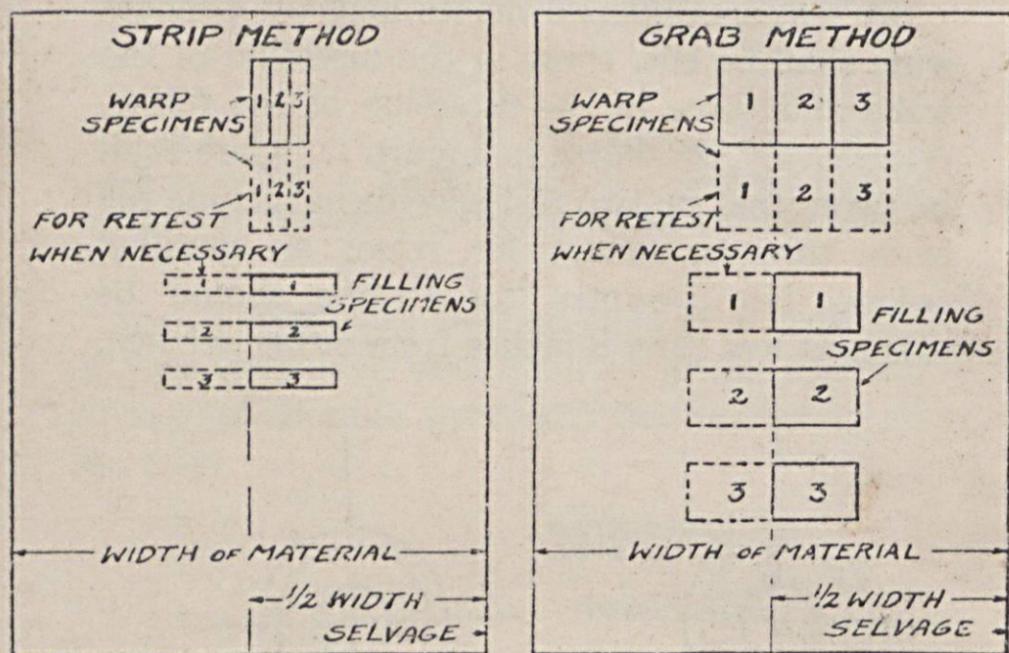


FIG. 1.—Layout of sample to obtain specimens for breaking strength

Material	Length of test specimen "a"	Distance between jaws "b"
	Inches	Inches
Cotton.....	6	3
Spun Silk.....	6	3
Wool.....	9	6
Linen.....	9	6
Silk.....	9	6
Jute.....	9	6
Ramie.....	9	6

Table 1—Length of test specimen and distance between jaws for different kinds of materials (strip method.)

Threads per inch	Width "c"
	Inches
Over 80	1 1/8
50 to 80	1 1/4
Under 50	1 1/2

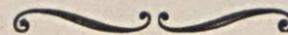
Table 2 — Width of specimen before raveling (strip method.)

BREAKING STRENGTH, STRIP METHOD

Six test specimens approximately "a" inches (see Table 1) long by "c" inches (see Table 2) wide shall be cut, three in the direction of the warp and three in the direction of the filling, respectively, as shown in Figure 1.

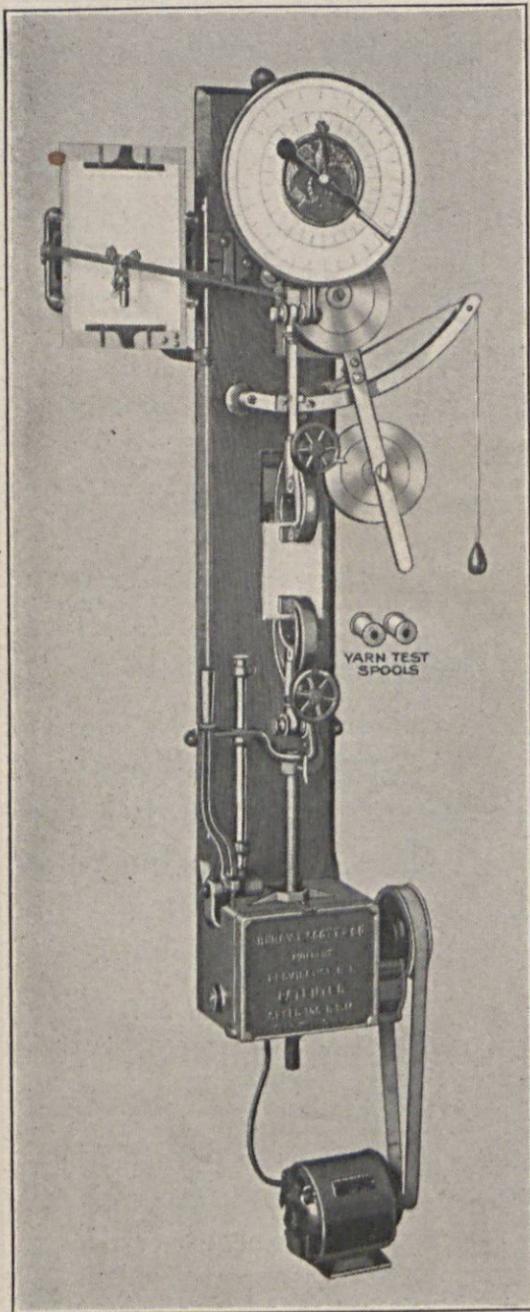
Each specimen shall be raveled to exactly 1 inch by taking from each side approximately the same number of threads. Care shall be taken that no two test specimens include the same threads, except for retest, as specified below. No specimen for testing should be taken at less than 8 inches from selvage.

The machine used shall be of the inclination balance type, as shown in Figure 2. The maximum capacity of the machine shall be such that no break shall occur beyond the limits, as shown in Figure 3. The lower or pulling jaw shall travel at a uniform rate of 12 inches per minute under no load. The distance between jaws shall be "b" inches (see Table 1) at the start of test. The width of the jaws shall be 1 1/2 inches or more. Jaws shall have a smooth and flat surface with edges slightly rounded to prevent cutting. The results of the tests in each direction shall be averaged. If a specimen slips in the jaw, breaks in the jaw, breaks at the edge of the jaw, or for any reason due to faulty operation, the result falls markedly below the general average, the result shall be disregarded, another specimen taken from the same threads, and the result of the break included in the average.



SCOTT TESTERS

MODEL DH



MODEL DH-2

The tester illustrated on this page is an improved form of our Model DH. A recorder is now available which adds greatly to the usefulness of the machine. The recorder is so designed that it may be put on any Model DH now in use.

The machine is of simpler construction than the Model J-2 but is accurately built and with proper care will give many years of accurate and consistent service.

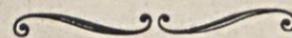
The tester fulfills every requirement of the American Society for Testing Materials and of the United States Government as set forth in this pamphlet.

The recorder does not magnify the elongation of the test specimen. The ratio between the actual elongation and that shown by the graph is 1 to 1 instead of 2 to 1 as in the case of the Model J-2 recorder. The graph obtained forms a permanent record which gives valuable information on the relation between strength and elongation at every point from the start of the test to the rupture of the sample.

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The machine is built in double capacities. It is designed for testing yarn, twine, etc., or as a combination yarn and cloth tester. The changes from one capacity to another or from a yarn to a cloth tester are easily and quickly made without the use of tools.

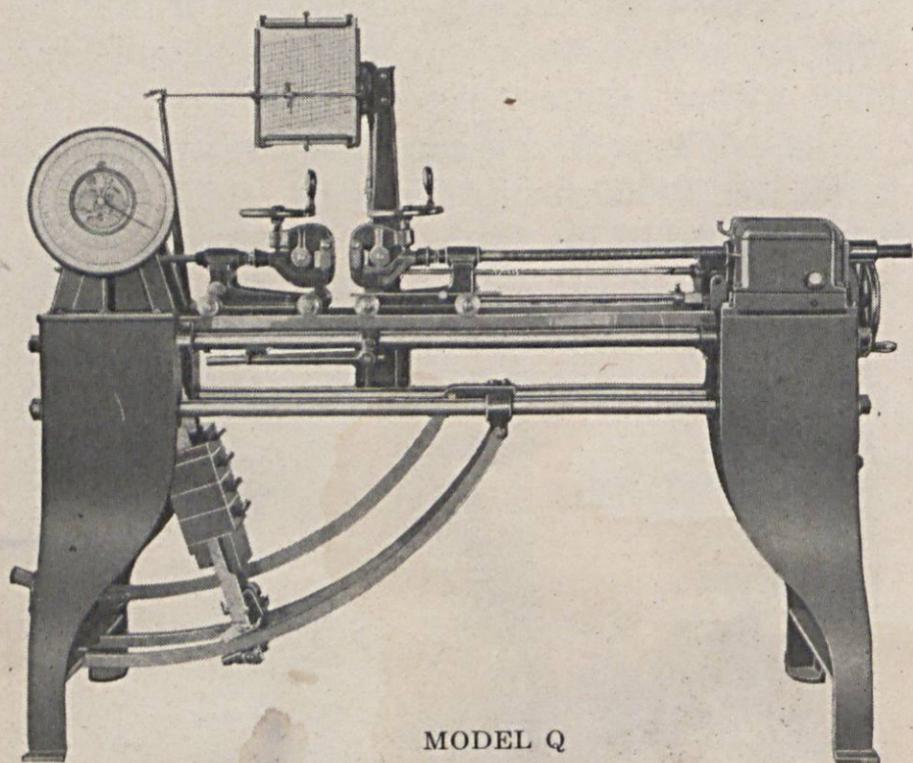
The following double capacities are available: 0-150 lbs., 0-300 lbs.; 0-25 kgms., 0-55 kgms.; 0-55 lbs., 0-110 lbs.



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SCOTT TESTERS

MODEL Q

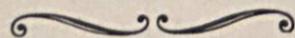


MODEL Q

This machine is of heavy construction. The frame is rigidly built and well braced. These features, common in all Scott Testers, eliminate any spring or "wink" in the machine throughout the range of its capacity. The record obtained is, therefore, a true picture of the characteristics of the material under test.

The horizontal tester is designed to test duck and other heavy fabrics, rope, wire, etc. It is built in double capacities in several combinations ranging from 300 to 2000 lbs.

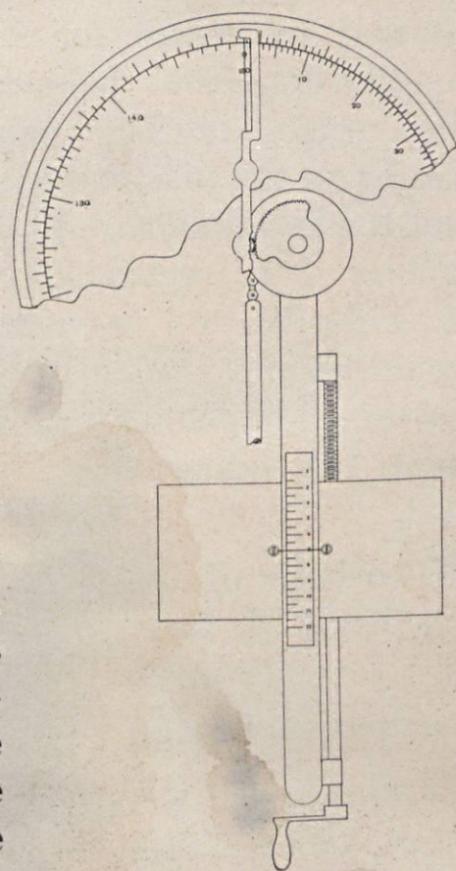
The recorders adaptable to this machine are: the flat platen type, shown in the illustration, with a magnification of elongation of 2 to 1; and the cylindrical type with which magnifications of 5, 10 or 20 to 1 may be obtained. The cylindrical type recorder is particularly valuable for making graphic records of test results on materials of low elongation.



SCOTT TESTERS

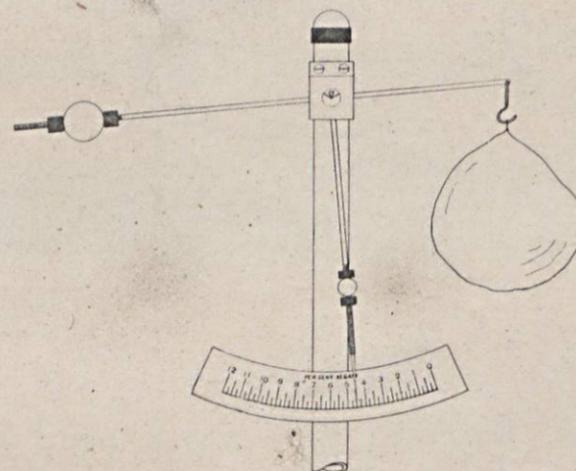
MODEL J-6

The Calculating Attachment is designed to furnish an easy and accurate means for determining the strength of yarn under standard conditions when conditioning equipment is not available. It is only necessary to know the percentage regain of the sample. The sliding weight is then set for this regain and the sample (skein) broken in the usual way. The strength indicated on the dial is the strength the yarn would have if its regain had been 7%, which is the generally accepted standard for cotton yarn.



CALCULATING ATTACHMENT

The percentage regain may be conveniently determined by means of the Regain Balance. A standard sample (supplied with the balance)



REGAIN BALANCE

is made up of such a weight that the pointer would indicate "zero" under bone dry conditions. In any other atmosphere the amount of moisture taken up is indicated as per-

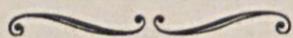
centage regain. Test samples (skeins) are hung in the same atmosphere with the balance and, after a reasonable time is allowed to elapse for the establishment of equilibrium, the balance reading indicates the regain in the samples. The sliding weight on the machine is then set to this value and the tests made. For example, yarn containing 3% regain and showing a strength of 118 lbs. on a standard Scott Tester would show a strength of 142 lbs. on a Scott Tester equipped with the calculating attachment, the sliding weight of which would be set at 3.

The basis of the Calculating Attachment is the A.S.T.M. formula (see specification D180-27):

$$\text{Corrected tensile strength} = \frac{\text{apparent strength} \times [100 + (6 \times 7)]}{100 + (6 \times \text{actual regain at test})}$$

Scales can be developed to correspond with other values of standard regain and rate, or to express the results in terms of bone dry condition.

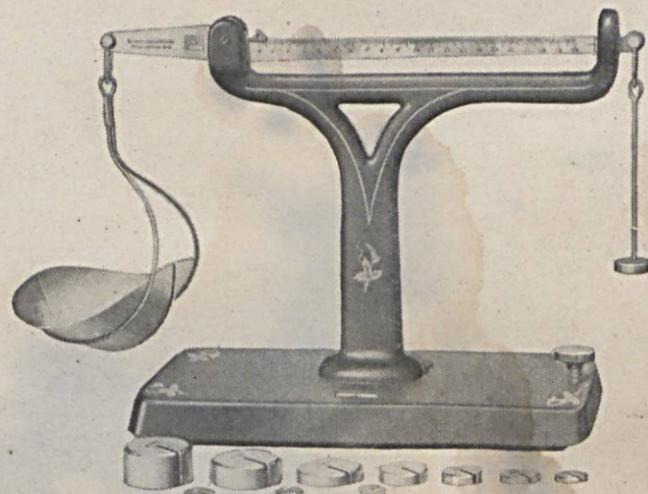
The attachment may be applied to any of the vertical types of Scott Testers.



Oven - Emerson

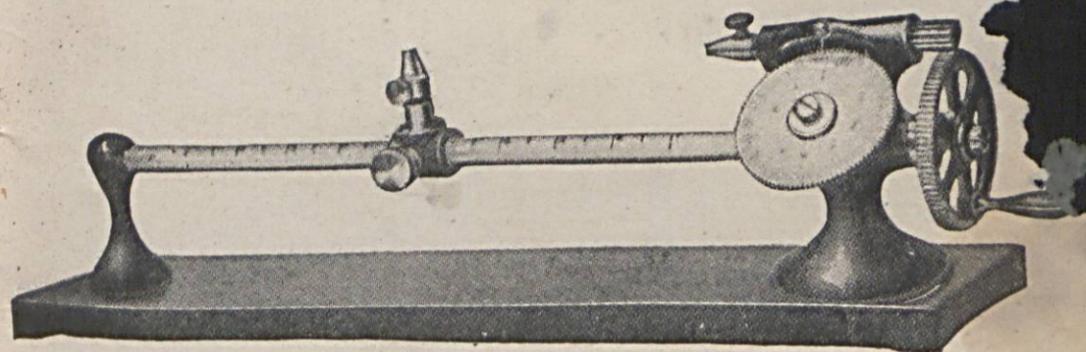
20⁰⁰

ROVING OR YARN SCALES



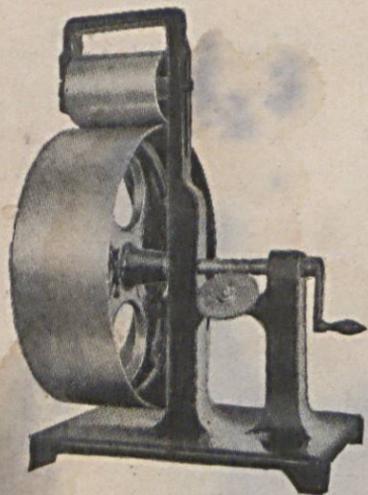
Graduated in tenths of grains or in ten thousandths of a pound. Capacity one pound avoirdupois

TWIST COUNTER



Built in Two Sizes — 10" and 20" Capacities

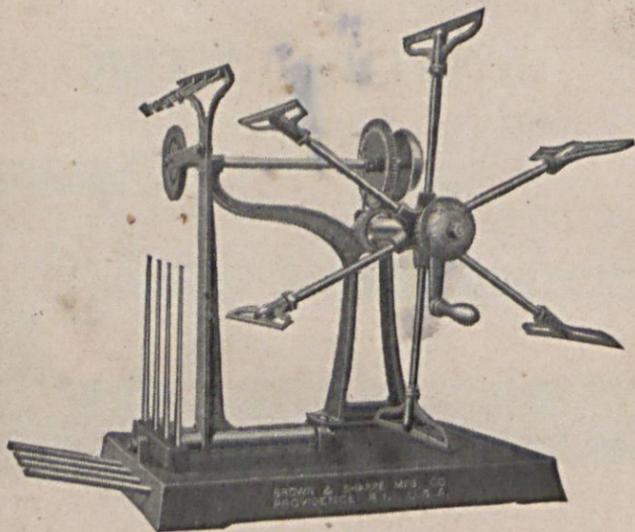
ROVING OR MEASURING REEL



36-inch or One-yard Reel

the

YARN REEL



4 or 7 Spindles

36" or 54" in diameter

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