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Schneider et al.

[11] **3,835,697**

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[54] **APPARATUS FOR TESTING FABRICS AND OTHER SHEET MATERIALS**

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[52] **U.S. Cl.** **73/7,** 73/159

[51] **Int. Cl.** **G01n 3/56**

[58] **Field of Search** 73/7, 159

[56] **References Cited**

UNITED STATES PATENTS

1,841,167	1/1932	Weinberg	73/7
3,286,505	11/1966	Penman	73/7

Primary Examiner—Donald O. Woodiel

Attorney, Agent, or Firm—George R. Nimmer

[57] **ABSTRACT**

Apparatus for testing fabrics and the like for wearability and generally comprises a generally horizontally extending base member including a broad upper surface, an anvil member having a longitudinally extending lofty upper-side, clamp means at the two anvil ends for removably attaching the test fabric in stretched condition above the anvil upper-side, a shoe member overlying the anvil and adapted to firmly downwardly abut the test fabric, powering means ultimately attached to the shoe member for causing repeated longitudinally reciprocatable movement thereof over a lengthy time period while abutting the test fabric, and other desirable features for implementing the apparatus purposes. For preferred apparatus embodiments, a pair of transversely separated anvil members are employed whereby the same kind of woven fabric can be tested simultaneously for wearability both in the warp and weft directions of the test fabrics.

9 Claims, 3 Drawing Figures

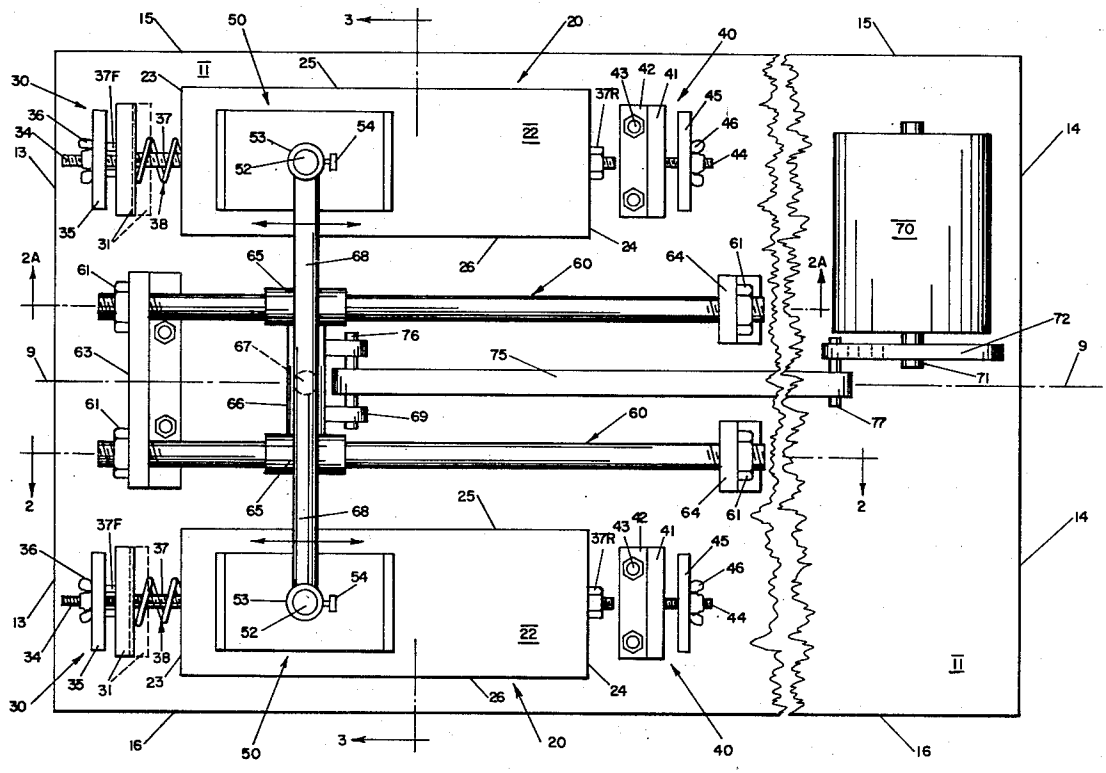
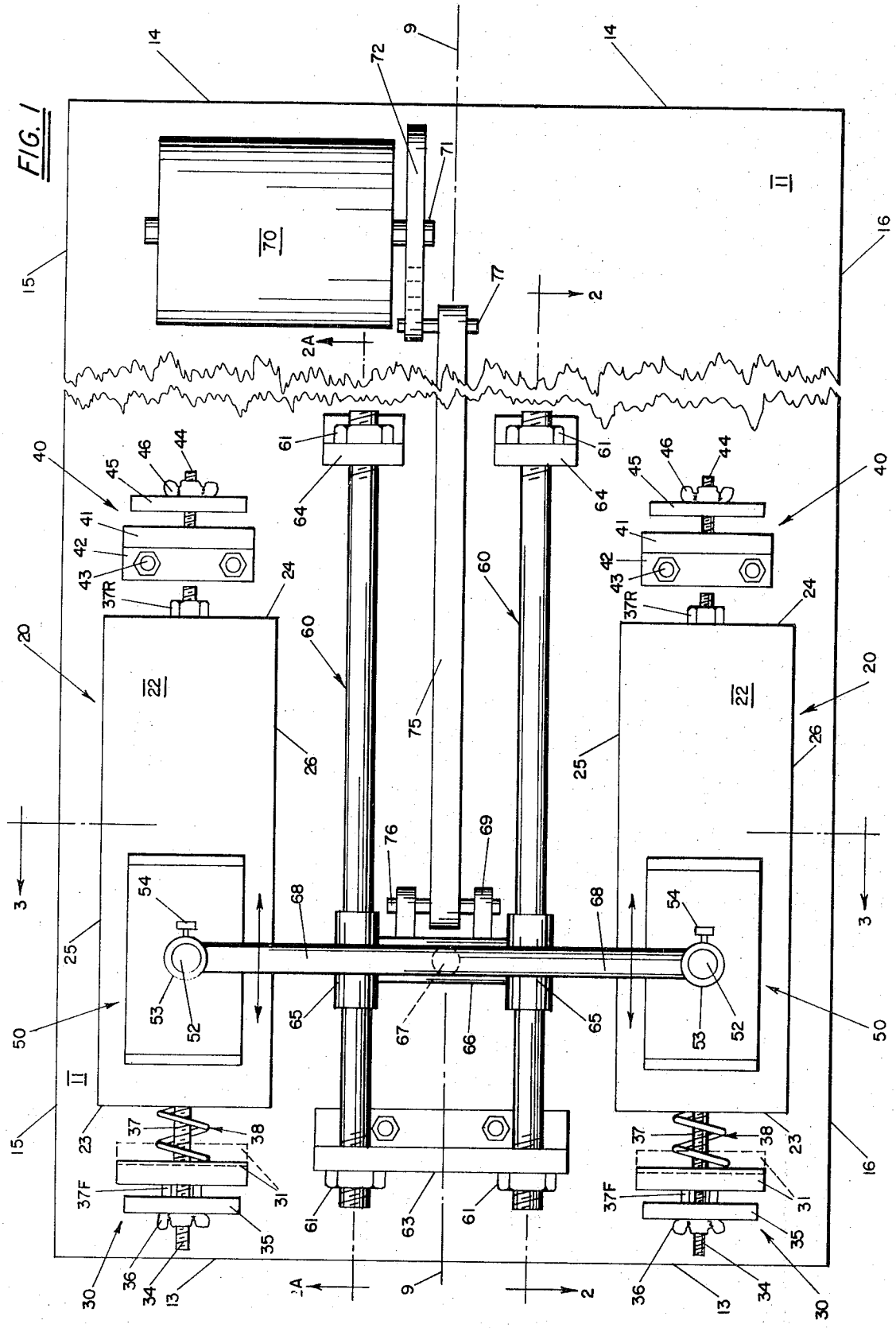


FIG. 1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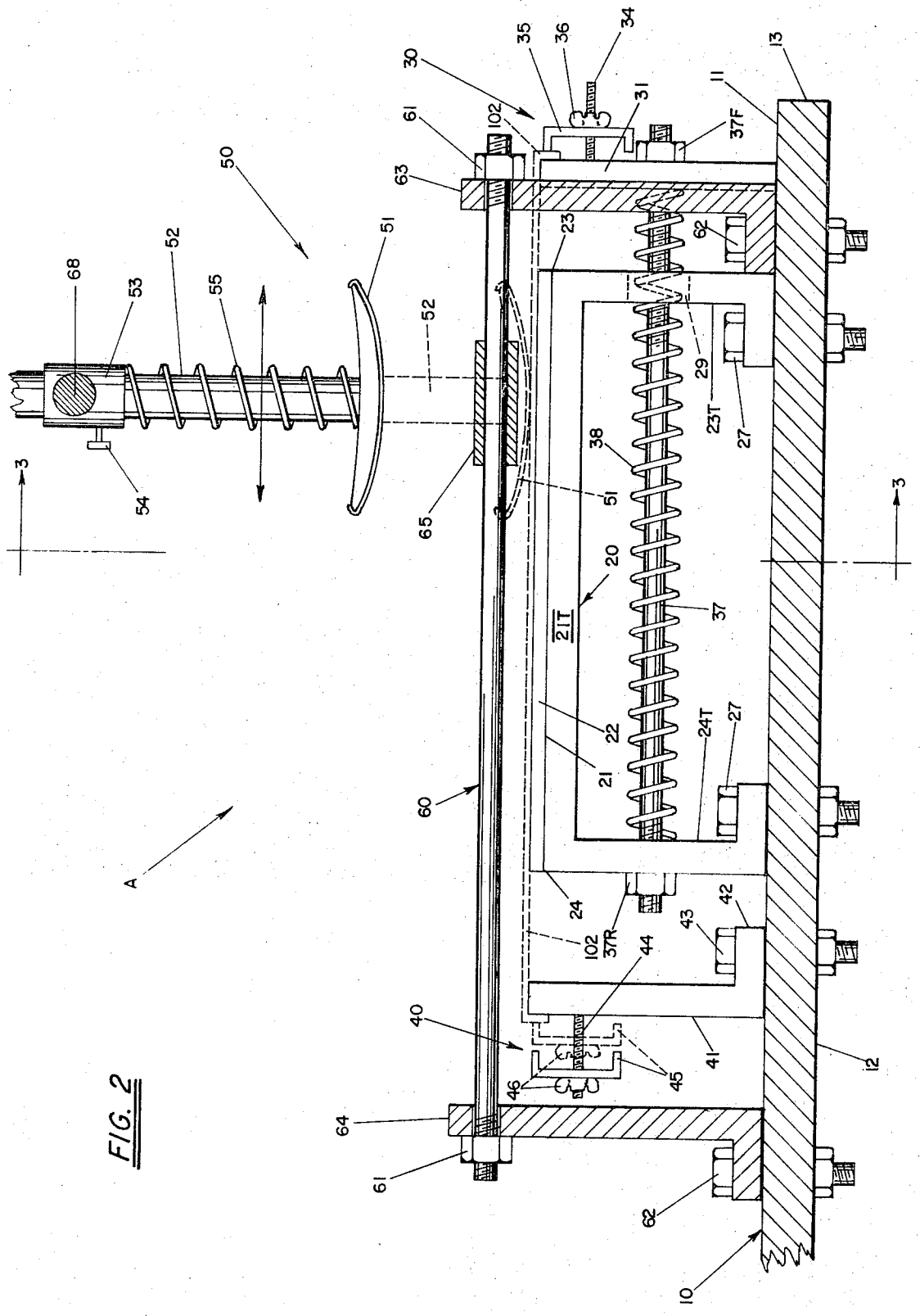
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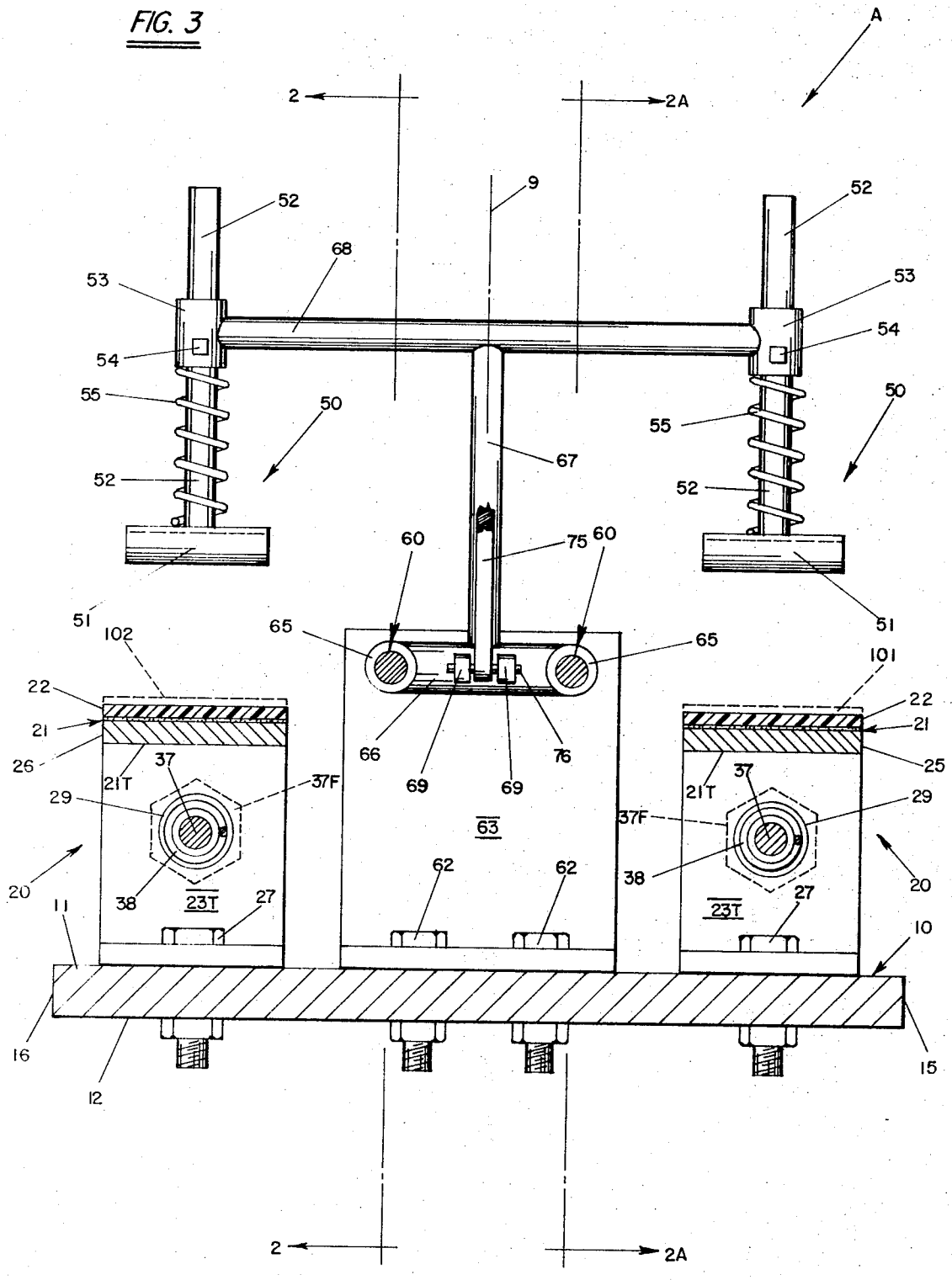
FIG. 2

FIG. 3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APPARATUS FOR TESTING FABRICS AND OTHER SHEET MATERIALS

Those engaged in the converting and processing of sheet materials, such as textiles, fabrics, leathers, papers, etc., have developed various apparatus for testing the sheet materials for wearability under actual use conditions. For example, as described in U.S. Pat. No. 2,189,589 (Mahannah, 1940), paper mills commonly subject their fibrous cellulosic sheet material to abrasion tests in an effort to predict the resistance of stationery papers to pencils and erasers. Similarly, as described in U.S. Pat. Nos. 1,632,591 (Dennis, 1927) and 2,590,839 (Clapham, 1952), textile mills commonly subject their woven sheet material fabrics to abrasive tests in an effort to predict their wearability for clothing, awnings, upholstery, etc. However, apparatus of the prior art for testing wearability of sheet materials has tended to be quite expensive and thus largely limited for use by the sheet material manufacturers or by commercial testing laboratories. Accordingly, many sheet material converters, which are likely to be relatively modest economic units such as a small upholstery shop or even a typical furniture manufacturer, are forced to rely upon reports received from a geographically remote sheet material testing site. Not only is such reliance costly and time consuming for sheet material converters, the test data is likely to be improperly correlated for the use purposes intended by a specific converter. Ideally, wearability testing should be performed "in house" by the furniture maker or other converter of sheet materials because the converter is in the best position to judge the applicability of the sheet material for the intended use. Not only would such "in house" wearability testing save time and money for the converter, it would also allow him to readily adapt to unusual or unexpected use situations for the sheet material. Moreover, for those converters who purchase sheet material supplies from various manufacturing mills, an unbiased objective comparison of competitively manufacturers wares would become readily available.

In the furniture trade, wearability of the furniture covering upholstery fabric depends upon several variables, and for this industry "in house" testing is particularly desireable. Upholstery fabric wearability depends upon the overall contour and use conditions of the selected furniture article. For example, in the case of woven textile fabrics it has been long recognized that wearability in the fabric "warp" and "weft" (i.e. the "fill") directions can be vastly disparate. Accordingly, it would be beneficial for the upholsterer to have readily available both the warp and weft wearability for each specific textile material so as to allow him to then apply the covering in the appropriate directions along the specifically encountered furniture article. Moreover, with many of the fabric wearability testers of the prior art, the testing apparatus abrasion action is apt to be grossly inappropriate and non-correlative for actual use conditions. In this vein are included rotating abrasive wheels and discs which do not even remotely similate the frictional forces between furniture covering and the clothing of the furniture occupant.

It is accordingly the general object of the present invention to provide improved apparatus for testing the wearability of sheet materials such as leathers, papers, textile fabrics and the like. It is an ancillary general object to provide improved apparatus for testing the resistance of sheet materials, and particularly upholstery fabrics, to withstand frictional or abrasive forces.

It is another general object of the present invention to provide apparatus for testing the wearability of textiles and other sheet materials, which apparatus is not only reliable but also relatively inexpensive for availability to "in house" testing by relatively economically modest sheet material converters. It is a further ancillary general object to provide reliable and economical testing apparatus, which is versatile in that a specific converter can modify the apparatus for his own peculiar intended purposes.

It is another object to provide apparatus of the abrasion type for testing the wearability of furniture upholstery fabrics, and wherein the overall apparatus and including the reciprocating abrasion element yield test data unusually well correlated to actual use conditions of furniture articles.

It is a further object to provide apparatus for testing the wearability of upholstery fabrics in the warp and weft directions simultaneously whereby the furniture upholsterer is apprised not only of the fabric's general character, but also the appropriate directions for employing same along the encountered furniture contour.

It is yet another object to provide apparatus for testing the wearability of fabrics and other sheet materials exceedingly quickly and reliably by a person of average skill and having only moderate training.

With the above and other objects and advantages in view, which will become more apparent as this description proceeds, the apparatus for testing textile fabrics and other sheet materials generally comprises a generally horizontal base member, an anvil member having a longitudinally extending upper-side located loftily above the base member, novel resiliently yieldable clamp means for mounting the sheet material to be tested in overlying working-surface relationship to the anvil upper-side, a shoe member over-lying the anvil upper-side and adapted to frictionally abut the sheet material to be tested, powering means for causing the shoe member to reciprocate vigourously longitudinally while abrading the sheet material and for a selected testing duration, and (for simultaneous warp and weft testing) a pair of anvil and shoe members together with novel means for reciprocatably supporting and powering the shoe members.

In the drawing, wherein like characters refer to like parts in the several views, and in which:

FIG. **1** is a top plan view of a representative embodiment "A" of the apparatus of the present invention.

FIG. **2** is a sectional elevational view taken along lines **2—2** of FIGS. **1** and **3**, which is a substantial mirror image of a sectional elevational view taken along lines **2A—2A** of FIGS. **1** and **3**.

FIG. **3** is a sectional elevational view taken along lines **3—3** of FIGS. **1** and **2**.

Apparatus embodiment "A" is intended for the simultaneous testing of two elongate sheet material strips, such as two strips of the same textile fabric extending longitudinally in the warp (**101**) and the weft (**102**) directions. However, if embodiment "A" were to be divided into substantially identical halves by an imaginary longitudinally extending medial vertical-plane **9**, each apparatus half might be employed for the testing of a single sheet material strip. Accordingly,

structural description will be devoted primarily to the apparatus half seen in the sectional elevational view taken along lines 2—2, the sectional elevational view taken along lines 2A—2A being a substantial mirror image thereof.

Representative embodiment "A" generally comprises a generally horizontally extending base member **10**, herein of constant vertical thickness between a pair of broad planar horizontal surfaces including upper surface **11** and lower surface **12.** The base member is herein selected of rectangular shape including a transversely extending fore-end **13,** a transversely extending back-end **14,** a longitudinally extending right-end **15,** and a longitudinally extending left-end **16.** The longitudinally extending imaginary vertical-plane **9** is, for the purposes of reference, herein defined to intersect base member **10** midway between and parallel to right-end **15** and left-end **16.**

There is an anvil member **20** including a substantially horizontal broad planar upper-side **21** located loftily above the base member upper surface (**11**). Anvil member upper-side **21** is herein selected of longitudinally elongate rectangular shape including a transversely extending front-edge **23,** a transversely extending rear-edge **24,** a longitudinally extending right-edge **25,** and a longitudinally extending left-edge **26.** As best seen in FIG. **2,** anvil embodiment **20** might be singularly constructed throughout of a structural material such as metal and including a horizontal table **21T** to define anvil upper-side **21,** an upright front-wall **23T** defining front-edge **23,** and an upright rear-wall **24T** defining the rear-edge **24.** The anvil member is attached to the base member, herein immovably attached through vertical bolts **27** passing through the horizontally flanged lower ends of the respective walls **23T-24T** and base member **10.** If the sheet material to be tested is a textile fabric, the immediately underlying horizontal support therefor is desireably of a resiliently compressive structural material. Accordingly, if the anvil table (**21T**) be of mettalic hardness, a separate layer (**22**) of polyurethane of similarly resiliently compressive resinous material is desireably laminated or otherwise attached conterminiously along the anvil edges (e.g. rectangular layer **22** conterminous along edges **23–26**). In such situations, the upper surface of topical layer **22,** rather than the anvil upper-side **21,** would be defined as the anvil work-surface for directly underlying the sheet material to be tested.

The sheet material to be tested for wearability is through the mechanism of a repeatedly longitudinally reciprocating shoe member (e.g. **50**). Thus, the sheet material strip to be tested needs to be removably securely applied in overlying abutting relationship with the anvil work-surface, e.g. **22.** In this vein, a pair of clamps are employed terminally of the anvil front and rear portions, herein taking the form of a front-clamp **30** and a rear-clamp **40** longitudinally separated by anvil **20** and spatially separated from front-wall **23T** and rear-wall **24T**, respectively. Rear-clamp **40** takes the form of a rigid L-shaped bracket having an upright-wall **41** and a bottom-flange **42** which is herein immovably attached to base member **10** with bolts **43.** Extending horizontally rearwardly of upright-wall **41** is a threaded stud **44,** and a clamp-plate **45** loosely surrounds stud **44.** A wing nut **46** threadedly engaged with stud **44** is adapted to longitudinally motivate clamp-plate **45** toward upright-wall **41** and thereby secure one transverely extending end of the sheet material sample to be tested, e.g. **101, 102.**

For many situations, especially involving textile fabrics, the sheet material to be tested needs to be in tightly longitudinally stretched condition during reciprocational abrasive testing thereof. For such purpose, there are clamp-tensioning means tending to maximize the longitudinal distance between the frontclamp and the rear-clamp during the actual period of abrasion testing. However, the longitudinal distance between the front-clamp and the rear-clamp needs to be of temporarily reduced length to facilitate clamping and declamping of the test sheets. For example, as indicated in phantom line in FIG. **1,** rear-clamp **40** might be stationary and front-clamp **30** might be longitudinally movable. In such situations, front-clamp **30** might comprise an upright-slab **31** having its lower end resting upon base upper surface **11** and longitudinally reciprocatably slidable therealong. Extending horizontally rearwardly of upright-slab **31** is a threaded stud **34,** and a clamp-plate **35** loosely surrounds stud **34.** A wing nut **36** threadedly engaged with stud **34** is adapted to longitudinally motivate clamp-plate **35** toward upright-slab **31** and thereby secure the other end of the sheet material sample to be tested.

Preferably, the temporary length reduction between the front-clamp and the rear-clamp is attained through a longitudinally resiliently yieldable clamp-tensioning means. For example, there is a substantially horizontal longitudinally extending spacer-rod **37** located in elevation between base member **10** and anvil table **21T,** said spacer-rod **37** passing through an enlarged opening **29** of anvil front-wall **23T** and having its rearward end passing through rearwall **24T** and removably secured thereat with nut **37R.** The forward end of spacer-rod **37** passes through and is removably threadedly secured at nut **37F** at upright-slab **31** of front-clamp **30.** There is a longitudinally elongate helical spring **38** surrounding spacer-rod **37** and bearing against a longitudinally movable clamp, herein said helical spring being longitudinally confined between anvil rear-wall **24T** and upright-slab **31.** Thus, the helical spring **38** normally urges movable front-clamp **30** in the forward direction as indicated in solid line in FIG. **1.** Moreover, the helical spring **38** is readily removable from the apparatus, as by the threaded members **37R** and **37F.** Accordingly, the fabric longitudinal tension is selectable depending upon the tension resiliency characteristics for the chosen helical spring (**38**). Moreover, minor adjustments of the fabric tension can be afforded through intervening spacers or washers (not shown) along spacer-rod **37.**

As had been previously alluded to, and as indicated in double-headed arrows in FIGS. **1** and **2,** a repeatedly longitudinally reciprocatable shoe member (e.g. **50**) is employed to abrasively test the sheet material for wearability. It will be seen that the longitudinally reciprocating non-roller form shoe member is uniquely adaptable for testing the wearability of fabrics and especially for furniture upholstery fabrics. As seen in FIG. **2,** shoe member **50** is of generally arcute shape including a linearly generated convex lower surface **51** which makes actual abrasive contact with the tested sheet material. Shoe **50** is rigidly non-rotatably connected to the lower portion os an upright support-bar **52,** and in top plan view shoe **50** has a pair of parallel longitudinally extending sides. With such configuration, various remov-

ably attachable laminae might be selected for the shoe lower extremity **51,** such as textile fabrics, leathers, sheet metals, etc. In this vein, it has been found that the use of removably attachable metallic mesh is desireable for the shoe lower extremity **51** and closely correlates wearability over relatively short test durations. It is desireable to temporarily elevate the shoe member while clamping and de-clamping test sheets, and in this regard, upright support-bar upper portion is slidably surrounded by a tubular collar **53** maintained at constant lofty elevation above the anvil working-surface. A setscrew **54** passing through collar **53** and bearing against support-bar **52** maintains the temporary increase in shoe member elevation. Shoe-tensioning means for applying a known downward force of the reciprocatable shoe member against the test sheets is desireable. In this regard a coil spring **55** surrounding support-bar **52** below tubular collar **53** might be employed. Preferably, the support-bar **52** upper portion is of uniform cross-sectional shape to permit its disengagement from collar **53.** In this way, the coil spring **55** is removably substitutable whereby the shoe member downward force against the tested sheet is selectable depending upon the tension resiliency characteristics of the coil spring (**55**) chosen.

In order to repeatedly longitudinally reciprocate the shoe member abrasively along the tested sheet, the shoe member is ultimately connected to a substantially horizontal longitudinally extending track means. Herein, the track means takes the form of a substantially horizontal rail **60** parallel to vertical-plane **9** and longitudinally lengthier than the anvil working-surface, e.g. **22.** Track rail **60** is maintained in elevation above and parallel to base upper surface **11** with a pair of angular brackets including rear-bracket **64** herein located transversely offset of vertical-plane **9** and a single transversely wider front-bracket **63** intersecting said vertical-plane **9.** The brackets **63** and **64** are immovably attached to base member **10** as by bolts **62,** and the rails **60** are maintained in longitudinally arrested relationship as through threadedly engaged nuts **61.** Longitudinal reciprocatability for the respective shoe abraders **50** is herein provided through ultimate connection with a cylindrically tubular slider member **65** surrounding and longitudinally slidably movable along the track rail **60.** With the dual anvils embodiment "A," there are along the two respective rails **60** two slider members **65** which are rigidly tied together in co-reciprocatable relationship with a transversely extending web **66** intersecting vertical-plane **9.** Appropriate to such dual anvils embodiment is a sturdy columnar member **67** extending rigidly vertically upwardly from web **66** and lying within vertical-plane **9.** Rigidly and nonrotatably connected to the upper end of column **67** is a transversely extending beam **68,** the leftward and rightward ends of said beam **60** being rigidly and non-rotatably connected to the respective tubular collars **53.**

There are powering means attached to the one or more shoe member abraders tend for causing repetitive longitudinally reciprocatable movement thereof and for an extended time duration. Herein, said powering means comprises an electric motor **70** immovably attached to base member **10,** such as nearer the back-end **14** thereof and wholly transversely offset of vertical-plane **9.** Corevolvably attached to the motor revolving shaft **71** is some selectable eccentric means, herein as a circular disc **72** that is transversely offset from vertical-plane **9.** Connection between the eccentric means and the shoe member is a longitudinally extending elongate crank-arm. Crank-arm **75** herein lies along vertical-plane **9** and has its forward portion pivotably connected with pin **76** to the rearwardly extending ears **69** of web **68.** The rearward portion of crank-arm **75** is pivotably connected with pin **77** to disc **72** at some radial distance from motor shaft **71** thereby providing a revolving eccentric means that causes longitudinally reciprocatable movement of shoe abraders **50** through intervening reciprocatable slider **65.** It is desireable that the pivot pin **77** be positionable a selectable distance from revolving shaft **71,** as by providing a plurality of incrementally radially spaced holes (hidden lines) in disc **72,** thereby providing a selectable stroke length for the crank-arm. Rheostats or the like might be employed to govern the angular velocity of motor shaft **71** to provide further operational flexibility for the testing apparatus. The operational direction of the powering means and hence the number of reciprocations for the shoe members abraders along the tested sheet might be governed by suitable counting mechanism, such as the well-known "Veeder Root" type.

It can thus be seen that the apparatus concept of the present invention for testing the wearability of textile fabrics and other sheet materials has several unique structural features which provide reliable test results. Moreover, these unique structural features provide a highly versatile testing apparatus that can be readily modified in several respects according to the specifically encountered sheet materials to be tested. Among the permitted apparatus modifications are: degree of stretch applied to test material, the texture and also the degree of downward pressure for the shoe abrader, the shoe abrader stroke length and its frequency of reciprocation, and frictional engagement characteristics between the test sheet and the underlying anvil.

From the foregoing, the construction and operation sheet materials testing apparatus will be readily understood and further explanation is believed to be unnecessary. However, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the appended claims.

What is claimed is as follows:

1. Apparatus for testing the expected wearability of fabrics and other sheet materials, said apparatus comprising:

A. A generally horizontally extending base member including a broad upper surface therefor;

B. An anvil member attached to the base member and including a generally horizontal longitudinally extending broad upper-side located loftily above the base member upper surface, said anvil member upper-side extending lengthily longitudinally between two transversely extending anvil edges including a front-edge and a rear-edge;

C. A pair of clamps including a front-clamp and a rear-clamp located terminally of and separated by said anvil, said clamps being adapted to removably attach a longitudinally extending sheet material test strip in stretched condition in overlying relationship with a working-surface anvil portion near the upper-side thereof;

D. Clamp-tensioning means tending to maximize the longitudinal distance between the front-clamp and the rear-clamp, said clamp-tensioning means being longitudinally resiliently yieldable for temporarily reducing the distance between said clamps;

E. A generally horizontal longitudinally extending track means attached to the base member and located above the base member upper surface;

F. A shoe member of vertically adjustable elevation and overlying the anvil upper-side, said shoe member being longitudinally reciprocatably associated along said track means;

G. Shoe-tensioning means tending to press the shoe member downwardly toward the anvil and the test sheet stretched therealong; and

H. Powering means attached to the shoe member for causing longitudinally reciprocations of the shoe member.

2. The apparatus of claim **1** wherein the anvil upper-side has a resiliently compressible pad superimposed upon and attached to said anvil upper-side whereby the longitudinally stretched and removably clamped test sheet material is in firm abutment downwardly against said pad as an anvil supported working-surface.

3. The apparatus of claim **1** wherein the track means comprises at least one substantially horizontal longitudinally extending rail maintained at substantially constant elevation loftily above the base member upper surface, there being a slider member slidably surrounding and longitudinally reciprocatably movable along said track rail, and the shoe member being ultimately connected to the slider member and co-reciprocatable therewith.

4. The apparatus of claim **3** wherein the powering means comprises an electric motor including a revolvable eccentric-means thereon, and an elongate crank arm pivotably connected to said revolvable eccentric-means and also to said longitudinally reciprocatably movable slider member.

5. The apparatus of claim **1** wherein the clamp-tensioning means comprises a substantially horizontal longitudinally extending elongate helical spring bearing against a clamp member and removably attached to the apparatus whereby the sheet material stretching tension is selectable depending upon the tension characteristics of the chosen helical spring.

6. The apparatus of claim **5** wherein said elongate helical spring surrounds a substantially horizontal longitudinally extending spacer-rod having at least one terminus thereof removably attached to a clamp member to facilitate helical spring substitution for selectable tension upon the sheet material.

7. The apparatus of claim **1** wherein the shoe member is attached to the lower portion of an upright support-bar, the support-bar upper portion being slidably surrounded by a tubular collar maintained at constant elevation above the base member upper surface, a set-screw passing through the tubular collar to vertically adjust the shoe member elevation whenever the apparatus operator is clamping andeclamping the tested sheet material, the shoe-tensioning means comprising a coil spring surrounding the support-bar between the shoe member and the upright tubular collar, said coil spring being removable from surrounding relationship with the support-bar whereby the shoe member downward force against the tested fabric is selectable depending upon the tension resiliency characteristics of the chosen coil spring.

8. The apparatus of claim **7** wherein the shoe member comprises a removably connected bottom-panel portion of selectable texture and for making firm though reciprocatable contact with the tested sheet material.

9. The apparatus of claim **1** adapted for simultaneously testing the same kind of textile fabric sheet material in the warp and weft directions thereof, there being a pair of anvil members in substantial parallelism and spaced on opposite sides of an imaginary longitudinally extending vertical-plane; wherein each of said anvil members is provided with a pair of terminal clamps and further comprises independent clamp-tensioning means for each pair; wherein the track means comprises a pair of substantially horizontal longitudinally extending elongate parallel rails located between the anvils and maintained at substantial co-elevation above the base member upper surface, each of said track rails being provided with a slider member slidably surrounding and longitudinally reciprocatably movable therealong, said slider members being attached together in co-reciprocatable relationship with a transversely extending web; wherein there is a pair of shoe members overlying the respective anvil members, each of said shoe members being ultimately connected to a sturdy columnar member extending rigidly uprightly from said transversely extending web; and wherein the powering means comprises an electric motor connected to the base member and including revolving eccentric means, and an elongate crank-arm lying along said imaginary upright-plane and being pivotably connected both to the motor shaft through the eccentric means carried thereby and also to the slider members connecting transverse web.

* * * * *