Dec. 9, 1969 K. J. HAMU 3,482,343

FRAME FOR STRESSING SHEET MATERIAL

Filed Jan. 22, 1968 2 Sheets-Sheet 1

FIG. 1.

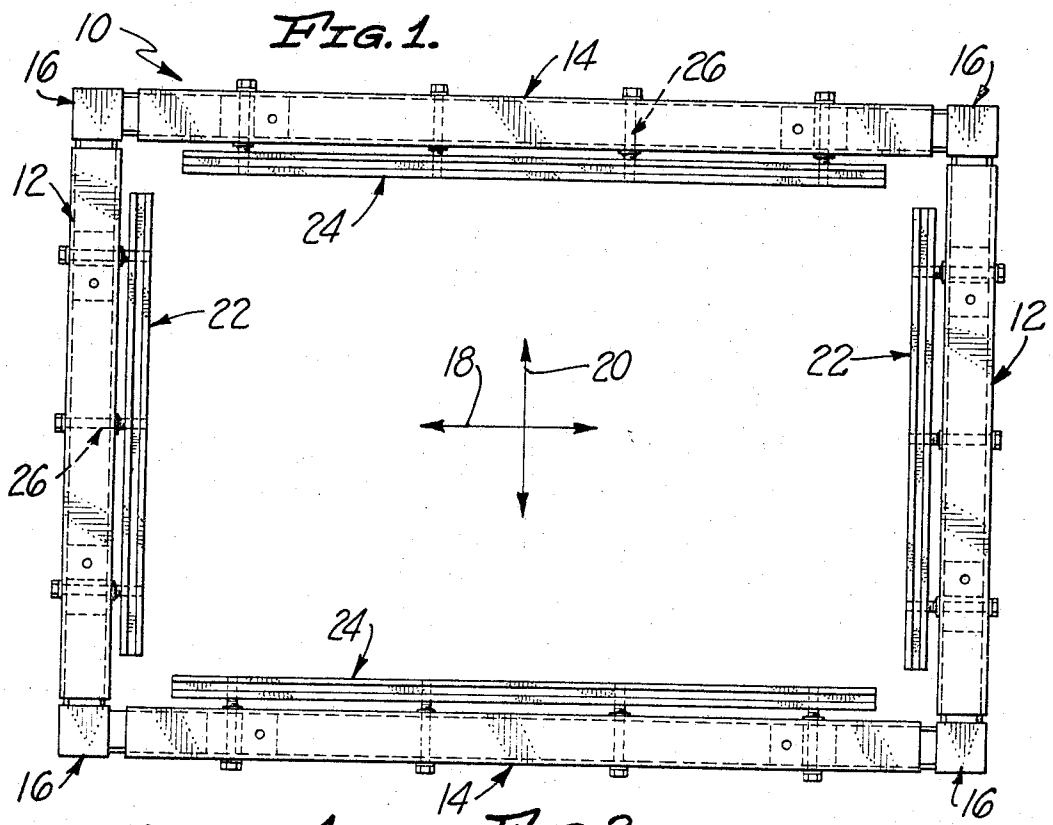

FIG. 2.

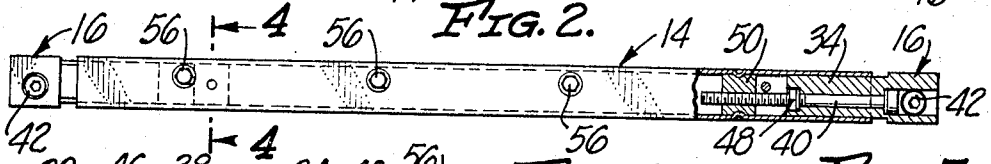

FIG. 3

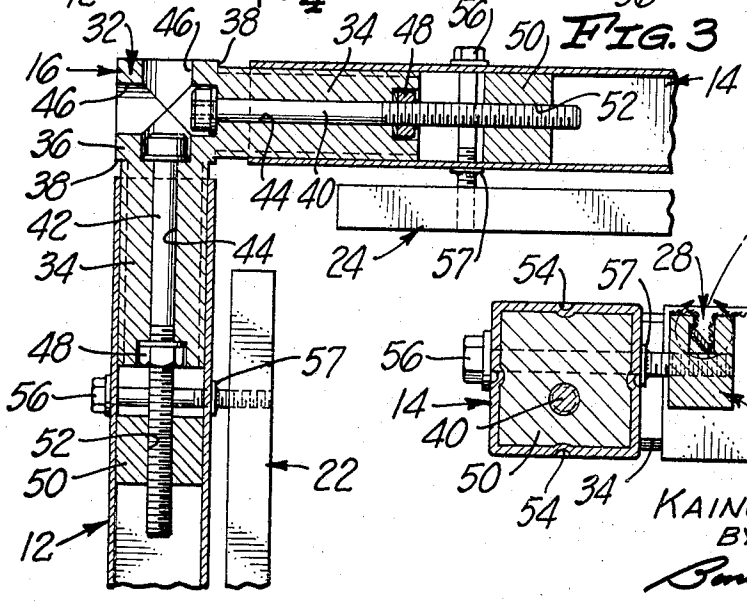

FIG. 5.

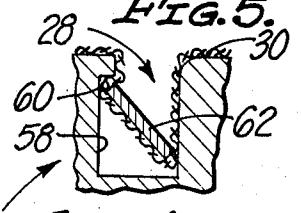

FIG. 4.

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FRAME FOR STRESSING SHEET MATERIAL

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FIG. 6.

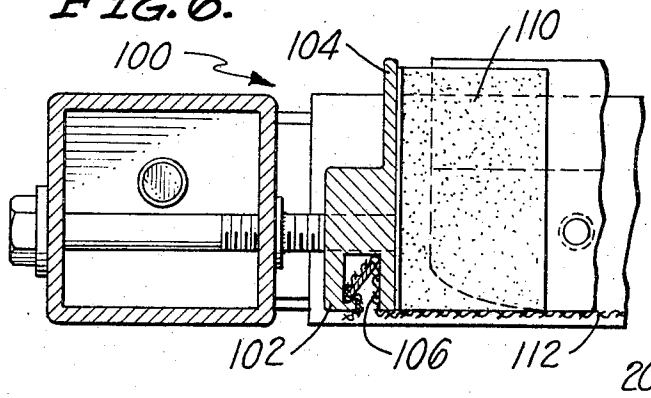


FIG. 9.

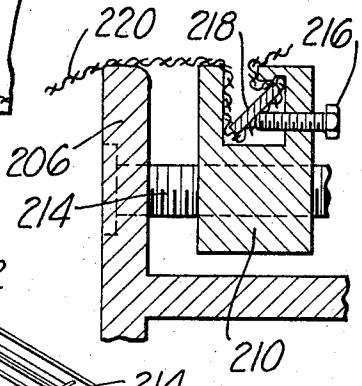


FIG. 7.

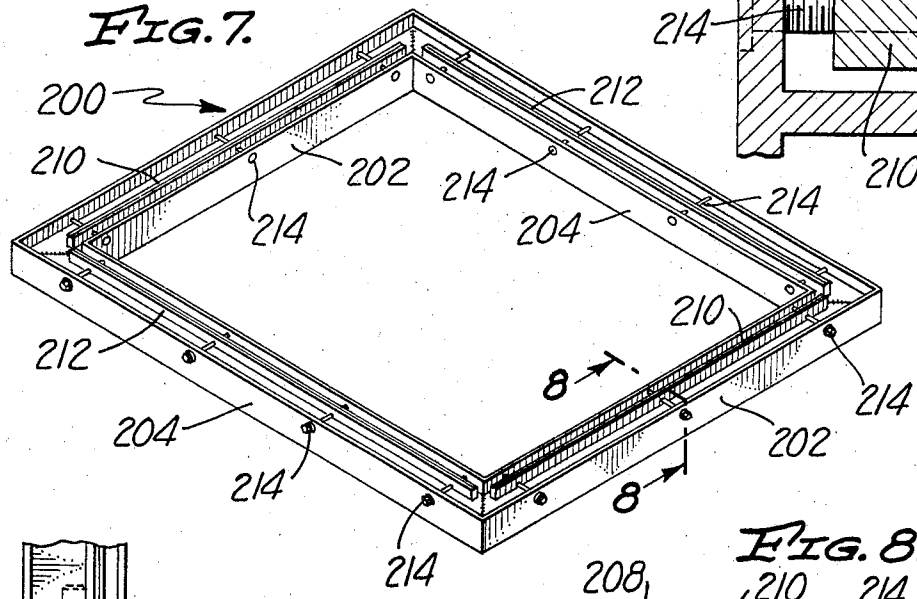


FIG. 8.

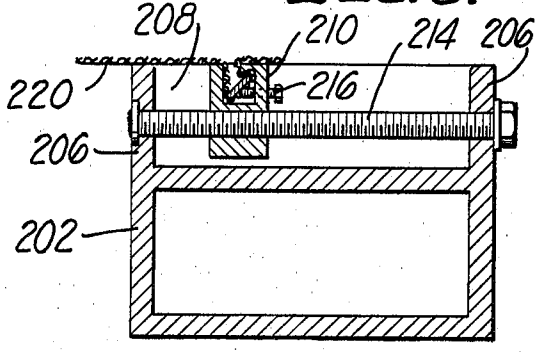
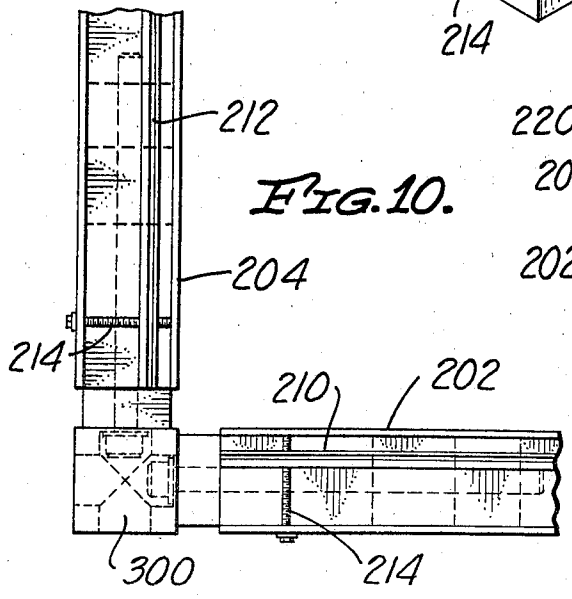


FIG. 10.



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3,482,343

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3,482,343

FRAME FOR STRESSING SHEET MATERIAL

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Continuation-in-part of application Ser. No. 633,261, Apr. 24, 1967. This application Jan. 22, 1968, Ser. No. 699,492

Int. Cl. D06c 3/08

U.S. Cl. 38—102.5 6 Claims

ABSTRACT OF THE DISCLOSURE

A stretch frame for biaxially stressing sheet material, such as printing screen, in mutually perpendicular edgewise directions, the frame having frame members mounting floating bars for attachment to the edges of the sheet material to be stressed, and means independently adjusting the frame members and floating bars to stress the sheet material in the edgewise direction in such a way as to permit both coarse and fine adjustments of the sheet tension.

This application is a continuation-in-part of my copending application Ser. No. 633,261, filed Apr. 24, 1967, and entitled Frame for Stressing Sheet Material.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates generally to handling devices for sheet material. More particularly, the invention relates to a stretch frame for biaxially stressing sheet material in mutually perpendicular edgewise directions.

As will appear from the ensuing description, the stretch frame of the invention may be employed for various uses. The primary application of the frame, however, is in the silk screen printing industry for supporting printing screen, fabric, and the like, in a taut condition. In this case, the frame is commonly referred to as a screen chase.

Prior art

A variety of stretch frames or screen chases of the character described have been devised. These existing frames, however, are characterized by excessive complexity and cost of manufacture, lack of both coarse and fine tension adjustments, difficulty of use, and other undesirable features.

SUMMARY OF THE INVENTION

The primary object of this invention is to provide an improved stretch frame of the character described which is not subject to the above noted and other deficiencies.

A more specific object of the invention is to provide an improved stretch frame of the character described which is characterized by simplicity of construction, economy of manufacture, capability of both coarse and fine adjustment of the tension in the sheet material being stressed, ease of use, and other highly desirable and beneficial features.

A further object of the invention is to provide a stretch frame of the character described which is uniquely adapted for use as a screen chase in the silk screen printing industry.

Other objects, advantages, and features of the invention will become readily evident as the description procceds.

With these and such other objects in veiw, the invention consists in the construction, arrangement, and combination of the various parts of the invention, whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims, and illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a plan view of a stretch frame, or screen chase, according to the invention;

FIGURE 2 is an edge view of the frame in FIGURE 1 with parts broken away for the sake of clarity;

FIGURE 3 is an enlarged fragmentary section through one corner of the frame;

FIGURE 4 is an enlarged section taken on line **4**—**4** in FIGURE 2;

FIGURE 5 is an enlargement of the area enclosed by the circular arrow **5**—**5** in FIGURE 4;

FIGURE 6 is an enlarged fragmentary section through a modified stretch frame or screen chase according to the invention;

FIGURE 7 is a perspective view of a further modified stretch frame or screen chase according to the invention;

FIGURE 8 is an enlarged section taken on line **8**—**8** in FIGURE 7;

FIGURE 9 is an enlargement of a portion of FIGURE 8; and

FIGURE 10 is a fragmentary enlargement of a further modified stretch frame or screen chase according to the invention.

In general terms, the invention provides a stretch frame, or screen chase, represented in the drawings by the frame **10**, having a pair of spaced and generally parallel first side frame members **12**, a pair of spaced and generally parallel second side frame members **14** extending normal to the first members, and corner means **16** joining the adjacent ends of the frame members for relative adjustment of the frame members **12** along a direction line **18** parallel to the frame members **14** and relative adjustment of the frame members **14** along a direction line **20** parallel to the frame members **12**. Thus, the frame members are relatively adjustable to vary the spacing between the parallel frame members **12** and the spacing between the parallel members **14**. Also embodied in the stretch frame is a set of floating bars for attachment to the edges of the sheet material to be stressed. This set of floating bars includes a pair of first bars **22** adjacent and parallel to the frame members **12**, respectively, and a pair of second bars **24** adjacent and parallel to the frame members **14**, respectively. The floating bars **22**, **24** are mounted on the respective frame members **12**, **14** by mounting means **26** which are adjustable to adjust the bars relative to the frame members. Thus, the bars **22** are adjustable relative to their respective adjacent frame members **12** along the direction line **18**. The bars **24** are adjustable relative to the frame members **14** along the direction line **20**. The floating bars **22**, **24** are equipped with means **28** for securing the bars to the sheet material **30** to be stressed.

Briefly, in use of the stretch frame or screen chase **10**, the frame members **12**, **14** and the floating bars **22**, **24** are adjusted inwardly to effectively contract the frame sufficiently to enable a sheet material **30** to be laid across the frame with the marginal edges of the material overlying the floating bars. The sheet material is then attached to the bars by securing means **28**. Thereafter, the frame members and the floating bars are adjusted outwardly to biaxially stress the sheet material in edgewise directions parallel to the direction lines **18**, **20**. In this regard, a feature of the invention resides in the fact that adjustment of the frame members **12**, **14** provides a coarse tension adjustment, the adjustment of the floating bars **22**, **24**, provides a fine tension adjustment for the sheet material.

Referring now in greater detail to the illustrated stretch frame or screen chase **10**, the frame members **12** and **14** will be observed to comprise tubes of rectangular cross section. While the frame members may be of equal length in some cases, the frame members **14** of the illustrated

frame are shown to be somewhat longer than the frame members **12**. The corner means **16** of the frame comprise generally L-shaped corner members **32** which are preferably castings. Each corner member has a pair of mutually perpendicular arms **34** which fit slidably within and have frame tubes **12, 14**. The juncture of the arms **34** of each corner member is enlarged slightly relative to the arms to form a cube-like corner portion **36**. This corner portion defines shoulders **38** facing and engageable with the adjacent frame tubes to limit relative telescoping movement of the tubes and corner members.

In addition to the corner members **32**, each corner means **16** of the illustrated frame comprise a pair of socket adjusting screws **40, 42** which extend through longitudinal bores **44** in the arms **34** of the corresponding corner member **32**. The screw heads are accessible through openings **46** in the corner portions **36** of the corner members to permit engagement of the screw heads with a wrench, or the like, for rotating the screws. The threaded shanks of the screws extend beyond the arms **34** of the corner members, as shown, and mount fixed thrust shoulders **48** which engage in sockets in the end faces of the arms, as shown. In the present instance, these thrust shoulders comprise nuts which are welded or otherwise rigidly fastened to the screws. Fixed within the ends of each frame tube **12, 14** are nuts **50** having threaded bores **52** axially aligned with and threadedly receiving the threaded shanks of the adjacent adjusting screws **42**. The illustrated nuts comprise metal blocks which complement the interior of the frame tubes and are fixed in place by dimples **54** in the tubes which protrude into recesses in the blocks.

It is evident at this point that adjustment of the screws **40** is effective to relatively adjust the frame members or tubes **12** along the direction line **18**, thus to vary the spacing between these members. Adjustment of the screws **42** is effective to relatively adjust the frame members or tubes **14** along the direction line **20** to vary the spacing between these members. Thus, the frame can be expanded and contracted by rotation of the corner adjusting screws. Of notable significance is the fact that the adjusting screws are effective to both positively contract and positively expand the frame; that is to say, rotation of the screws in one direction is effective to positively separate the frame members and thereby expand the frame. Rotation of the screws in the opposite direction is effective to positively move the frame members toward one another and thereby contract the frame.

The floating bars **22, 24** which support the sheet material **30** comprise long slender bars of rectangular cross section. As shown best in FIGURE 4, the floating bars are disposed with corresponding surfaces thereof facing and located substantially flush with the normally upper sides of the frame members **12, 14**. Extending between the frame members and their respective adjacent floating bars are adjusting screws **56** which constitute the floating bar mounting means **26**. Adjusting screws **56** are rotatable in their respective frame members and have their heads exposed at the outer sides of these members to permit the screws to be turned. The threaded shanks of the adjusting screws project inwardly a distance beyond the frame members and are threaded in the adjacent floating bars. As shown in FIGURE 3, these adjusting screws **56** are retained against movement relative to the respective frame members by the screw heads and by flanges **57** formed as by welding washers to the screw shanks, in order to provide for positive selective movement by the screw of the bars in either direction. Thus the floating bars **22, 24** are positively adjustable both inwardly and outwardly along the direction line **18, 20** relative to the frame members **12, 14** and independently of adjustment of these frame members. Referring to FIG. 4, it will be observed that the adjusting screws **40, 42**, and **56** are offset so as to not interfere with one another.

As noted earlier, the floating bars **22, 24** have means **28** for attaching the bars to the marginal edges of the sheet material **30** to be stressed. These attaching means comprise longitudinal solts or grooves **58** which enter the normally upper surfaces of the bars. Each groove is undercut to define a shoulder **60** along the open side of the groove. Removably positioned within each groove is an anchor strip **62** which is laterally dimensioned to fit diagonally in the groove, in the manner illustrated in FIGURE 4.

In use, the stretch frame or screen chase **10** is initially contracted, by inward adjustment of the frame members **12, 14**, sufficiently to enable the sheet material **30** to be laid over the frame with the marginal edges of the material overlying the floating bars **22, 24**. The sheet material is then secured to these bars by pressing the edges of the material into the bar grooves **58** and then inserting the anchor strips **62** into the grooves, over the sheet material, so that the strips engage under the bar shoulder **60**, as shown in FIGURE 5, thus to firmly anchor the material to the bars.

At this point, the outer frame adjusting screws **40, 42** are rotated in directions to separate the opposing frame members **12, 14** and thereby initially tension or stress the sheet material **30** in edgewise directions parallel to the direction of lines **18, 20**. This adjustment, in effect provides a coarse tension adjustment for the sheet material. Thereafter, the floating bar adjusting screws **56** are rotated to finally tension or stress the sheet material. This latter adjustment provides a fine tension adjustment for the sheet material. With regard to this fine tension adjustment, it is evident that the floating bar adjusting screws **56** may be independently adjusted to equalize, with a high degree of accuracy, the tension in all portions of the material **30** and in the edgewise directions of both direction lines **18** and **20**.

Lateral insertion of the anchor strips **62** into the floating bar grooves **58** is desirable for the reason that it greatly facilitates attachment of the sheet material to the floating bars **22, 24**. Obviously, the anchor strips may be removed laterally from the grooves to release, with equal facility, the sheet material from the floating bars. As noted earlier, the present stretch frame may be utilized for a variety of purposes but is intended primarily as a screen chase in the silk screen printing industry for supporting silk printing screens, or the like, in a taut condition. Obviously, the frame may be also utilized to support fabric, wire mesh, and a variety of other sheet-like materials.

Turning now to FIGURE 6, there is illustrated a modified stretch frame **100** according to the invention which is identical to the stretch frame just described except for the floating screen anchor bars **102** which are used in the modified frame. In this case, each floating bar has a flange **104** extending from the side of the bar opposite its screen receiving groove **106**. Also, the adjacent ends of the four floating bars of the stretch frame are bridged by fluid seals **110**. In this instance, the fluid seals comprise strips of tape which are secured to the inner surfaces of the floating bars, as shown. The modified stretch frame **100** is placed in its inverted sloping position shown when applying ink to the frame screen **112**. In this position, the floating bars **102** and their currently upstanding flanges **104**, and the seals **110** between the adjacent floating bars, provide a well for retaining ink on the screen.

FIGURES 7 through 9 illustrate a further modified screen frame **200** according to the invention. In this case, the outer frame members **202, 204** are rigidly joined by welding their adjacent ends to one another. As will be explained presently in connection with FIGURE 10, however, these members may be adjustably joined in much the same way as the frame members of the earlier described stretch frames. Also, the frame members **202, 204** have modified cross sections which may be best observed in FIGURE 9. Referring to this latter figure, it will be seen that each frame member is essentially a hollow rectangular tube with upstanding flanges **206** along its op-

posite longitudinal sides. Flanges **206** define therebetween an upwardly opening channel **208**. Channels **208** contain the floating screen anchor bars **210, 212** of the modified stretch frame. Each floating bar is supported on its respective frame member **202, 204** by a number of adjustable lead screws **214**. Each lead screw extends between and is journalled at its ends in the flanges **206** of the respective frame member. The lead screws are axially restrained by the illustrated shoulder means, whereby the screws are free to rotate, but are secured against axial movement. Each floating bar **210, 212** has threaded bores through which its respective lead screws **214** pass. Accordingly, rotation of the lead screws for each floating bar is effective to laterally adjust the bar relative to its adjacent frame member **202, 204**.

The floating bars **210, 212** are essentially identical to the floating screen anchor bars of the first described embodiment of the inventeion. Thus, the sole difference between the floating bars resides in the fact that the floating bars **210, 212** of FIGURES 7 through 9 have screws **216** for locking their screen anchor strips **218** in clamping engagement with the frame screen **220**. In this regard, it will be observed that the grooved sides of the floating bars are exposed at the open sides of the frame channels **208** and are substantially flush with the upper edges of the frame flanges **206**.

The modified stretch frame **200** is used in essentially the same way as the first described stretch frame of the invention. The modified stretch frame, however, permits inward adjustment of the floating bars **210, 212**, to create slack in the screen **220** during washing of the screen, without inadvertent release of the screen from the coating bars.

As noted earlier, the outer frame members **202, 204** of the stretch frame just described may be adjustably joined in the manner illustrated in FIGURE 10, rather than welded, as shown in FIGURE 7. In this case, the frame members are joined by corner members **300** which are essentially identical to the corner members in the first described stretch frame of the invention and are inserted into the open ends of the lower tubular portions of the frame members. The corner members and frame members are joined in the same manner as in the first described stretch frame, whereby the frame members may be adjusted relative to one another, as before.

Clearly, therefore, the invention herein described and illustrated is fully capable of attaining the several objects and advantages preliminarily set forth.

The inventor claims:

1. A frame for biaxially stressing sheet material in mutually perpendicular edgewise directions comprising:
- an open rectangular frame having a central opening bounded by side and end frame members,
- a pair of first floating bars adjacent and parallel to said side frame members,
- a pair of second floating bars adjacent and parallel to said end frame members,
- adjustable mounting means supporting said bars on their respective adjacent frame members for adjustment of said first bars lengthwise of said frame and adjustment of said second bars laterally of said frame,
- said bars including means for attaching the marginal edges of said sheet material to said bars, and
- seal means joining the adjacent ends of said bars so as to define with said sheet material a well.

2. A stretch frame according to claim **1** wherein:
- said floating bars include upstanding flanges for increasing the depth of said well, and
- said seal means comprise tape secured to the inner surfaces of the adjacent bars.

3. A frame for biaxially stressing sheet material in mutually perpendicular edgewise directions comprising:
- an open rectangular frame including side and end frame members,
- a pair of first floating bars adjacent and parallel to said side frame members,
- a pair of second floating bars adjacent and parallel to said end frame members,
- adjustable supporting means supporting said bars on their respective adjacent frame members for adjustment of said first bars laterally of said frame and adjustment of said second bars longitudinally of said frame, and
- said bars having normally upwardly opening grooves to receive the marginal edges of said sheet material, angularly disposed anchor strips positioned in said grooves for gripping said marginal edges, and screws carried by said bars and engageable with said anchor strips for retaining the latter in gripping engagement with said marginal edges.

4. A frame for biaxially stressing sheet material in mutually perpendicular edgewise directions comprising:
- an open rectangular frame having a central opening bounded by side and end frame members,
- each said frame member having a normally lower tubular portion and upstanding flanges defining therebetween an upwardly opening channel,
- a pair of first floating bars positioned within and extending longitudinally of the channels in said side frame members,
- a pair of second floating bars positioned within and extending longitudinally of the channels in said end frame members,
- lead screws journalled at their ends in the flanges of each frame member and passing through threaded bores in the corresponding floating bar, whereby rotation of said lead screws is effective to adjust said first floating bars laterally of said frame and said floating bars longitudinally of said frame, and
- means for attaching the marginal edges of said sheet material to said bars.

5. A stretch frame according to claim **4** wherein:
- the adjacent ends of said frame members are rigidly joined as by welding.

6. A stretch frame according to claim **4** wherein:
- said frame members are relatively adjustable and have adjacent open ends, and
- adjustable corner means extending into and adjustably joining the adjacent ends of said frame members.

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PATRICK D. LAWSON, Primary Examiner

U.S. Cl. X.R.

38—102.91

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,482,343 December 9, 1969

Kaino J. Hamu

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, after line 52, insert the following claims:

7. A frame for biaxially stressing sheet material in mutuall perpendicular edgewise directions, comprising:
a pair of spaced and generally parallel first frame members,
a pair of spaced and generally parallel second frame members extending between corresponding ends of and generally normal to said first frame members,
corner members at the corners, respectively, of said frame and disposed in slidable telescoping engagement with the adjacent fra members, whereby said corner members join the adjacent ends of said frame members for relative adjustment of said first frame members along first direction lines paralled to said second frame members to vary the spacing between said first frame member and relative adjustment of said second frame members along second direction lines paralled to said first frame members to vary the spacing between said second frame members,
adjusting means connected between said corner members and their respective adjacent frame members for independently relatively adjusting each corner member and each of its adjacent frame members in the endwise direction of the frame members, said adjusting means comprising a pair of rotatable axially fixed adjusting screws carried by each corner member with the screw axes extending longitudinally of the adjacent frame members, respectively, and nuts threaded on said adjusting screws and fixed within the respective adjacent frame members,
a pair of first floating bars adjacent and extending longitudinal of said first frame members, respectively,
a pair of second floating bars adjacent and extending longitudina of said second frame members, respectively,
adjustable mounting means supporting said bars on the respective adjacent frame members for adjustment of said first bars relative to said first frame members along said first direction line and adjustment of said second bars relative to said second frame members along said second direction line,
said floating bars including means for attaching to said bars the marginal edges of a sheet to be stressed, and

said frame members and floating bars being independently adjustable to biaxially stress said sheet in edgewise directions parallel to said direction lines.

8. A stretch frame according to Claim 7 wherein:
said frame members comprise tubes of rectangular cross section, and
said corner members comprise mutually perpendicular arms slidably disposed within and having rectangular cross sections complementing the central openings in said tubes.

9. A frame for biaxially stressing sheet material in mutually perpendicular edgewise directions, comprising:
a pair of spaced and generally parallel first frame members comprising tubes of rectangular cross-section,
a pair of spaced and generally parallel second frame members extending between corresponding ends of and generally normal to said first frame members, said second frame members comprising tubes of rectangular cross-section,
corner means joining the adjacent ends of said frame members for relative adjustment of said first frame members along first direction lines parallel to said second frame members to vary the spacing between said first frame members, and relative adjustment of said second frame members along second direction lines parallel to said first frame members to vary the spacing between said second frame members, said corner means comprising generally L-shaped corner members having mutually perpendicular arms slidably disposed within and having rectangular cross-sections complementing the central openings in their respective tubular frame members,
a pair of first floating bars adjacent and extending longitudinally of said first frame members, respectively,
a pair of second floating bars adjacent and extending longitudinally of said second frame members, respectively,
adjustable mounting means supporting said bars on the respective frame members for adjustment of said first bars relative to said first frame members along said first direction line and adjustment of said second bars relative to said second frame members along said second direction line,
said floating bars including means for attaching to said bars the marginal edges of a sheet to be stressed, and
said frame members and floating bars being independently adjustable to biaxially stress said sheet in edgewise directions parallel to said direction lines.

10. A frame for biaxially stressing sheet material in mutually perpendicular edgewise directions, comprising:
a pair of spaced and generally parallel first frame members,
a pair of spaced and generally parallel second frame members extending between corresponding ends of and generally normal to said first frame members,
corner means joining the adjacent ends of said frame members for relative adjustment of said first frame members along first direction lines parallel to said second frame members to vary the spacing between said first frame members, and relative adjustment of said second frame members along second direction lines parallel to said first frame members to vary the spacing between said second frame members,
a pair of first floating bars adjacent and extending longitudinally of said first frame members, respectively,
a pair of second floating bars adjacent and extending longitudinally of said second frame members, respectively,
adjustable mounting means supporting said bars on their respective adjacent frame members for adjustment of said first bars relative to said first frame members along said first direction line and adjustment of said second bars relative to said second frame members along said second direction line,
said floating bars having corresponding surfaces and substantially flush with the normally upper surfaces of said frame members, undercut longitudinally extending grooves entering said surfaces of said floating bars and defining shoulders along the open sides of the respective grooves, and anchor strips laterally insertable into said grooves through said open sides thereof and engageable under said shoulders for attaching to said floating bars the marginal edges of a sheet to be stressed, and
said frame members and floating bars being independently adjustable to biaxially stress said sheet in edgewise direction parallel to said direction lines.

11. A stretch frame according to Claim 10 wherein:
said frame members define a central rectangular opening in said frame, and
said bars are disposed within said opening along the inner sides of the respective frame members.

12. A frame for biaxially stressing sheet material in mutually perpendicular edgewise directions, comprising:
a pair of spaced and generally parallel tubular first frame members,
a pair of spaced and generally parallel second tubular frame members extending between corresponding ends of and generally normal to said first frame members,

generally L-shaped corner members at the corners, respectively, of said frame and each including generally mutually perpendicular arms slidably fitted within the ends of the respective adjacent frame members,
first adjusting screws extending between said corner members and said first frame members lengthwise of said first frame members and operatively connected between said corner members and said first frame members whereby rotation of said screws effects relative adjustment of said corner members and said first frame members lengthwise of said first frame members,
second adjusting screws extending between said corner members and said second frame members lengthwise of said second frame members and operatively connected between said corner members and said second frame members, whereby rotation of said second adjusting screws effects relative adjustment of said corner members and said second frame members lengthwise of said second frame members,
said adjusting screws being adjustable to effect relative adjustment of said first frame members along first direction lines parallel to said second frame members to vary the spacing between said first frame members and relative adjustment of said second frame members along second direction lines parallel to said first frame members to vary the spacing between said second frame members, and
means for attaching to said frame members the marginal edges of a sheet to be stretched.

13. A stretch frame according to Claim 12 wherein: said sheet attaching means comprise means on said frame members having undercut grooves extending longitudinally of said frame members, respectively, and opening through one side of said frame, said grooves defining shoulders along the open sides of the respective grooves, and anchor strips laterally insertable into said grooves through said open sides thereof and engageable under said shoulders.

In the heading to the printed specification, line 8, "6 Claims." should read -- 13 Claims. --.

Signed and sealed this 10th day of November 1970.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR
Commissioner of Patents