United States Patent

Stewart et al.

[15] **3,680,805**

[45] **Aug. 1, 1972**

[54] LIGHT TABLE WITH MULTIPLE AXIS TILTING, AND TENSION CONTROL OF TRAVELING ILLUMINATED MEDIA

[72] Inventors: **Wilton A. Stewart,** Pacific Palisades; **Ying-Nien Yu,** Marina Del Rey, both of Calif.

[73] Assignee: **Integraphic Inc.,** Santa Monica, Calif.

[22] Filed: **Sept. 3, 1969**

[21] Appl. No.: **854,980**

[52] **U.S. Cl.**.....**242/67.4,** 40/86 R, 108/23, 242/55

[51] **Int. Cl.**.....**B65h 17/02,** A47b 37/00

[58] **Field of Search**..242/67.1 R, 67.1 D, 67.5, 67.2, 242/55, 67.3; 108/23, 90, 53; 40/53 R, 86 R, 86 A, 70 A, 31 R; 26/70

[56] **References Cited**

UNITED STATES PATENTS

2,595,055	4/1952	Clark et al.	242/67.4
3,002,703	10/1961	Hinchman	242/180
3,203,636	8/1965	Owen	242/75.51 X
3,358,393	12/1967	Lewis	40/31
3,364,604	1/1968	Donaldson et al.	40/31

Primary Examiner—George F. Mautz
Attorney—White & Haefliger

[57] **ABSTRACT**

The invention concerns a light table having capability for adjustable tilting in multiple modes and to extreme angularity relative to horizontal, and with further provision for rapid reversal of film travel at any speed without loss of film tension, both hand and motor operation being enabled.

5 Claims, 19 Drawing Figures

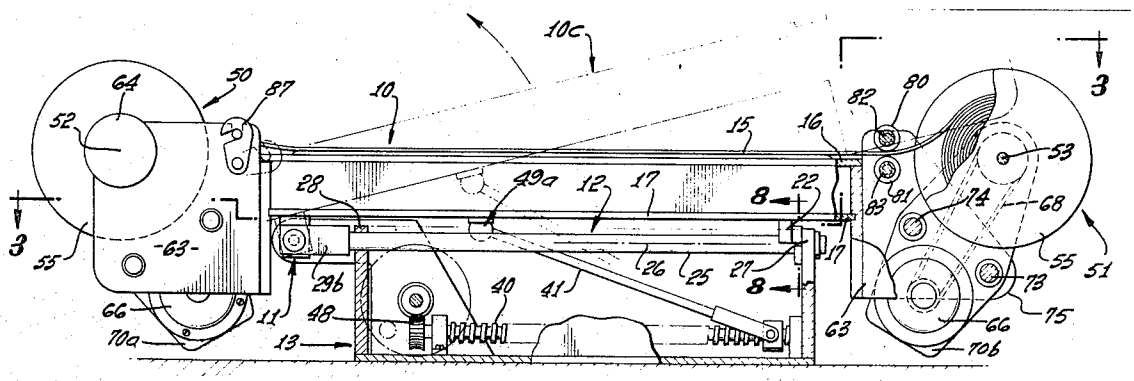


FIG. 1.

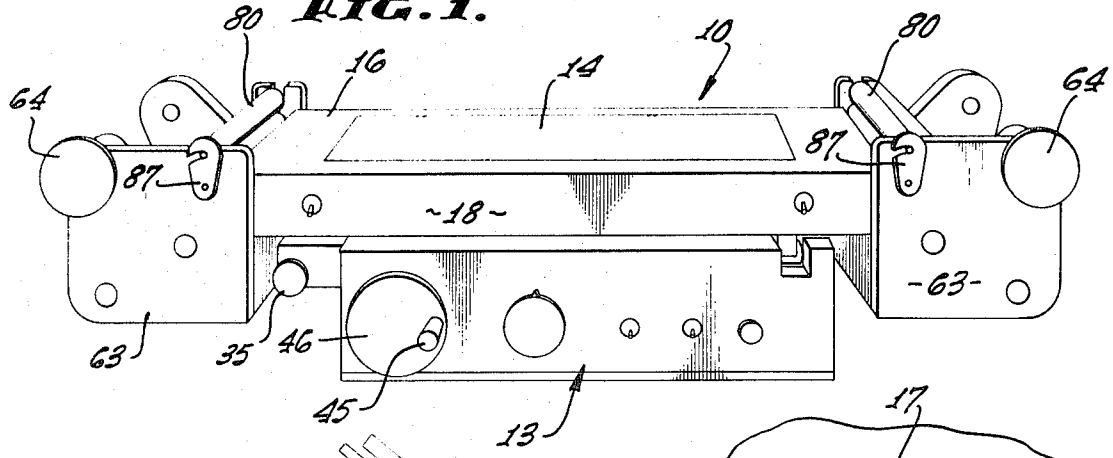


FIG. 4.

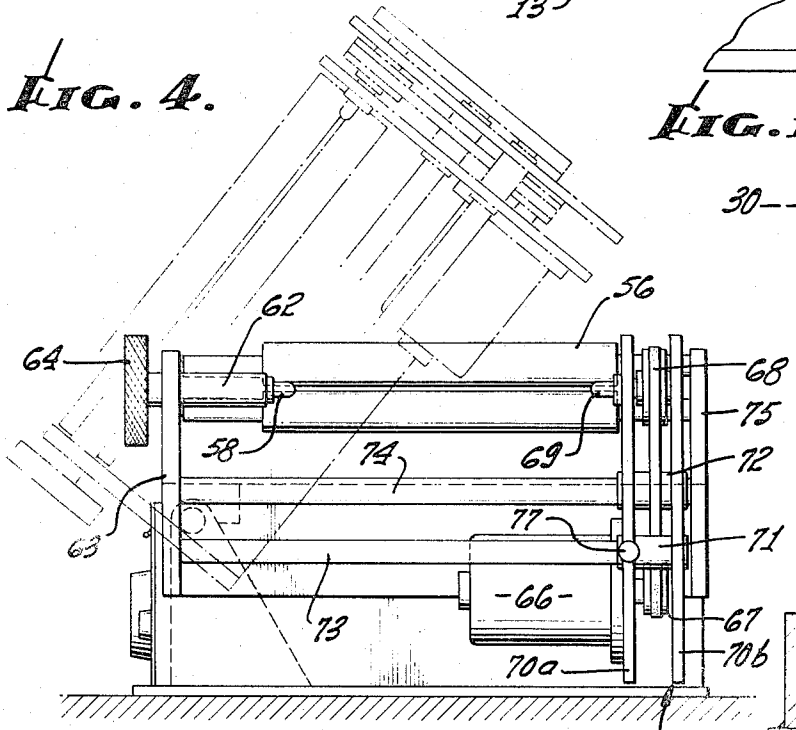


FIG. 11.

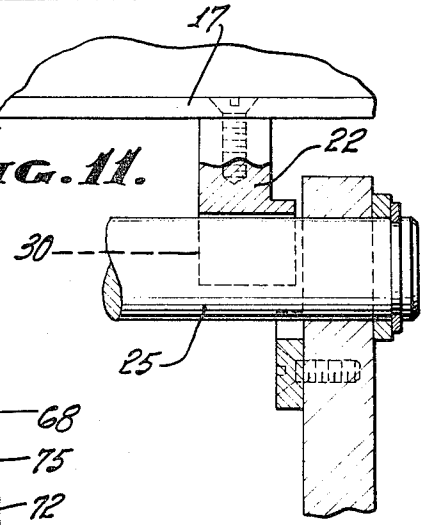


FIG. 16.

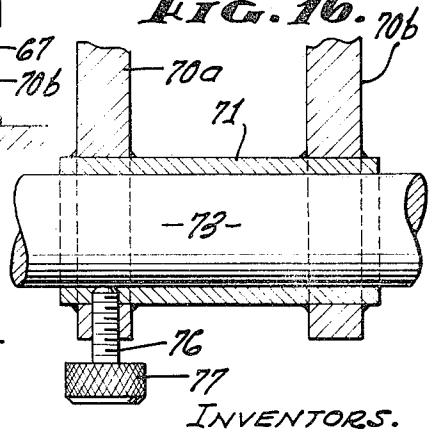
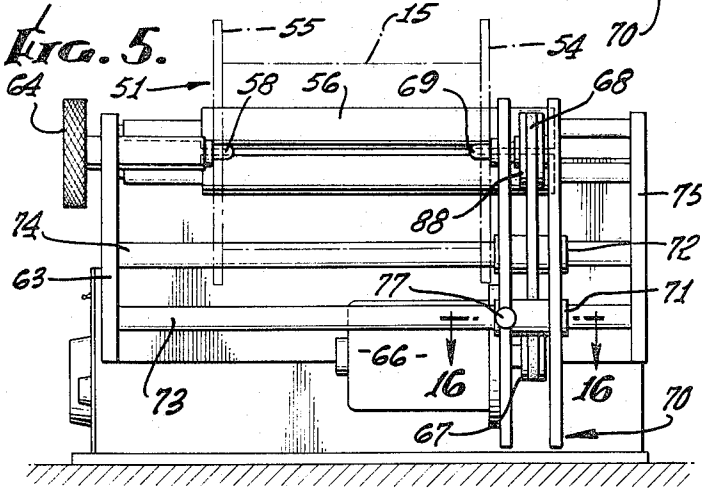


FIG. 5.



INVENTORS.
WILTON A. STEWART
YING-NIEN YU
BY White & Haefliger
ATTORNEYS.

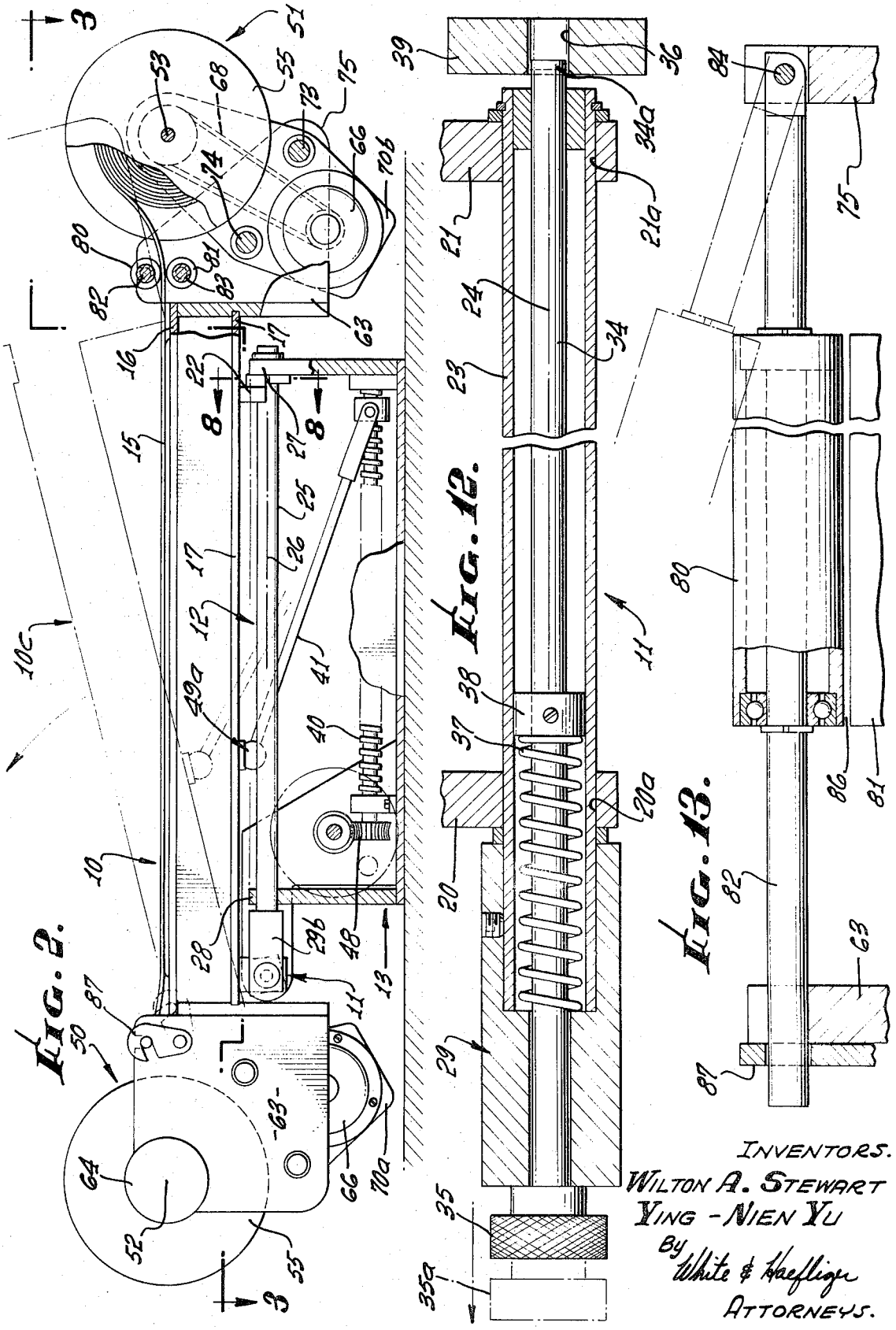


FIG. 2.

FIG. 12.

FIG. 13.

INVENTORS.
WILTON A. STEWART
YING-NIEN YU
By White & Haefliger
ATTORNEYS.

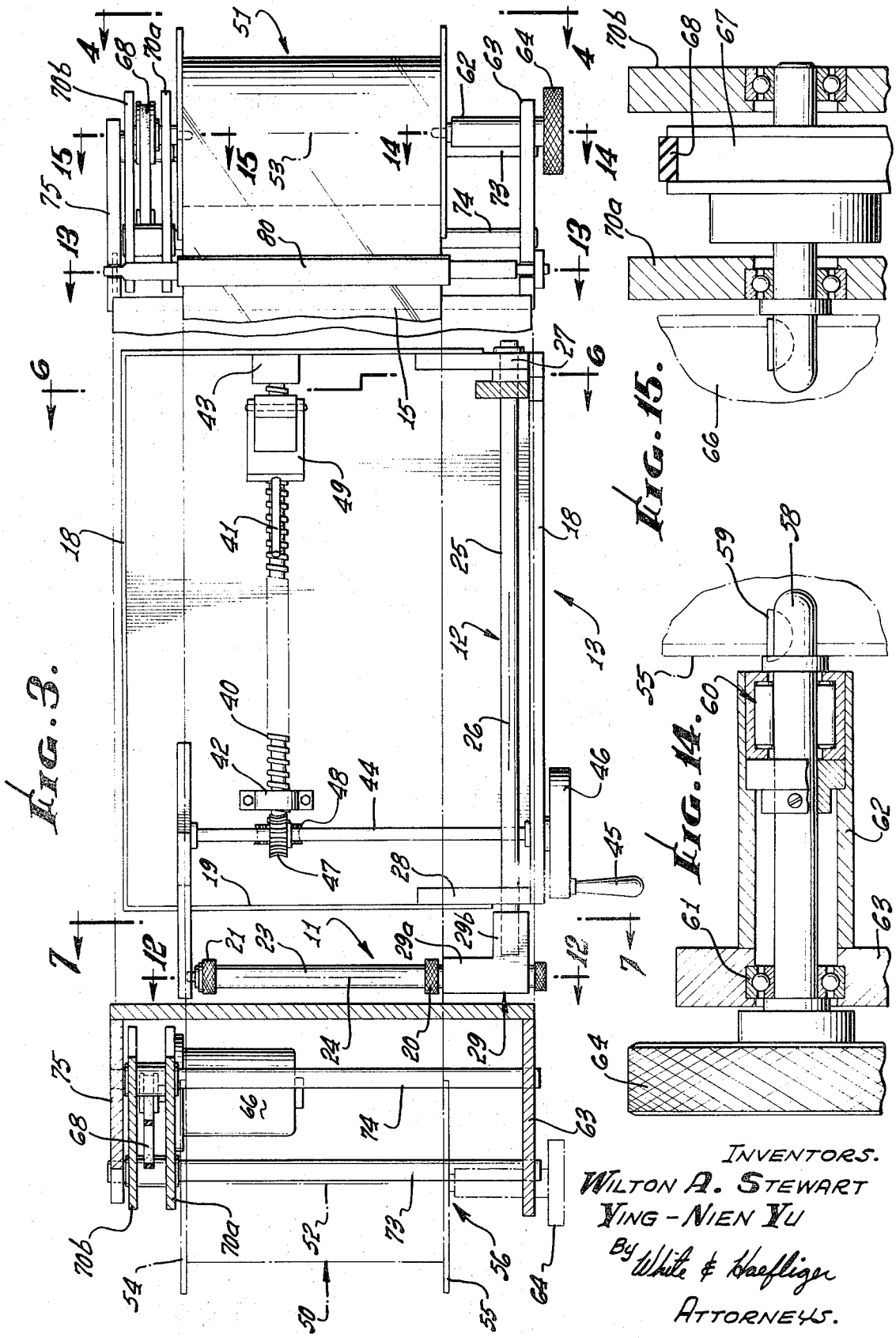


FIG. 3.

FIG. 15.

FIG. 14.

INVENTORS.
WILTON A. STEWART
YING-NIEN YU
By White & Haefliger
ATTORNEYS.

FIG. 6.

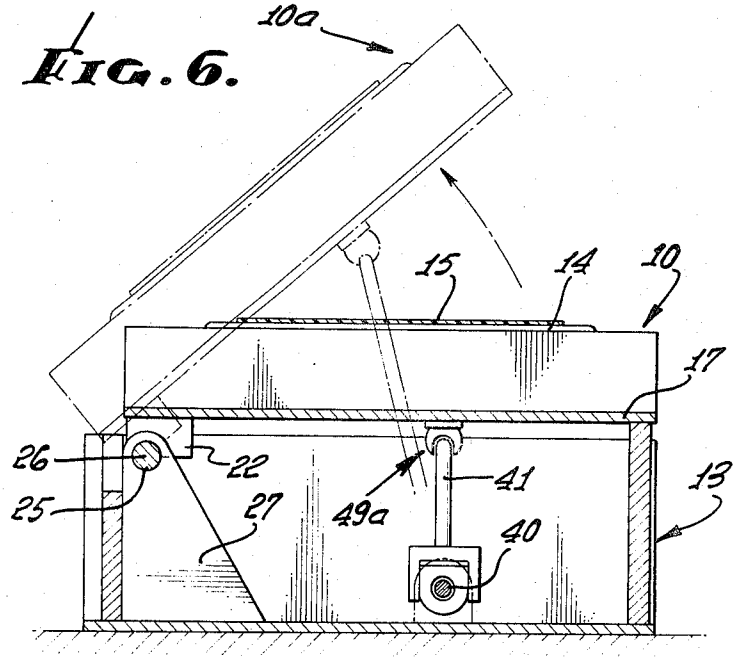


FIG. 10.

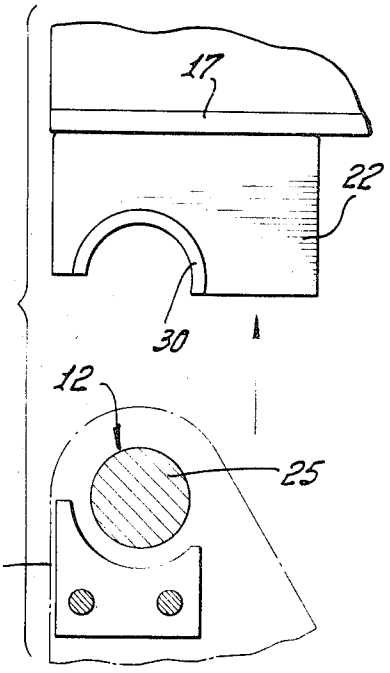


FIG. 7.

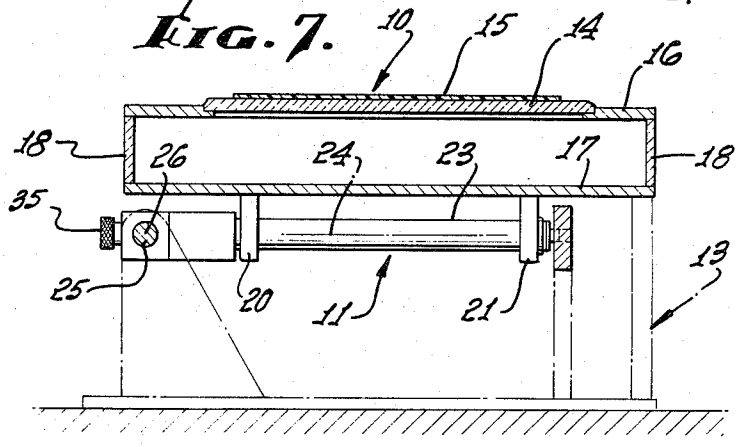


FIG. 9.

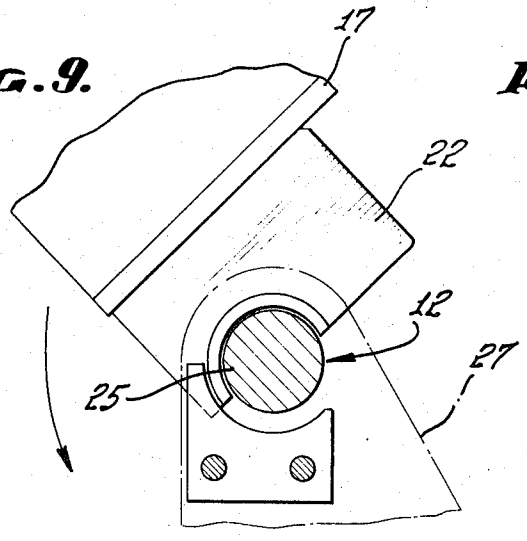
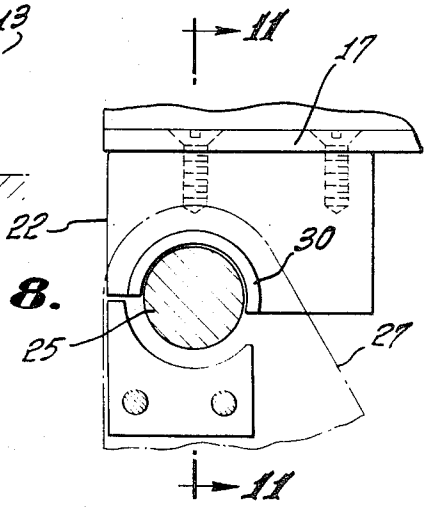


FIG. 8.



INVENTOR.
WILTON A. STEWART
YING-NIEN YU
By White & Haefliger
ATTORNEYS.

FIG. 17a.

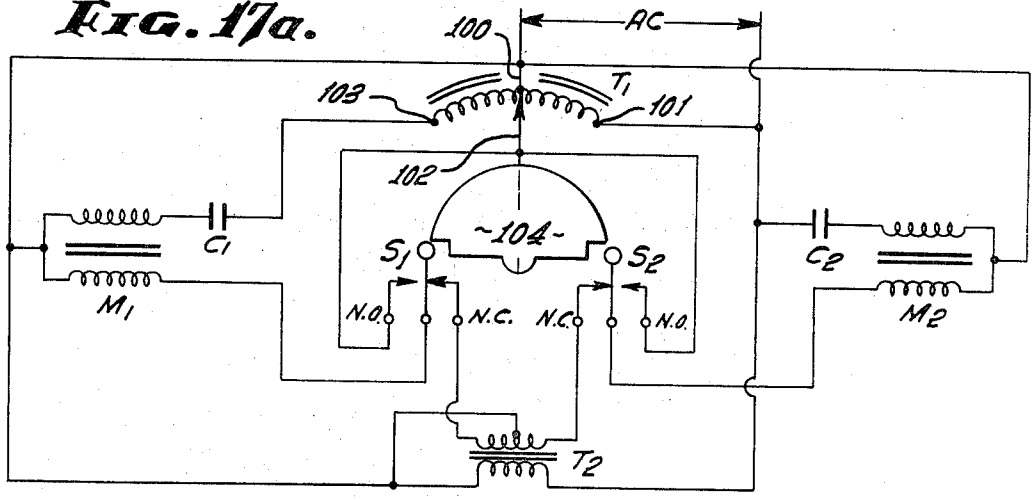


FIG. 17b.

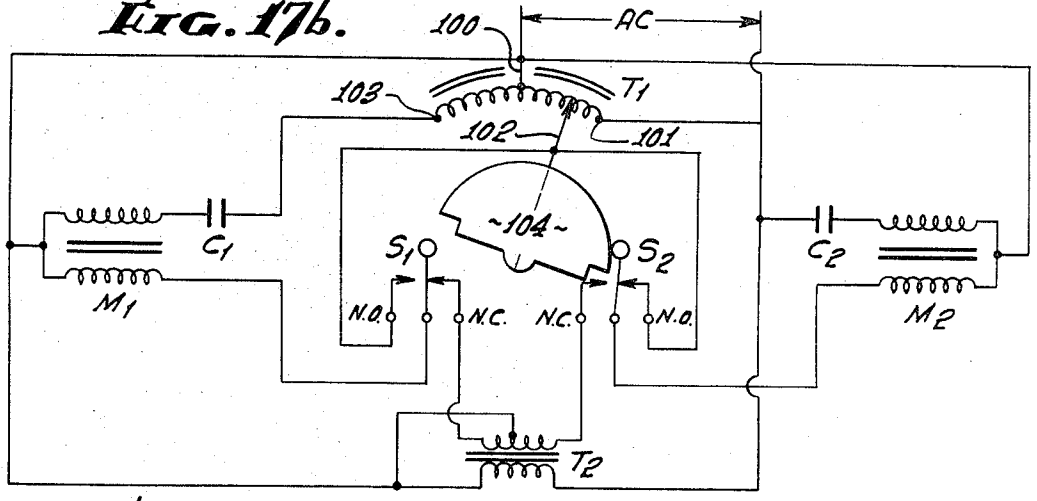
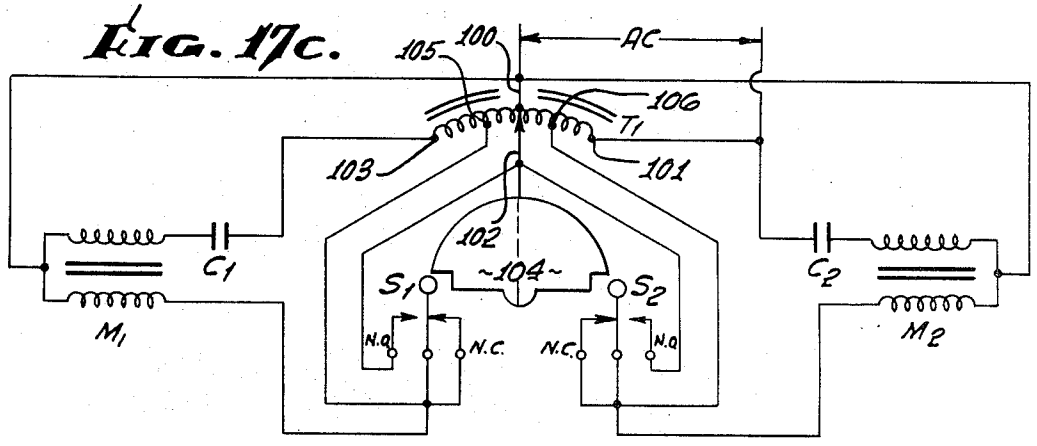


FIG. 17c.



INVENTORS.
WILTON A. STEWART
YING-NIEN YU
By White & Haefliger
ATTORNEYS.

LIGHT TABLE WITH MULTIPLE AXIS TILTING, AND TENSION CONTROL OF TRAVELING ILLUMINATED MEDIA

BACKGROUND OF THE INVENTION

This invention relates generally to light tables or boxes, and, more particularly concerns a highly versatile light table embodying a number of unusual advantages having to do with table tilting in multiple modes, and film or sheet drive control.

In the past, light tables have lacked certain important advantages which characterize the present invention. Among them are capability for adjustable tilting of the light table in multiple modes and to extreme angularity with respect to horizontal; film transport means which provides for rapid reversal of film travel at any speed and eliminates loss of tension during such reversal; and a high degree of simplicity and compactness of overall construction of the table; and the combination of hand operation and motor operation within one system which eliminates the need of dual systems existent in the conventional light table film transport.

SUMMARY OF THE INVENTION

It is a major object of the invention to provide a light table embodying combinations and sub-combinations of advantages as referred to above, whereby problems with prior tables are effectively eliminated. Basically and as respects the table tilt feature of the invention, an assembly is provided which comprises: a table having a top plate which is translucent to pass light therethrough for illuminating the underside of media overlying the plate; a first hinging support for the table defining a first axis about which the table may be adjustably tilted; a second hinging support for the table defining a second axis about which the table may be adjustably tilted; and control means operatively connected with the table to control tilting thereof about each of the axes independently of tilting about the other of the axes. Typically, the table may be sufficiently free of the second support when supported by the first support and tilted about the first axis that tilting of the table about the second axis is prevented, and vice versa. Further, an adjustable connection may be provided to cooperate with one of the supports to selectively control pivoting of the table about the two axes. As a result, the table may be selectively tilted in either of two modes, as for example endwise and frontward, by operation of a single actuator as will be seen.

In this regard, the actuator structure may, with unusual advantage, include a rotatable lead screw and an arm, one end of which is movable lengthwise of the screw in response to screw rotation, and the other end of the arm may extend proximate the underside of the table in supporting relation therewith throughout tilting of the table in both modes in response to lead screw rotation. Further, releasable means may be provided to be operable to selectively connect the table to either of the supports for controlling selective tilting of the table about the two axes, as will be described. Finally, means may typically be carried by the table to effect controllable travel of a sheet or film across the translucent plate, in either of the tilt modes.

As respects film or sheet transport, the invention typically embodies a pair of spools spaced apart relative to the translucent plate for winding and unwinding the sheet, thereby to displace it endwise over the plate; a pair of electrical motors each connected in driving relation with one of the spools, and control means operable in one mode to effect motor current supply to cause one motor to rotate one spool in sheet winding sense and the other motor to retard rotation of the other spool in sheet unwinding sense, and in another mode to effect motor current supply to cause the other motor to rotate the other spool in sheet winding sense and the other to retard rotation of the one spool in sheet unwinding sense. As a result sheet tension is maintained during transport. In this regard, the spools may typically be releasably mounted to the table to rotate about spool axes, and the table and mounted spools may be tiltable as a unit, as referred to above.

Additional features include provision for mounting the spools for adjustment shifting parallel to the spool axes so that the motors may be coupled to spools of different lengths; and the provision of control means that includes a variac or equivalent, a transformer, switches through which different transformer windings may be coupled to the motors, a manual control to operate the variac, and a cam operated by the manual control to selectively operate the switches, with advantages as will appear.

These and other objects and advantages of the invention, as well as the details of an illustrative embodiment will be made clear from the following detailed specification and drawings in which:

DRAWING DESCRIPTION

FIG. 1 is a perspective showing of one form of the invention;

FIG. 2 is an enlarged front elevation taken in section to show how endwise table tilt may be effected;

FIG. 3 is a top plan view, partly in section, taken on line 3—3 of FIG. 2;

FIG. 4 is an end elevation taken on line 4—4 of FIG. 3;

FIG. 5 is an end elevation like FIG. 4, but showing adjustment shifting of a motor drive for one of the sheet or film spools;

FIG. 6 is a section taken on lines 6—6 of FIG. 3;

FIG. 7 is a section taken on lines 7—7 of FIG. 3;

FIG. 8 is an enlarged section taken on line 8—8 of FIG. 2 to show one table pivot support;

FIG. 9 is a view like FIG. 8, but showing the table rotated about an axis through the pivot support;

FIG. 10 is a view of the FIG. 8 pivot support with the table displaced upwardly relative to the support during table pivoting about another axis;

FIG. 11 is a section taken on line 11—11 of FIG. 8;

FIG. 12 is a section taken on line 12—12 of FIG. 3;

FIG. 13 is a section taken on line 13—13 of FIG. 3;

FIG. 14 is a fragmentary section taken on line 14—14 of FIG. 3;

FIG. 15 is a fragmentary section taken on line 15—15 of FIG. 3;

FIG. 16 is an enlarged fragmentary section taken on line 16—16 of FIG. 5; and

FIGS. 17*a*–17*c* are wiring diagrams showing electrical motor control.

DESCRIPTION OF PREFERRED EMBODIMENT

In the drawings a light box or table **10** is carried by first and second hinging supports **11** and **12** on a mounting cabinet **13**. In this regard, the table typically contains a light source and has a top plate **14** which is longitudinally elongated and translucent to pass light upwardly for illuminating the underside of media overlying the plate. Such media may comprise a film or sheet **15** adapted to be drawn longitudinally over the plate.

In the example shown, the table also includes top, bottom and upright side and end panels **16**, **17**, **18** and **19**, with flanges **20** and **21** projecting downwardly from the bottom panel for table supporting engagement with the hinging support **11**, as seen in FIG. **12**. Further, a flange **22** projects downwardly from the bottom panel **17** for table supporting engagement with the hinging support **12**.

Support **11** may typically and advantageously comprise a lateral tube **23** defining a first axis **24**, whereas support **12** may typically and advantageously comprise a longitudinal rod **25** defining a second axis **26** which is generally normal to axis **24**. Rod **25** is shown as attached to and carried by the cabinet **13** at structure locations **27** and **28**; whereas tube **23** is carried at one end by L-shaped bracket **29** so as to pivot about axis **26** when the table is subjected to forward tilting, i.e., from the table position (flat) represented in FIG. **7** to the table position (tilted) represented in broken lines **10***a* in FIG. **6**. L-shaped bracket **29** has one arm **29***a* attached to one end of tube **23**, and another arm **29***b* pivotally carried by the end of rod **25** projecting beyond cabinet structure **28**, as best seen in FIG. **3**.

Accordingly, the table **10** may be tilted frontwardly, as described, or alternatively about lateral axis **24** as represented by the table tilted position indicated by broken lines **10***c* in FIG. **2**. In the latter mode, the flange **22** is elevated relative to the rod **25**, as for example is represented in FIG. **10**. Note that the flange carries a C-shaped section **30** of a bearing sized to seat downwardly on and rotate relatively about the rod **25** to accommodate forward tilting of the table, as is clear from FIGS. **8** and **9**. Under these circumstances, the table is rotated about the second axis defined by rod **26**, and the tube **23** is rotated with the table. On the other hand, when the table is tilted about axis **24** as indicated at **10***c* in FIG. **2**, the table is free of the second support **12** including rod **25** so that pivoting about the latter is prevented until such time as the table is returned to horizontal position so that section **30** may engage rod **25**.

It is an important feature of the invention that an adjustable connection is provided to cooperate with one of the two hinging supports to selectively control pivoting of the table about the two axes **24** and **26**, with the result that the tilt mode of the table may be very simply controlled. One such adjustable connection is shown in FIGS. **3** and **12** to include a latch plunger **34** controlled by a knob **35**, and having a terminal **34***a* adapted to penetrate a keeper opening **36**. A compression spring **37** within tube **23** urges the plunger flange **38** to the right in FIG. **12**, maintaining penetration of the plunger terminal **34***a* into the keeper opening, which is defined by structure **39** integral with the cabinet. In this condition, the rod **34** is coaxial with the tube **23** and axis **24** is maintained to extend laterally and horizontally so that the table may be pivoted as at **10***c* in FIG. **2**, the flanges **20** and **21** pivoting about the tube **23** (which extends through flange bores **20***a* and **21***a*).

When it is desired to pivot the table about longitudinal axis **26**, the plunger knob **35** is retracted to the left, to position **35***a* in FIG. **12**, whereby the terminal **34***a* is released from the opening. If desired, the plunger may be held in retracted position by a suitable detent. During each forward pivoting, the tube **23** rotates or tilts with the table due to its connection therewith as via flanges **20** and **21**.

The above described adjustable connection may be considered as one aspect of a control means operatively connected with the table to control tilting thereof about each of the axes **24** and **26**. Another aspect of such control means includes actuator structure movable to effect table tilting about such axes, and a single manual control for effecting movement of the actuator structure.

As one example of such actuator structure, FIGS. **2** and three illustrate the provision of a rotatable lead screw **40**, and an arm **41** one end of which is movable lengthwise of the screw in response to screw rotation, and the other end of which extends proximate the underside of the table in supporting relation therewith throughout tilting of the table about axes **24** and **26**. In this regard, the lead screw may be bearing supported at **42** and **43**; a manual control shaft **44** may be rotatable by handle **45** and disc **46** to cause helical gear **47** on shaft **44** to rotate the lead screw as by rotating gear **48** on the screw; and a follower **49** on the screw may be advanced and retracted along the screw to advance and retract the lower end of the actuator arm **41**. The upper end of the arm has ball joint connection at **49***a* to the lower panel **17** of the table. These components, and especially the arm **41**, may advantageously be so located that when the plunger **34** is latched in FIG. **12** position, turning of the screw **40** by the handle **45** will necessarily result in table pivoting in the mode seen at **10***c* in FIG. **2**; whereas, when the plunger **34** is released from FIG. **12** latched condition, turning of screw **40** by handle **45** will necessarily result in table pivoting in the mode seen at **10***a* in FIG. **6**. As a result, only one manual control is needed to effect table pivoting in two different modes, as for example up to 75° from horizontal in each mode.

A further important aspect of the invention concerns the provision for transport of media such as a sheet or film back and forth over the illumination plate on the tiltable table in its various tilt modes and without loss of sheet tension. In this regard, two spools **50** and **51** are provided to wind and unwind the sheet **15**, thereby to displace it endwise over the plate **14**. The spools are mounted to the table at opposite ends thereof, for rotation about axes **52** and **53**. Spool end flanges such as are indicated at **54** and **55** confine the wound sheet there between, the flanges being carried by drums **56** defining end openings **57** to receive penetration of support shafts **58** seen in FIG. **14**. The latter shafts, which are keyed to the spools at **59**, turn in support bearings **60** and **61** which are carried by tube and plate structures **62** and **63**, the latter being attached to the table **10** as is clear from FIGS. **1** and **3**. Manually rotatable knobs **64** are integral with the shafts **58** so that the

spools may be slowly turned, manually, to slowly displace a sheet or film over the plate **14**, when the drive motors are not energized.

The opposite ends of the spools are coupled to drive structure including electrical motors **66**, such drive structure including motor shafts connected to drive pulleys **67**, V-belts **68**, driven pulleys **88**, and driven shafts **69** releasably connected to the spools. These drive elements are mounted to carriages **70**, each including a pair of plates **70*a*** and **70*b***. Each carriage is in turn slidably mounted by sleeves **71** and **72** on parallel bars **73** and **74** which extend laterally between front plate **63** and rear plate **75** affixed to the table. Accordingly, each carriage may be adjustably shifted lengthwise of bars **73** and **74** to connect the drive structure to a particular spool inserted into position onto a support shaft. Also, spools of different length, corresponding to different sheet or film widths, may thereby be accommodated. Note the provision, in FIGS. **5** and **16**, of a set screw **76** threaded into sleeve **71** to engage bar **73**, and having a knob **77**, which may be tightened to clamp the carriage to the bar when the drive is coupled to the spool. It is clear from FIG. **4** that the entire drive structure as described is adapted to pivot with the light table.

FIGS. **1**, **3** and **13** show the provision of sheet guide rollers **80** and **81** proximate each spool. Such upper and lower rollers guide the sheet **15** onto the table as it unwinds off a spool proximate one end of the table, and guide the sheet as it leaves the opposite end of the table and winds onto the spool proximate that end. The rollers are carried by shafts **82** and **83**, which are supported by plates **63** and **75**, previously referred to. Upper shafts **82** are hinged at **84**, so as to be pivotable upwardly as seen in FIG. **13**, allowing insertion or withdrawal of the sheet **15** in the spool **86** between the guide rollers. Pivoted clips **87** seen in FIG. **1** retain the projecting ends of the upper shafts in lowered position during sheet transport between the spools.

FIGS. **17*a***, **17*b*** and **17*c*** show the wiring diagram providing electrical motor control. AC Power is connected to the center terminal **100** and one end terminal **101**, of the variable output voltage transformer T_1. The output voltage varies from zero when terminal **102** is coincident with terminal **100** to full AC Power line voltage when terminal **102** is coincident with terminal **101** or to negative full AC Power line voltage when terminal **102** is coincident with terminal **103**. The output voltage on terminal **102** of T_1 is connected to the normally open, N. O. terminals of both switches S_2 and S_3.

Transformer T_2 provides a motor current supply to motors M_1 and/or M_2 to retard rotation of the respective spools in a sheet winding sense when switch S_1 and/or switch S_2 are not actuated by the cam **104**. For convenience and to provide a single control, the cam and terminal **102** of T_1 are mounted so as to move together. The output voltage on terminal **102** of T_1 is applied to a winding of motor M_1 through switch S_1 when the cam is rotated to actuate switch S_1.

Alternatively, the output voltage on terminal **102** of T_1 is applied to a winding of motor M_2 through switch S_2 when the cam is rotated to actuate switch S_2.

When both switches S_1 and S_2 are *not* actuated by the cam, as in FIG. **17*a***, the retarding torques of motors M_1 and M_2 are equal and opposite, and the media (sheet or film) is stationary under tension and not transported in either direction.

When the cam is manually or otherwise rotated to actuate switch S_2 but not switch S_1, and the terminal **102** on transformer T_1 is manually or otherwise positioned between terminals **100** and **101** to provide a desired output voltage as in FIG. **17*b***, current is supplied to motor M_2 and AC Power through switch S2 to rotate one spool in a sheet winding sense. At the same time, current is supplied to motor M_1 from transformer T_2 through switch S_1 to retard rotation of the other spool in a sheet unwinding sense. Thus said sheet is wound onto the spool driven by motor M_2 and tension is maintained in the sheet by retardation of the other spool by motor M_1.

Alternatively, the sheet may be wound onto the spool driven by motor M_1 by rotating the cam to actuate switch S1 and positioning terminal **102** of transformer T_1 between terminals **103** and **101** of transformer T_1. At the same time, current is supplied to motor M_2 from transformer T_2 through switch S_2 to retard rotation of the spool driven by motor M_2. Thus said sheet is wound onto the spool driven by motor M_1 and tension is maintained in the sheet by retardation of the other spool by motor M_2.

The speed and the direction of winding the sheet onto one or the other spool is controlled by adjusting the location of terminal **102** between terminals **103** and **101** on transformer T_1, and selection of the appropriate spool for retardation is controlled by the cam actuating switches S_1 and S_2. Thus smooth and continuous control of the sheet winding speed is obtained from full speed in one direction to zero to full speed in the other direction while continually maintaining retardation tension on the sheet to prevent inertial effects in slowing down to throw slack in the film.

The arrangement of the electrical connections to transformer T_1 produce an important circuit simplification. AC electrical power is connected to terminals **100** and **101** and is also applied, through phasing capacitor C_2, to one winding to motor M_2. Power of the opposite phase is generated across terminals **103** and **100** of transformer T_1 which, when applied to one winding of motor M_1 will produce a rotation of the armature of motor M_1 in a direction opposite to that of motor M_2. Thus a transformer with a single center-tapped winding can be used to produce opposite rotations of two motors.

A further simplification of the electrical circuit is shown in FIG. **17*c*** to eliminate transformer T_2 by connecting the second winding of motor M_1 to a fixed tap, **105**, on transformer T_1 between terminals **103** and **100** and by connecting the second winding of motor M_2 to a fixed tap, **106**, on transformer T_1 between terminals **100** and **101**.

We claim:

1. In a light table assembly, the combination comprising

a. a table having a top plate which is translucent to pass light therethrough to illuminate the underside of a sheet overlying the plate,

b. a pair of spools spaced apart relative to the plate for winding and unwinding a sheet thereby to displace the sheet endwise of and over the plate,

c. a pair of electrical motors and drive means connecting each motor in driving relation with one of said spools, therebeing structure carrying the drive means at opposite ends of the table for relative shifting into and out of driving relation with the spools, and

d. control means operable in one mode to effect motor current supply to cause one motor to rotate one spool in sheet winding sense and the other motor to retard rotation of the other spool in sheet unwinding sense, and in another mode to effect motor current supply to cause said other motor to rotate said other spool in sheet winding sense and said one motor to retard rotation of said one spool in sheet unwinding sense.

2. The combination of claim **1** including support means releasably mounting said spools to said table for rotation about spool axes, the table and spools being tiltable as a unit.

3. The combination of claim **2** wherein the motors are shiftable with the drive means on said structure and parallel to said spool axes whereby the motors may be coupled to spools of different lengths.

4. The combination of claim **1** wherein said control means includes a variac, a transformer, switches through which different transformer windings may be coupled to the motors a manual control to operate the variac, and a cam operated by said manual control to selectively operate said switches.

5. The combination of claim **3** including manually rotatable control knobs coupled to said spools for transmitting rotary drive to the spools independently of said motors.

* * * * *