# United States Patent [19]

**Giani**

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[54] **ADJUSTABLE ROTARY SCREEN SUPPORT WITH TELESCOPING DRIVE**


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**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 218,749, Jan. 18, 1972, abandoned.

[30] **Foreign Application Priority Data**

Jan. 21, 1971 Italy ..... 1951/71

[52] **U.S. Cl.** ..... **101/116;** 101/115; 101/127.1

[51] **Int. Cl.** .... **B41l 13/16;** B41f 15/10; B41f 15/38

[58] **Field of Search** ..... 101/116, 115, 127.1, 128.1, 101/129, 152



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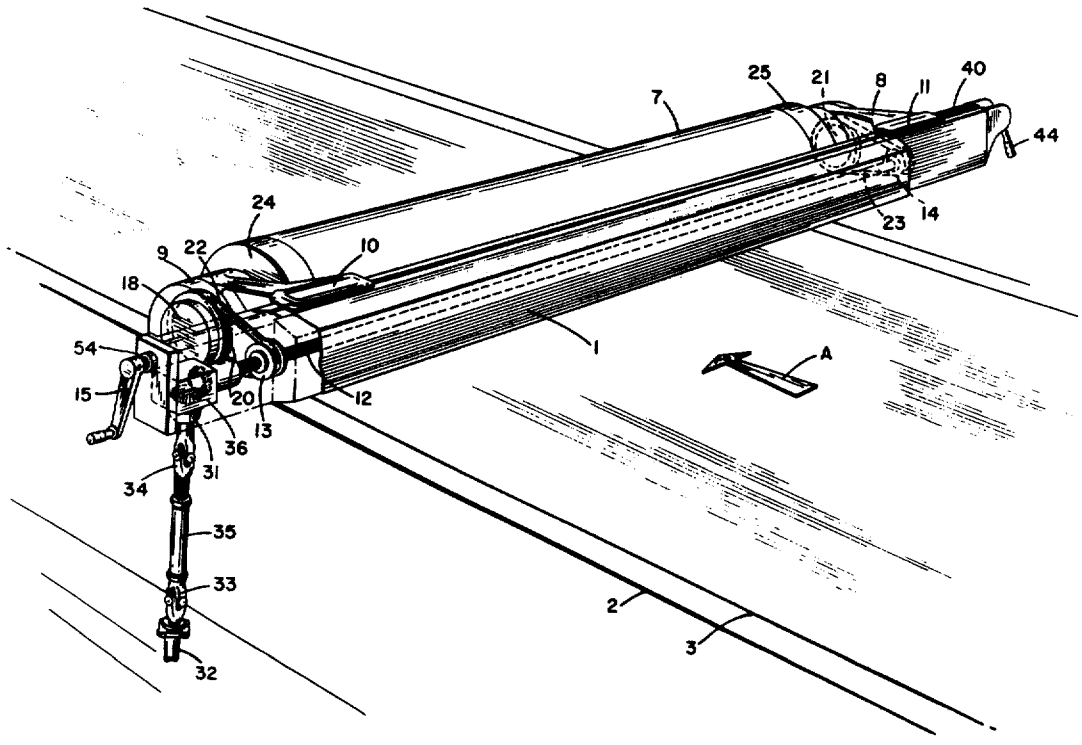
[57] **ABSTRACT**

Apparatus for supporting and driving cylindrical printing screens, in which a screen is supported in ball joint sockets contained in respective screen supporting heads, one of which is adjustably mounted on a cross member; the latter in turn is hinged to the printing machine frame by two end supports which permit pivotal movement of the cross member. A horizontal shaft running parallel to the cross member is provided on which are adjustably mounted two pinion gears which cooperate with sprockets mounted on each end of the screen, the pinion gears and sprockets being coupled by respective transmission belts and the shaft itself being driven by a transmission means which includes a double universal joint interconnected by a telescoping shaft, one joint being connected to the shaft through a bevel gear arrangement and the other joint being coupled to a source of motive power.


**10 Claims, 5 Drawing Figures**



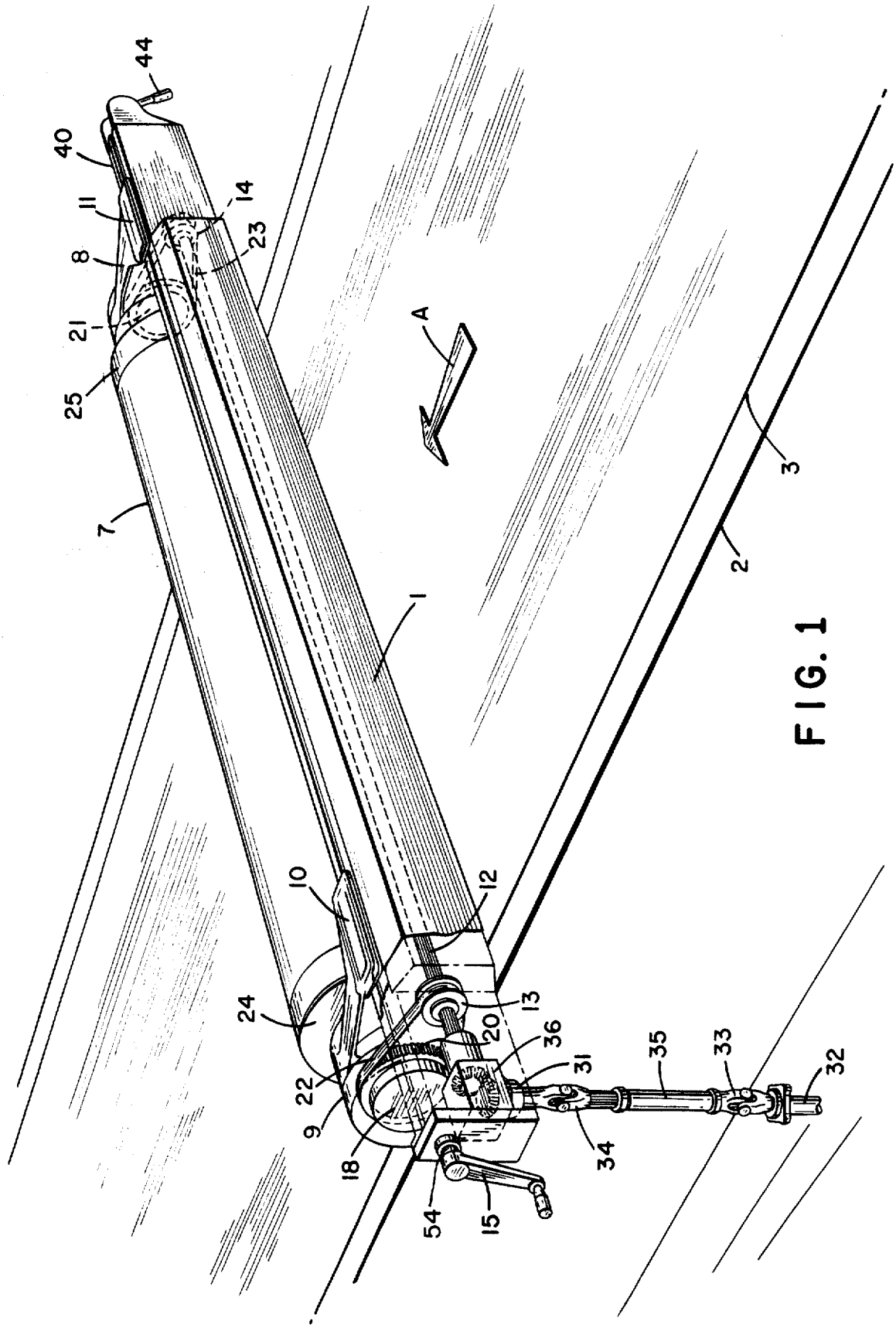

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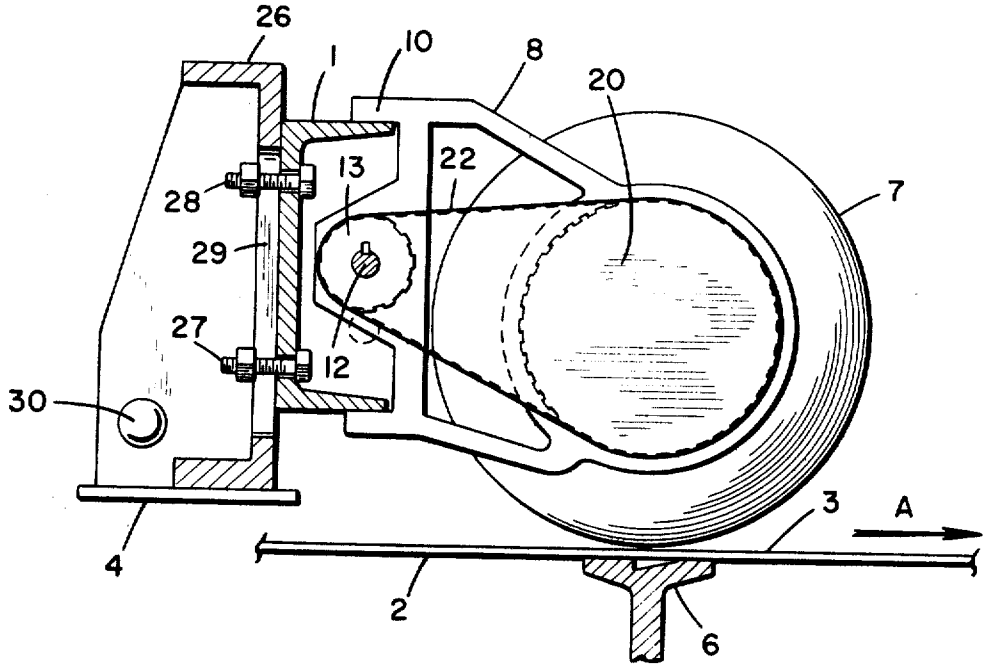
FIG. 1

FIG. 2



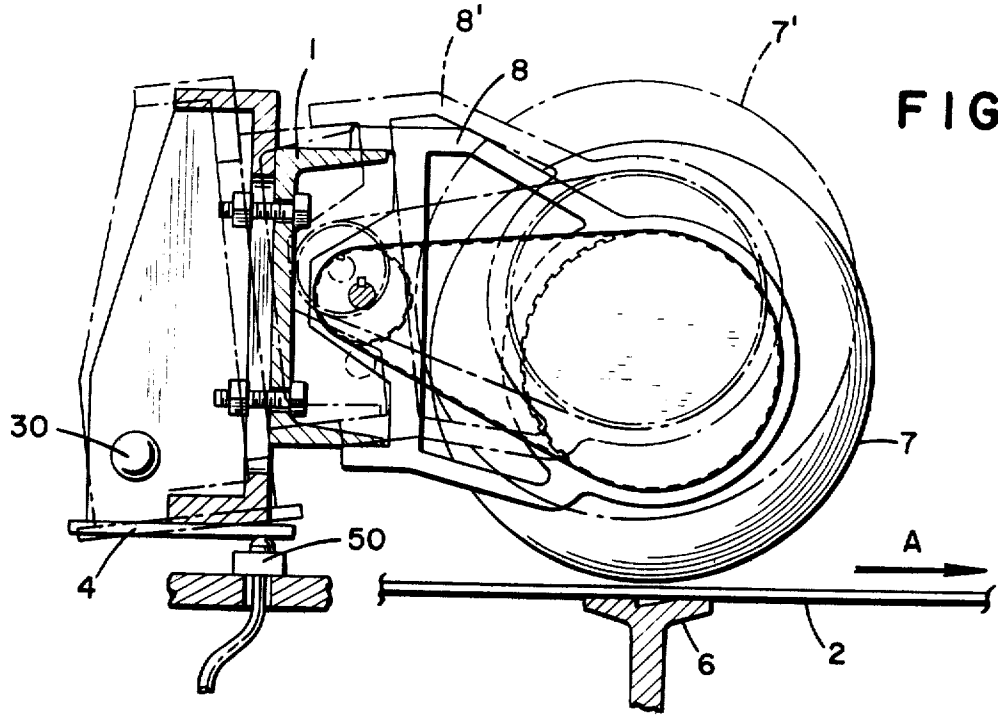




FIG. 2A

FIG. 3

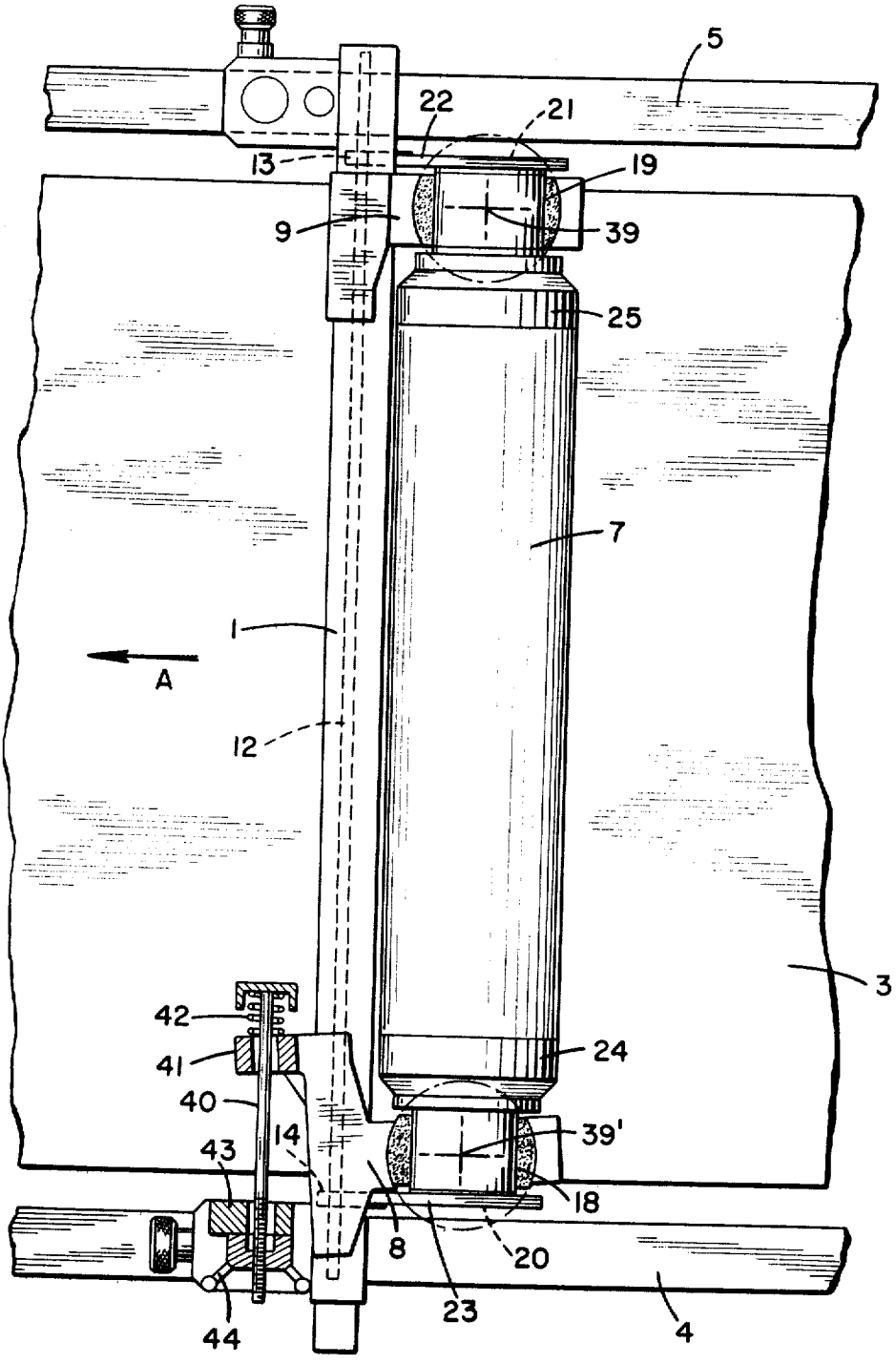
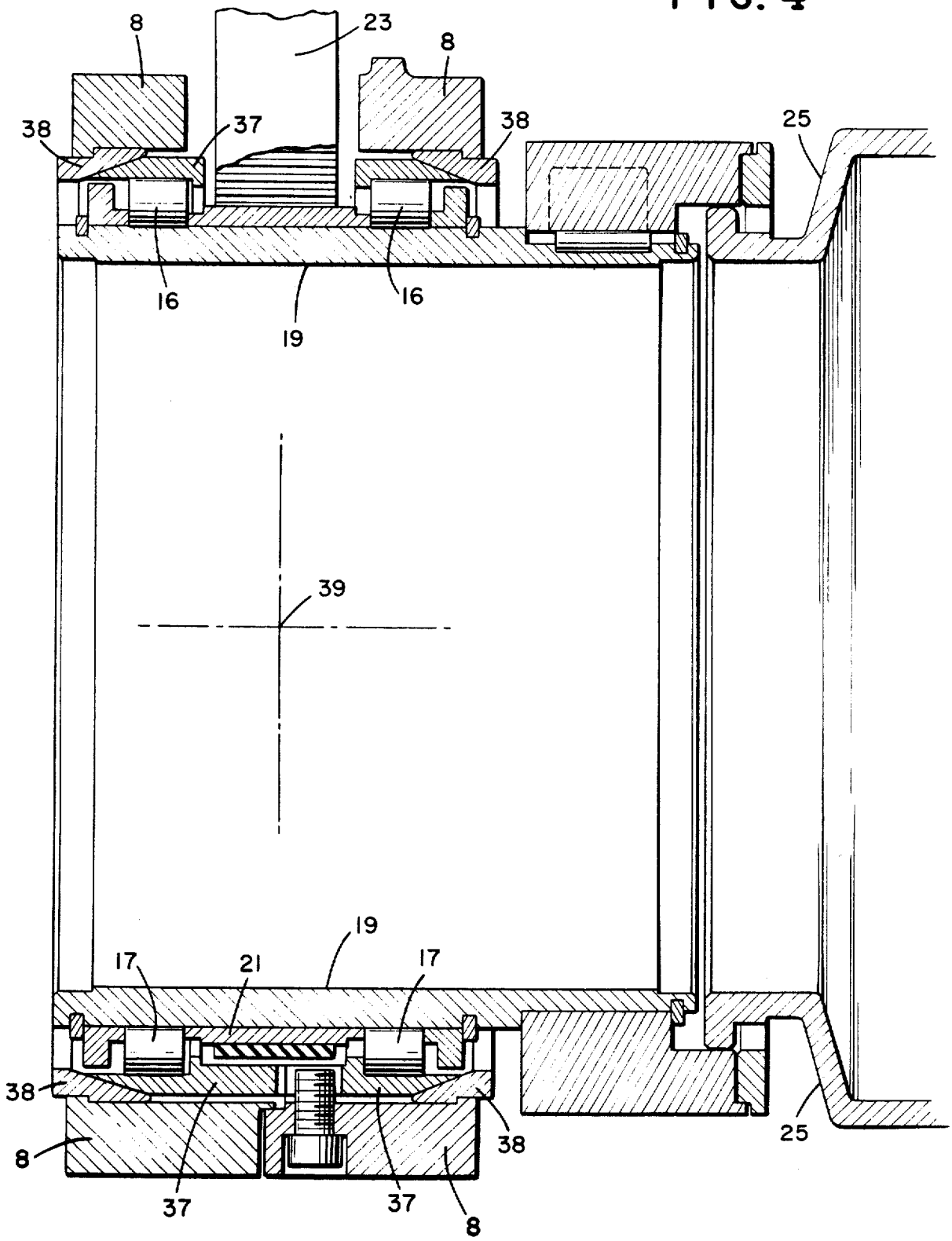


FIG. 4



# ADJUSTABLE ROTARY SCREEN SUPPORT WITH TELESCOPING DRIVE

## CROSS-REFERENCE TO RELATED APPLICATIONS

This application is related to Ser. No. **396,601** which is a continuation-in-part of Ser. No. **154,762** filed June **21, 1971** and now abandoned.

This is a continuation-in-part of copending application Ser. No. **218,749**, filed Jan. **18, 1972**, and now abandoned.

The present invention relates to an apparatus for supporting and driving the rotary cylindrical screens of a printing machine for fabrics and in general for ribbon-like materials.

As is known, in the rotary screen printing machines for fabrics in general and ribbon-like materials in particular, the ribbon to be printed is carried by an endless carrying belt over a printing table, and the printing screens consist of perforated cylindrical screens through which the dye flows.

Quite frequently, due for instance to the diversity of the patterns to be printed onto the fabrics or ribbons, it will be necessary to change the printing screens by replacing them with others of a different diameter and-/or of a different length.

In order to ensure a good printing quality it is necessary when changing the cylindrical screens that their inferior or printing zone, i.e., the zone in contact with the fabric to be printed, always maintain a constant position with respect to the printing table.

In conventional printing machines, in order to allow the change of the screens, in general, use must also be made of the change of driving gears and of the relevant screen holder heads. By similar technical solutions and by using screen holder heads, horizontally shiftable along the machine frame, and using likewise movable printing tables, it has also been attempted to solve the problem of maintaining constant the position of the rotary screen printing zones in contact with the fabrics to be printed with respect to the printing table itself.

However, the already known printing machines do not solve in a satisfactory way the technical problems indicated above. Thus, for instance, they are too bulky, delicate and complex to operate and do not allow the use of screens that vary in diameter at will within a certain range, and so forth.

A further drawback to be found in conventional printing machines is the misalignment of the screen ends, a misalignment that causes torsional strains which result in rapid wearing or breakage of the screens themselves and a drop in printing quality.

Thus, an object of this invention is to provide a supporting and driving apparatus for the cylindrical screens of printing machines that will allow, by means of simple operation, replacement of the rotary screens, and that will permit, under all conditions, the best relative position of the printing screens with respect to the other devices of the printing machine.

A further object of this invention is to provide an apparatus for driving screens having varying diameters within a certain range without the need of changing any driving gear.

Still another object of this invention is to provide an apparatus in which the screen supporting devices are such as to ensure, under all conditions, a perfect and automatic alignment of the screen ends.



A still further object is to provide an apparatus that will ensure s smooth drive without clearances, and which will require only little maintenance.

All these objects, and others which will be evidenced by the detailed description that follows, are practically achieved by a new and improved supporting and driving apparatus for the cylindrical screens of a printing machine in which the material to be printed is carried by an endless belt over a printing table. The apparatus of this invention includes a cross member mounted on a frame and supporting two cylindrical screen supporting heads, one of which is adjustably mounted on the cross member, and transmission means for rotatably driving the opposite ends of a cylindrical screen extending substantially parallel to the cross member. This apparatus further comprises: end support means, rotatably hinged to the frame, for rotatably supporting the ends of the cross member, and provided with means to permit the slidable displacement of the cross member in a vertical direction; ball joint supporting means, recessed in the supporting heads for carrying and maintaining the opposite ends of the cylindrical screen in a self-alignment during rotation; a horizontal transmission shaft, supported by the cross member, on which two pinion gears are mounted, the pinion gears being coupled for rotation through respective transmission belts with two sprockets mounted one at each end of the cylindrical screen; a transmission means, for driving the horizontal transmission shaft, including a double universal joint interconnected by a telescopic shaft; and a tensioning device for the cylindrical screen interposed between the stationary supporting head and the frame.

The invention will now be described in more detail, according to a preferred but not exclusive practical embodiment, with reference to the attached drawings, wherein equivalent parts are indicated by the same reference numbers:

FIG. **1** represents a partial perspective view of a supporting and driving apparatus according to this invention;

FIG. **2** shows a transverse cross section of the apparatus in FIG. **1**;

FIG. **2A** shows a mechanism for lifting the screen support apparatus;

FIG. **3** represents a partially cross sectioned plan view of some details appearing in a machine provided with devices for the self-aligning of screen ends and with a tensioning device for the same screen; and

FIG. **4** is a sectional view of a supporting head, showing the ball joint bearing means for supporting and rotating the screen ends in self-alignment condition.

Referring to these figures and particularly to FIGS. **1** and **2**, all the elements constituting the supporting and driving apparatus of the present invention are carried by a cross member **1** transversely applied to a printing machine of the type having an endless carrying belt **2** on which fabric **3** to be printed is attached. The two ends of cross member **1** are supported by two opposite longitudinal side frames **4** and **5** (FIG. **3**) of the machine, as more clearly explained hereinafter. Endless belt **2** slides, in the sense shown by arrow A, on a counterpressure table **6** (see FIG. **2**), not relevant to the purposes of this invention. The known cylindrical screen **7** is supported, in way enabling it to rotate in contact with endless belt **2**, by two supporting heads **8** and **9** which are coupled, through linking slides **10** and

11, with cross member 1; head 8 is mounted in a stationary manner while head 9 is slidably assembled for extended displacement on cross member 1 to allow the use of cylindrical screens having different lengths.

A splined shaft 12 is placed parallel to cross member 1 and rotatably supported at its ends as well as at some central zone by the same cross member 1. Two pinion gears 13 and 14 are provided on shaft 12 and pinion gear 14 is slidable on the same shaft 12 to allow its adaptation to the various cylindrical screen lengths and, more particularly, to follow the axial displacements of supporting head 9.

This latter head 9 is axially displaceable along the cross member 1 by means of a threaded spindle 54 positioned parallel to cross member 1 and splined shaft 12 working with a stationary nut screw (FIG. 1); by rotating the threaded spindle 54 with the crank 15 (FIG. 1) it is possible to displace the supporting head 9 in order to accommodate cylindrical screens of different lengths.

Sleeves 18 and 19, on which two sprockets 20 and 21 are keyed, rest rotatably on rollers 16 and 17 (FIG. 4), the whole being housed inside supporting heads 8 and 9. Two cog belts 22 and 23 transmit rotary motion from pinion gears 13 and 14 to sprockets 20 and 21 and consequently, to both sleeves 18 and 19. Since each sleeve is coupled by known means with an end flange 24 or 25 of the cylindrical screen, the rotation of splined shaft 12 causes the cylindrical screen to rotate.

As already stated, cross member 1 is supported by the two longitudinal side frames 4 and 5 of the machine. According to a very important feature, both ends of cross member 1 are constrained at two end supports 26 (only one of which is clearly shown in FIG. 2). The cross member 1 is connected with the end supports 26 (FIG. 2) by means of two pairs of screwbolts 27 and 28 passing through slots 29. This type of connection permits extensive manual adjustment of the cross member 1 in the vertical direction to allow the use of cylindrical screens having varying diameters.

End supports 26 are rotatably mounted on horizontal axle 30, supported by the two opposite longitudinal side frames of the machine; supports 26, after the printing operation is stopped, are rotated about the longitudinal axis of axle 30 by means of known pneumatic means acting at the bottom of the supports themselves; in this manner the supporting heads 8 and 9 together with the cylindrical screen are lifted and removed from the endless carrying belt 2.

One example of such pneumatic lifting means is shown in FIG. 2A, wherein primed reference numerals indicate the corresponding elements in the lifted position (which elements are shown in broken lines). Basically a piston member of pump 50 acts on frame member 4 to rotate the frame (and thus cross member 1, etc.) about axle 30.

Therefore, the cross member and the cylindrical screen supporting heads benefit by two large combined shiftings: a vertical lift shift and a rotational tilt (together with supports 26) around axle 30. These possibilities of lift shift and tilt (which are impossible to achieve with the printing machines of the known prior art), available to the cross member and to the cylindrical screen supporting heads, permit changing and using cylindrical screens having substantially different diameters while keeping the contact zone of the cylindrical screen and printing table always in the same respectively correct position; this results in clearly practical advantages as to the setting up (adjustment) of various screens on the printing machine.

The rotary operating motion is transmitted to splined shaft 12 (and consequently to the cylindrical screen) through a telescopic shaft driven by the main machine motor or by an auxiliary motor, unimportant with regard to the object of this invention.

The transmission consists (FIG. 1) of two end shafts 31 and 32, connected to each other through a telescopic shaft 35 and two universal joints 33 and 34. A bevel gear box 36 allows the transmission of the rotary motion from the substantially vertical telescopic shaft to the horizontal splined shaft 12.

The use of telescopic shaft 35 ensures that the portion of the bevel gear 36 connected to shaft 31 will remain in engagement with the portion of the bevel gear connected to shaft 12. Therefore shaft 12 will operate even when cross member 1 is lifted to its maximum height and supports 26 are tilted to this maximum angular displacement (which occurs when large diameter cylindrical screens are used).

The apparatus of the present invention further includes means to automatically align the cylindrical screen flanges 24 and 25 through which the cylindrical screen is supplied with rotary motion. This aspect of the invention substantially eliminates the torsional strains which are found in conventional printing machines and which arise from the misalignment of opposite flanges 25 and 24 due to clearances and deformations which produce unwanted displacements of the parts (sleeves 18 and 19) bearing said flanges.

As shown by FIG. 4, the means for self-aligning the flanges includes ball joints enclosed in supporting heads 8, 9 and consisting of rollers 16, 17 interplaced between each sleeve (18 and 19) and a spherically-shaped cradle 37 which can swing within a spherically-shaped seat 38, all of which makes a single unit with the corresponding supporting heads. Sprockets 20 and 21, shrunk-fit on rotatable sleeves 18 and 19, are preferably placed between the axially inner and outer rollers of the pairs of rollers 16 and 17.

As shown in schematic FIGS. 3 and 4, sleeves 18 and 19, as well as the associated flanges, can rotate both in the cylindrical printing screen sense (working motion) as well as around points 39 and 39' (FIGS. 3 and 4), which are the centers of the ideal spheres enclosing the joints.

In particular, from FIG. 3 it can be seen that the transverse axes of symmetry of the supporting head and relevant sleeve need not necessarily parallel each other, although opposite flanges remain aligned.

The elasticity of the cog belts is such as to absorb and take up the non-coplanarity between the pinion gear plane and the plane of the corresponding sprocket.

Finally, the essential axial tensioning of the cylindrical screen is obtained by applying a tension to the stationary head which supports the cylindrical screen. This is accomplished by means of tie rod 40 which passes through ear 41, laterally projecting from the stationary head; a spring 42 is interposed between this ear and a stop cap; the end of the tie rod opposite to the stop cap is locked against projection 43 protruding from the longitudinal side frame by means of a manually operated hand wheel 44 or cam lever.

The misalignment suffered by the stationary head 8 (FIG. 3) in consequence of the tensioning does not in-

fluence the opposite flanges **24** and **25**, owing to the presence of the above-described ball joints.

Of course, the hereinabove described apparatus may undergo functional or structural changes of equivalent character without thereby falling outside the scope of this invention.

What is claimed is:

**1.** Apparatus for supporting and driving cylindrical screens of a printing machine for fabrics and ribbon-like materials, in which the material to be printed is carried by an endless belt over a printing table, comprising:

a frame;

a cross member mounted on said frame;

a pair of printing screen support heads mounted on said cross member for supporting a cylindrical printing screen mounted therebetween, the longitudinal axis of the screen extending substantially parallel to the cross member;

means adjustably mounting one of said heads for axial movement along said cross member toward and away from the other head which is held stationary with respect to the axial movement of said adjustably mounted head;

end support means, rotatably hinged to the frame, for supporting the ends of said cross member, said support means being provided with means to permit slidably displacing said cross member in a direction substantially normal to the plane of said belt;

ball joint supporting means, recessed in said supporting heads, for supporting and aligning the opposite ends of said printing screen during rotation thereof;

first transmission means for rotatably driving said printing screen, including a horizontal shaft supported by the cross member, two pinion gears mounted on said shaft, and two sprockets mounted one on each end of said screen, said pinion gears and sprockets being coupled for rotation through respective transmission belts;

second transmission means for driving said first transmission means, and including a double universal joint interconnected by a telescopic shaft, one joint being coupled to said first transmission means and the other to a source of motive power; and

tensioning means coupled between the stationary supporting head and said frame for applying tension to said printing screen.

**2.** Apparatus according to claim **1**, wherein said means to permit slidably displacing the cross member comprises vertical slots formed in said end support means and screwbolts connecting said cross member to said end supports and slidably displaceable in said vertical slots.

**3.** Apparatus according to claim **1**, wherein said adjustable screen supporting head is mounted on said cross member by means of a threaded spindle, coupled with a stationary nut screw, said threaded spindle being rotated by a crank.

**4.** Apparatus according to claim **1**, further comprising sleeves mounted on the respective screen supporting heads, each sleeve having one portion coupled to the screen and a second portion coupled to the corresponding ball joint supporting means to maintain said screen in printing alignment with said printing surface.

**5.** Apparatus according to claim **4**, wherein said ball joint supporting means comprises a pair of rollers interposed between each sleeve and a spherically-shaped cradle swinging within a spherically-shaped seat, said cradle being recessed in said two screen supporting heads.

**6.** Apparatus according to claim **5**, wherein said two sprockets are rigidly mounted on said sleeves and placed between the rollers of each pair of rollers.

**7.** Apparatus according to claim **1**, wherein said tensioning means comprises a tie rod, coupled at one end and through a spring with the stationary screen supporting head, and at the other end locked to the frame by means of a lever.

**8.** Apparatus according to claim **1**, wherein said two vertical end supports are rotatably hinged to a horizontal axle extending substantially parallel to the longitudinal axis of said printing screen and supported by the frame.

**9.** Apparatus according to claim **3**, wherein one of said pinion gears is coupled to said adjustably mounted supporting head for axial movement therewith along said splined shaft.

**10.** Apparatus according to claim **1**, wherein said first transmission means and said second transmission means are connected to each other through a bevel gear box.

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