Oct. 8, 1940. H. J. HICKS 2,217,366

SILK SCREEN PRINTING APPARATUS

Filed Aug. 4, 1939 2 Sheets-Sheet 1

Fig. 1.

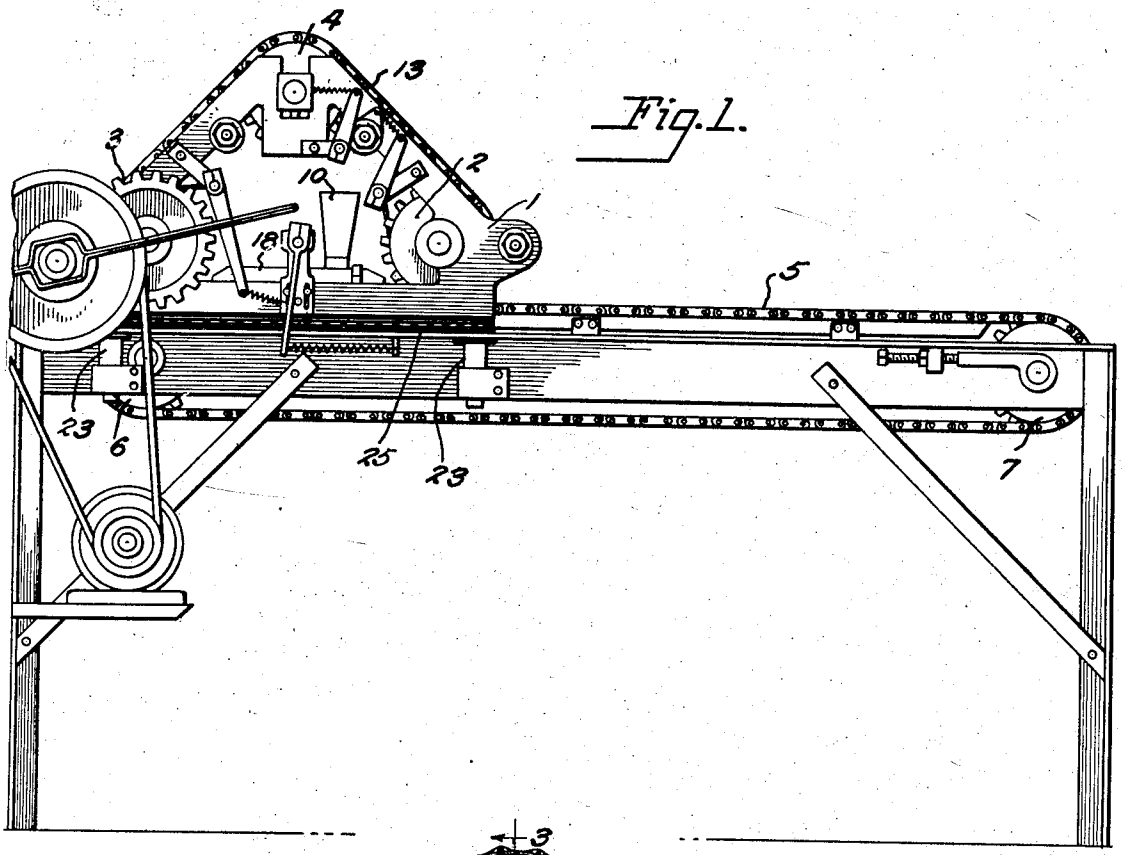
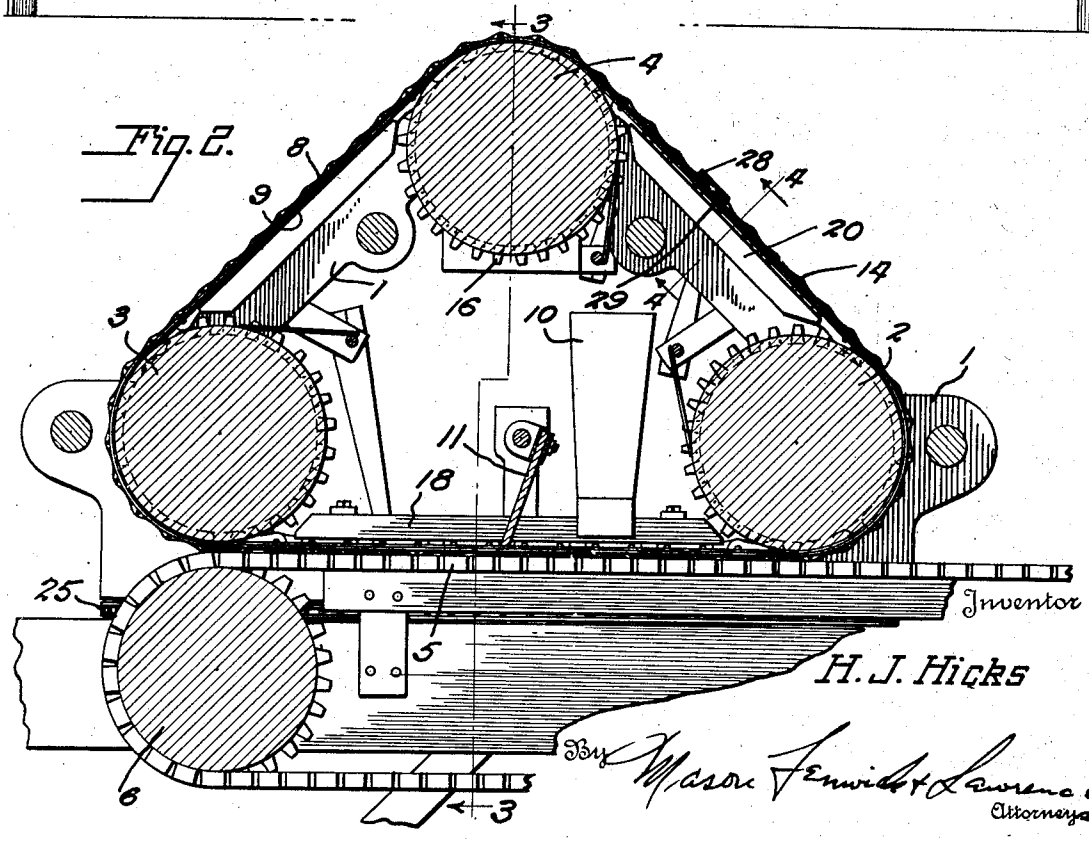


Fig. 2.



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Fig. 3.

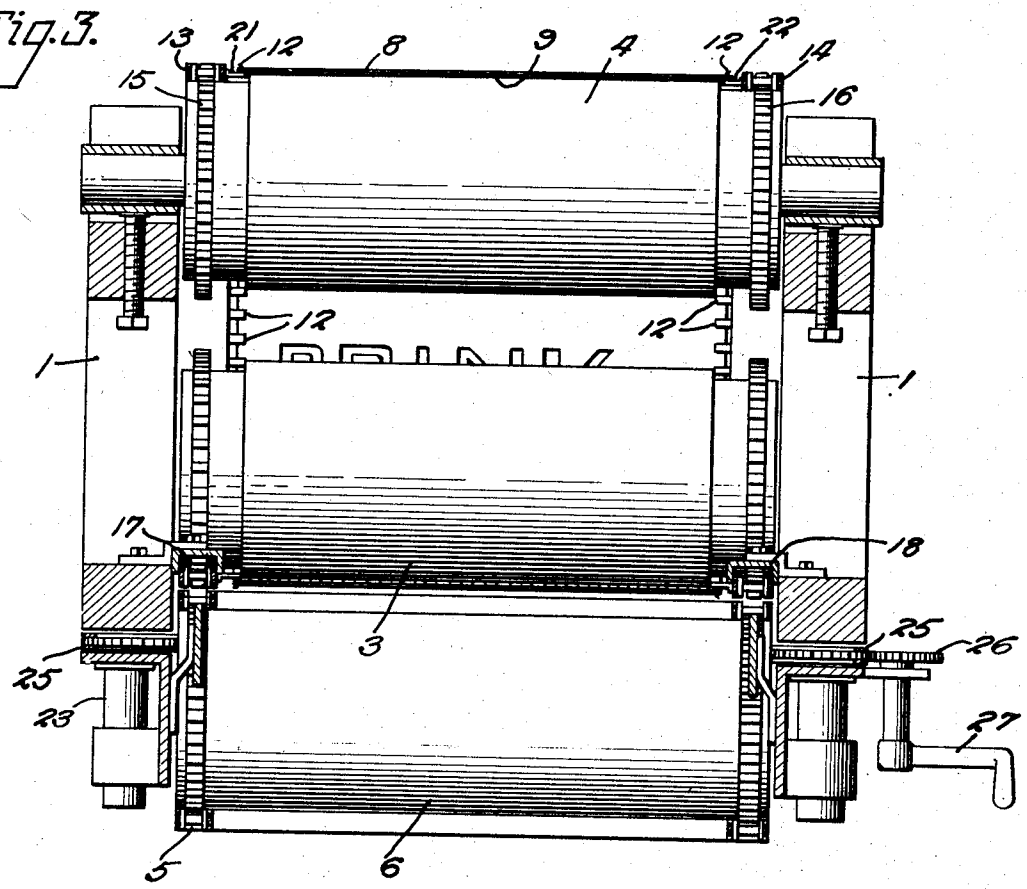


Fig. 4.

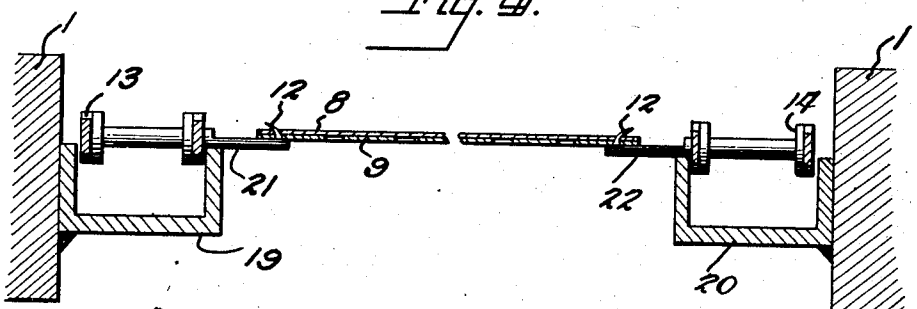
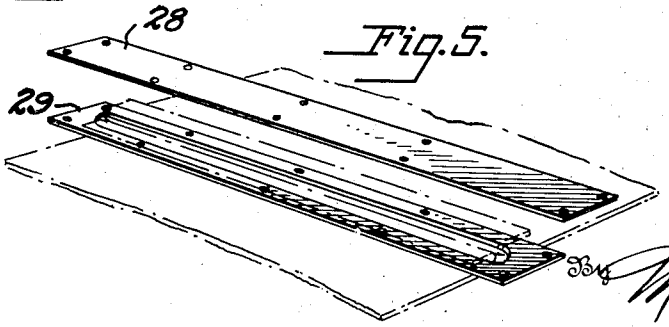


Fig. 5.



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UNITED STATES PATENT OFFICE

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SILK SCREEN PRINTING APPARATUS

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Application August 4, 1939, Serial No. 288,437

6 Claims. (Cl. 101—122)

This invention pertains to printing machines of the type for so-called screen or web printing. Especially is the invention concerned with cooperating means to maintain accurate alignment and constant tensioning on the fine screen that is used in this type of printing.

Screen printing applies ink through a fine mesh web such as silk in contact with a surface to be printed. A stencil against the web outlines suitable characters to be printed. Ink applied with a squeegee fills the stencil openings. In modern practice the stencil with the screen in the form of an endless web is carried around suitable rollers. The moving web and stencil contact a sheet to be printed carried on a travelling conveyor.

The meshes of the web must remain taut and in alignment so as not to distort the printing nor to transmit so much ink as to blur. Moreover, this requirement must be met throughout a relatively long period of usefulness despite relatively high speed operations.

Heretofore the printing screen has been short lived. A silk web should be as taut substantially as a drum head. Tension to effect requisite tautness has tended to separate the meshes. The tendency of the meshes to separate is accentuated in travel around the rolls not only because previous tensioning means along the edge of the screen have imposed too severe strains, but also because change in the linear rate of travel around the periphery of the rolls imposes added stress on the tensioning means and thus on the fabric of the screen. Travelling metal bands have been used to tension the screen laterally, but heretofore have tended either to release the fabric or else to break the bands. If the bands are of sufficiently heavy material to remain tight, they tend to bind around the rolls and thus to impede travel of the screen.

If the lateral tensioning means of the screen be of relatively thick material, a problem arising at the periphery of the rolls is that the inner surface and the outer surface of the thick material must travel at different linear speeds. The outer surface moving on the greater arc increases its speed while the inner surface on the smaller arc decreases its speed. Thus the outer surface tends to stretch while the inner surface tends to compress. If the printing screen is aligned with the outer surface, the printing screen likewise tends to stretch and to displace the meshes longitudinally; while if the screen is placed in alignment with the inner surface of the lateral tensioning means, play in the meshes tends to distort them, if not finally to weaken the webs.

A purpose of this invention is to provide means to hold a printing screen under substantially constant tension throughout during its travel in the printing machine and thus to enhance the efficiency and the period of usefulness of the screen. A specific purpose is to provide lateral tensioning means for the printing screen that shall remain constantly and accurately spaced so as to maintain constant lateral tensioning, but also to impose no added longitudinal strains at the periphery of the rolls over which the screen travels. A further purpose is to provide tensioning means of extreme simplicity so that the screen may be applied or may be released quickly. An object also of this invention is to provide simple means to adjust the tensioned screen vertically. These and other objects will be apparent in the following illustrative description of this invention, presented in conjunction with the accompanying drawings and pointed out more broadly in the appended claims.

In the drawings:

Figure 1 presents in side elevation an assemblage of printing rolls carrying a printing screen and stencil in conjunction with a conveyor for material to be printed;

Figure 2 presents an enlarged vertical section of the roll and screen assembly according to this invention viewed from opposite to Figure 1;

Figure 3 shows a vertical cross-section through the rolls and screen assemblage of Figure 1;

Figure 4 shows a detailed section across a screen and stencil with suitable tensioning means, taken along the line 4—4 of Figure 2;

Figure 5 presents an exploded perspective view of means to secure the ends of a printing screen in suitable longitudinal and lateral tension.

Various objects and benefits of this invention are accomplished by providing a series of lateral tensioning means to travel around the rolls of a printing machine on what is known as the pitch line of the tensioning means. This is an arcuate path where the change in linear travel or in longitudinal tension deviates scarcely at all from that at intermediate positions of travel between the rolls. In the preferred embodiment of this invention illustrated in the drawings accurate spacing is maintained between opposite edges of the screen at positions intermediate the several rolls. As illustrated, the printing screen is tensioned laterally between tentering hooks carried by chains that run in guides between the rolls and also in grooves at the ends of the rolls in such manner as to maintain accurate lateral spacing throughout and also to move the tentering hooks

and screen along the pitch line of the chains.

Reference is made more particularly to the specific embodiment of this invention illustrated in the drawings. However, this invention is not necessarily limited to the form shown, inasmuch as the invention may be practiced in other forms and modifications.

In the drawings like reference characters designate similar parts in the various views.

The printing machine comprises a triangular frame 1 having three rolls 2, 3 and 4. Rolls 2 and 3 are rotated at the bottom of the frame and roll 4 at the top. A moving conveyor 5 is carried under the lower rolls 2 and 3 by driven wheels 6 and 7 in synchronism with the rolls.

The triangular frame 1 carries an endless screen 8 on the inner side of which are suitable stencil elements 9. This stencil also may be in the form of an endless web. It is secured by conventional means to the screen 8 so as to move in synchronism therewith. The screen is carried around the frame over the rolls 2, 3 and 4. At the bottom between rolls 2 and 3, the screen 8 is moved substantially in contact with the conveyor 5. The conveyor 5 carries material to be printed in concurrent travel with the screen and stencil so that printing occurs over this horizontal course. Within the frame 1 are maintained suitable adjuncts to printing, such as a source of ink supply 10 and a squeegee plate 11 which rides upon the inner surface of the stencil 9 so as to distribute ink evenly.

Figure 3, a vertical section across the frame 1, shows upper roller 4 and lower rear roll 2 carrying roller chains 13 and 14 with tentering hooks 12 for laterally tensioning the printing screen 8. These tentering hooks are carried by chains 13 and 14 at each side of the screen 8. To propel the chains 13 and 14, sprocket rims are secured at the outer ends of each roll. For example, on upper drum 4 is fastened gear wheel 15 to engage the chain 13 and at the other end of the drum 4 is secured the gear wheel 16 to engage the chain 14. At the bottom similar sprocket wheels are placed on the rolls 2 and 3 likewise to engage the respective chains 13 and 14.

Means are included under this invention to maintain the sprocket chains 13 and 14 in constant, accurate, spaced relation to each other. For this purpose, guide walls are fixed between the three rolls 2, 3 and 4. Thus at the bottom of the frame between rolls 2 and 3 is secured a pair of opposed guide channels 17 and 18 while along the upper sides of the triangular printing frame 1 are secured similar pairs of guide channels between the wheels 2 and 4 and 3 and 4. The sprocket chain links bear against the inner wall of the channels. This is shown, for example, in Figure 4 where chain link 13 rides in channel 19 and sprocket link 14 is shown in channel 20.

The chain links may be of standard construction except that preferably the roller pins conventional with such chains are extended from the inner face in the form of a flat plate. Thus, for example, the link 13 bears the extended plate 21 and link 14 bears an opposed plate 22. Each lateral plate bears a tentering hook 12 and each is positioned between the top and the bottom of the chain so the hook 12 is effective at the pitch line of the chain. Thus as the chains and hooks for the screen travel around each roll, they maintain the same lineal speed and preserve an even longitudinal tension on the screen.

At the end of each roll means are provided to permit lower portions of the chain links and tentering hooks to travel somewhat below the level of the roll surface. For example, as shown in Figure 3, the end of each roll is depressed or grooved so that the lower portion of hook 12 travels below the surface of the roll. Hook 12 may abut the end of the roll or may be spaced somewhat therefrom. A further improvement is provided to prevent sagging of the chain or of the hook at the rolls. This is accomplished by adjusting the height of the grooved outer ends of the rolls to act as support for the inner side of the tensioning chains 13 and 14.

Intermediate the rolls are guide walls 19 and 20, shown in Figure 4, which maintain the driven chains 13 and 14 constantly spaced from each other. This is conveniently accomplished by channel members secured to the printing frame in which channels the chains 13 and 14 fit. To prevent sagging of the sintering hooks 12 and of the screen 8, the inner side of the chain is supported by the inner guide walls 19 and 20.

Further serving to maintain suitable tension on the screen 8 are plates adapted to fit between the lateral tensioning chains 13 and 14. To these plates are fastened ends of screen 8. As shown in Figure 5, ends of the screen 8 are secured between a pair of these plates 28 and 29. Conveniently the lower plate 29 may be slotted so that the ends of the screen 8 may be brought up therethrough. Upon these are secured the upper plate 28, for example by suitable screws. Thus, strengthening means and fastening means and constant tensioning means are comprised in this pair of plates 28 and 29.

It is desirable to adjust the tensioned screen vertically and evenly in some simple manner. For example, this may be desirable to accommodate different thicknesses of stock to be printed. To this end the frame 1 is supported at each corner upon jackscrews 23 and 24. Each screw is provided with a sprocket wheel for a flexible drive element, for example chain 25, to engage the sprocket wheels and encircle the entire frame and move each jackscrew in synchronism with the others. Simple means to rotate this chain 25 and thus to adjust the frame vertically is provided in the sprocket wheel 26 maintained to engage the chain 25 and provided with a crank extension 27. Thus the crank may be rotated and the frame thereby adjusted vertically with assurance of even tensioning and contact over the entire printing screen.

In use, printing stock is fed to the printing frame 1 upon the travelling conveyor 5. Conveyor 5 and the screen rolls are driven in synchronism by suitable means of conventional nature. Suitable stencils are fastened outside the continuous screen so as to travel around the rolls with the screen. The screen is adjusted vertically to the stock to be printed. The tension on the screen is adjusted suitably by vertical adjustment of the apex roll. This adjustment both laterally and longitudinally is maintained throughout a considerable period of usefulness of the screen by the constant lateral tension and longitudinal tension that is imposed both between the rolls and at the rolls. As the screen with its attached stencil moves along the bottom of the frame a supply of ink is furnished to the stencil and distributed evenly thereover by a squeegee blade that presses upon the face of the stencil. Surplus ink may be carried to upper portions of the frame but will be caught by suitable launders

and returned to the ink supply. The maintenance of nice adjustment of tension throughout the entire course of travel of the printing screen is exceedingly effective to maintain clear printing and a long period of usefulness of the screen.

In this description the word "ink" is intended to be representative of paint or other desired media. The term "screen printing" is intended to represent broadly a method of imprinting or transposing a desired design upon stock. Reference to silk is intended to include also other textiles or rubber, or other fibres or porous material.

This application is a continuation-in-part of my copending application Serial No. 264,819, filed March 29, 1939.

In accordance with the patent statutes the principles of this invention have been illustrated by a preferred embodiment thereof, but it will now be apparent to those skilled in the art that modifications and alterations may be practiced within the scope of the appended claims.

What I claim is:

1. In a screen printing machine comprising a continuous screen trained around rolls with means to engage the edges of the screen with driven elements along each side of the screen and guiding means at the ends of each roll to maintain constant lateral spacing between the driven lateral elements and of the screen in passage around each roll, an improvement to maintain screen alignment comprising rigid guide walls extending between each roll and positioned between the driven elements to maintain constant lateral spacing between the driven lateral elements and of the screen at positions between each roll.

2. In a screen printing machine comprising a continuous cloth screen trained around rolls, an improvement to maintain screen alignment comprising a chain along each side of the screen, tentering hooks extending from the chains to engage the edges of the screen for lateral tensioning, sprocket wheels to drive each chain, guiding means at the end of each roll to maintain constant lateral spacing between the chains and of the screen in passage around each roll, the tentering hooks being mounted on the chains at the pitch line of the chains, and rigid walls extending between each roll and positioned between the chains to maintain constant lateral spacing between the chains and of the screen at positions between each roll.

3. In a screen printing machine comprising a continuous cloth screen trained around rolls, an improvement to maintain screen alignment comprising sprocket wheels at the ends of each roll, a chain at each side of the rolls engaged by the sprocket wheels, tentering hooks extending from the inner sides of each chain at the pitch line of the chains to secure the screen, a groove at each of the rolls for travel of the chains and screen around the rolls, and guide walls for the hooks extending between each roll to maintain constant lateral tensioning of the screen at positions between each roll.

4. In a screen printing machine comprising a continuous cloth screen trained around rolls, an improvement to maintain screen alignment comprising sprocket wheels at the ends of each roll, a chain at each side of the rolls engaged by the sprocket wheels, tentering hooks extending from the inner sides of each chain at the pitch line of the chains to secure the screen, and guide walls for the hooks extending between each roll to maintain constant lateral tensioning of the screen at positions between each roll, there being supporting surfaces at the inner side of each sprocket wheel and at each intermediate guide wall to prevent sagging of the inner side of each chain link.

5. In a screen printing machine comprising a continuous cloth screen trained around rolls, an improvement to maintain screen alignment comprising driven chains at the sides of the screen, sprocket wheels at the ends of the rolls for driving the chains and guide walls spaced apart intermediate the rolls for spacing the chains, and plates fitting between the chains to engage ends of the screen to maintain lateral and longitudinal tension on the screen.

6. A screen printing machine comprising a triangular frame, rolls mounted in the frame for support of a continuous screen, guide elements mounted on the rolls to maintain constant lateral and longitudinal tension on the screen in passage over the rolls and spaced guide walls mounted on the frame between the rolls to maintain constant lateral tension at positions intermediate the rolls, lifting screws positioned at the corners of the frame and a flexible drive element encircling the frame and engaging the lifting screws to provide uniform vertical adjustment of the frame and of the printing screen.

HARRY J. HICKS.