June 21, 1966 E. A. GSELL 3,256,809

PRINTING APPARATUS COMPRISING TWO TABLES AND PRINTING MACHINE TRANSFER MEANS

Original Filed April 22, 1963 6 Sheets-Sheet 1

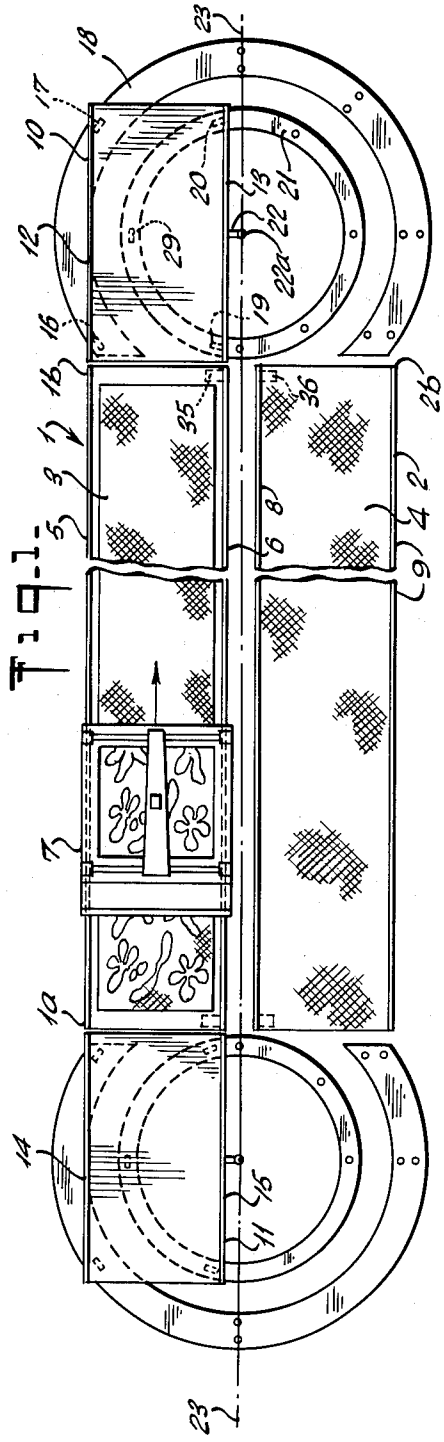

Fig. 1.

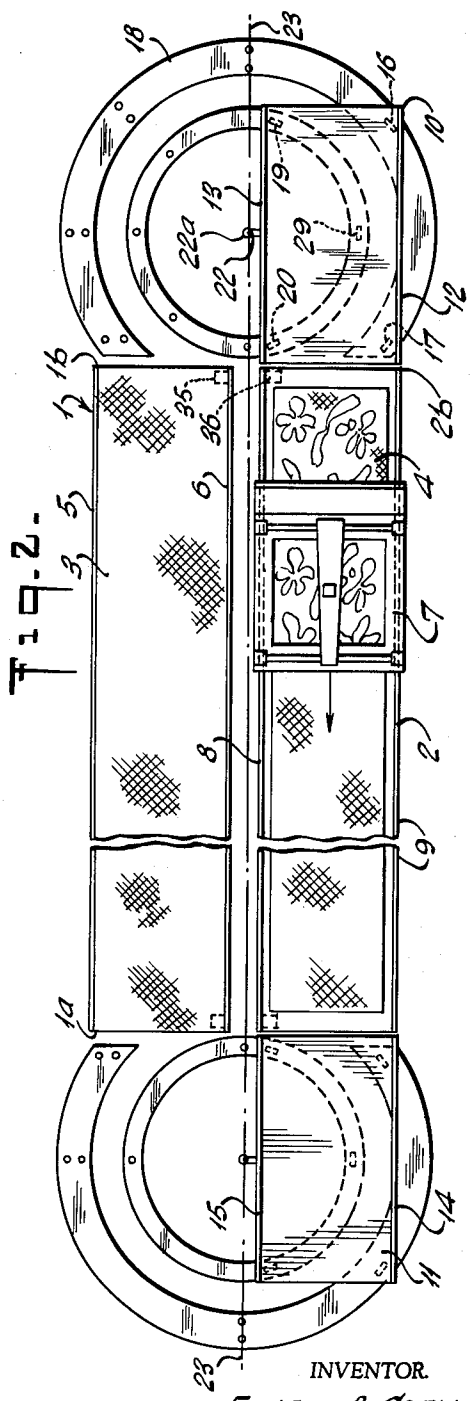

Fig. 2.

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Original Filed April 22, 1963 6 Sheets-Sheet 2

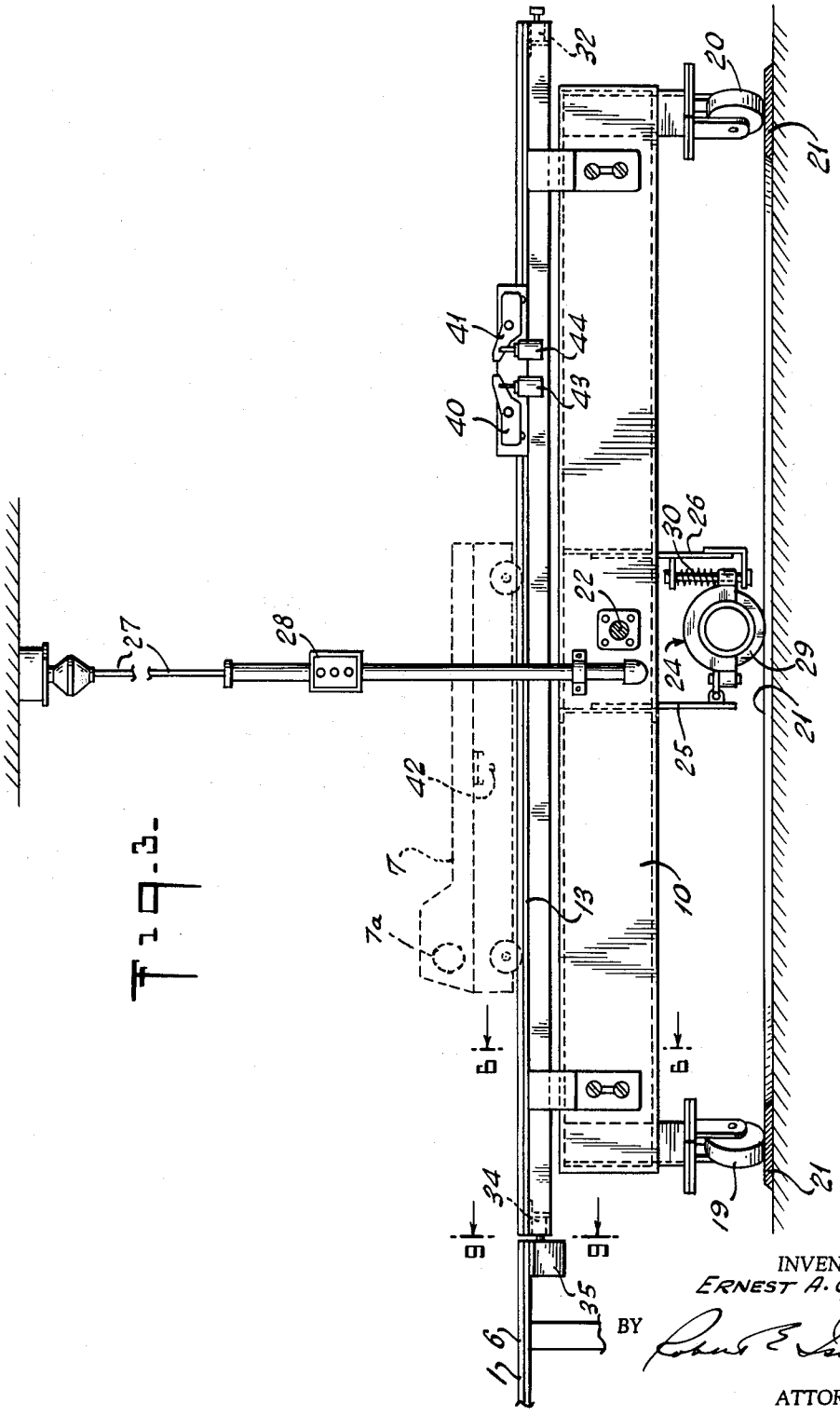

FIG. 3.

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PRINTING APPARATUS COMPRISING TWO TABLES AND PRINTING MACHINE TRANSFER MEANS

Original Filed April 22, 1963 6 Sheets-Sheet 3

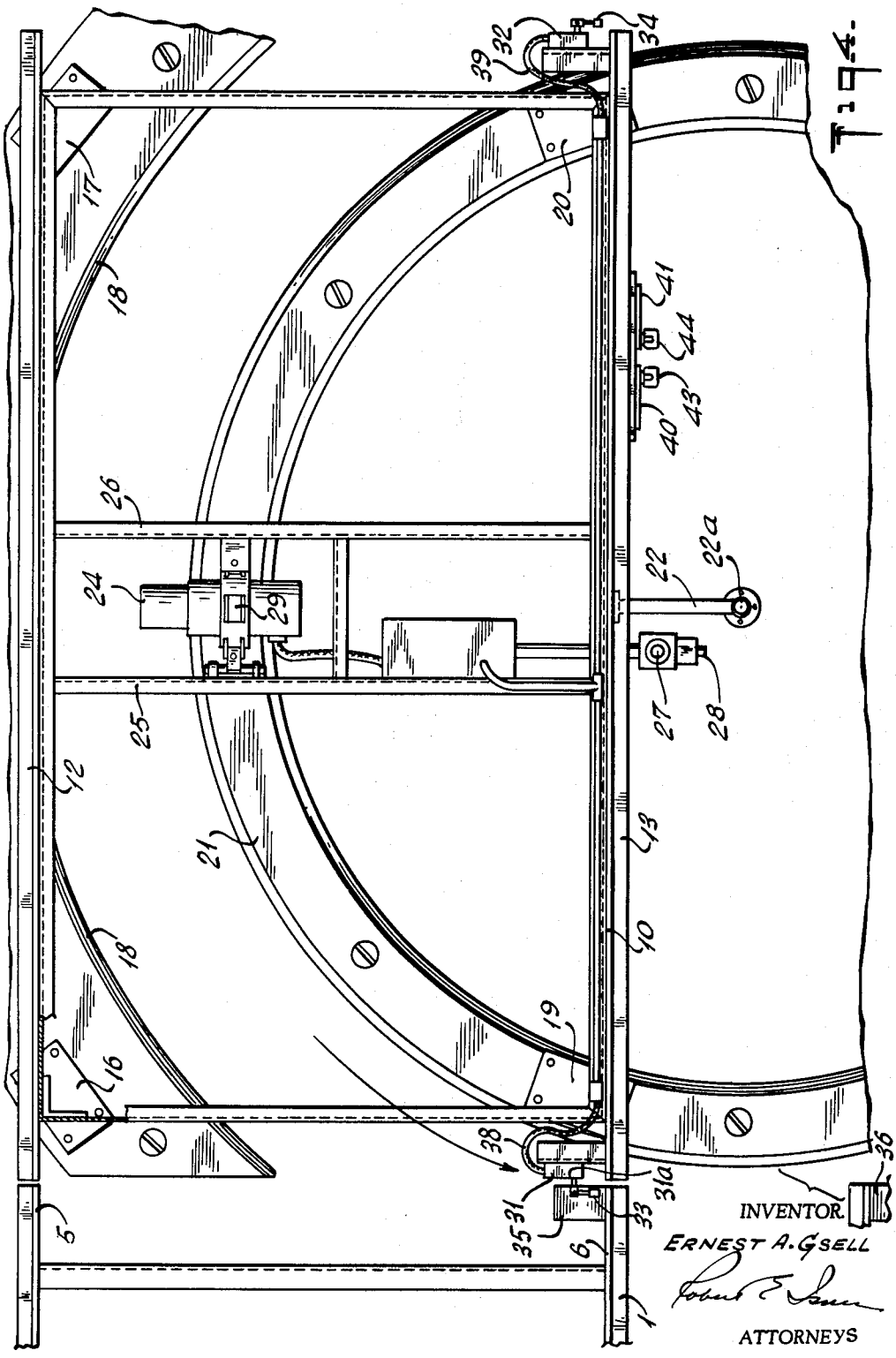

FIG. 4.

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June 21, 1966 E. A. GSELL 3,256,809

PRINTING APPARATUS COMPRISING TWO TABLES AND PRINTING MACHINE TRANSFER MEANS

Original Filed April 22, 1963 6 Sheets-Sheet 4

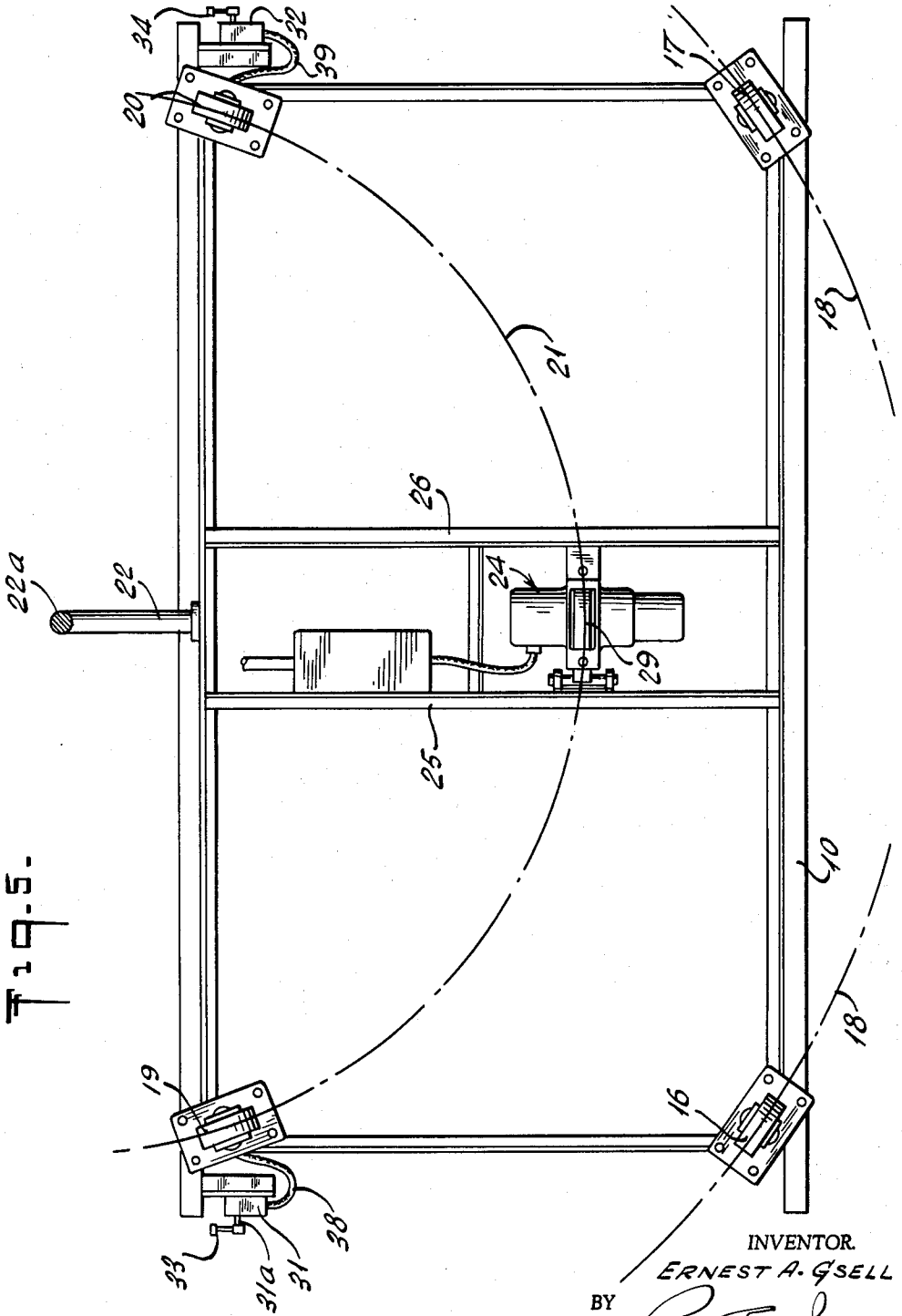

FIG. 5.

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June 21, 1966 E. A. GSELL 3,256,809

PRINTING APPARATUS COMPRISING TWO TABLES AND PRINTING MACHINE TRANSFER MEANS

Original Filed April 22, 1963 6 Sheets-Sheet 5

FIG. 6.

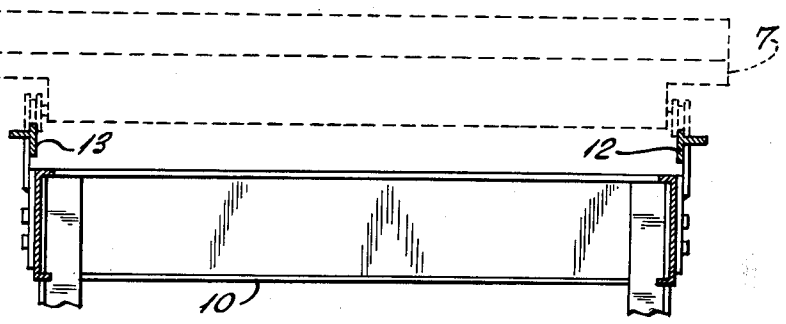


FIG. 7.

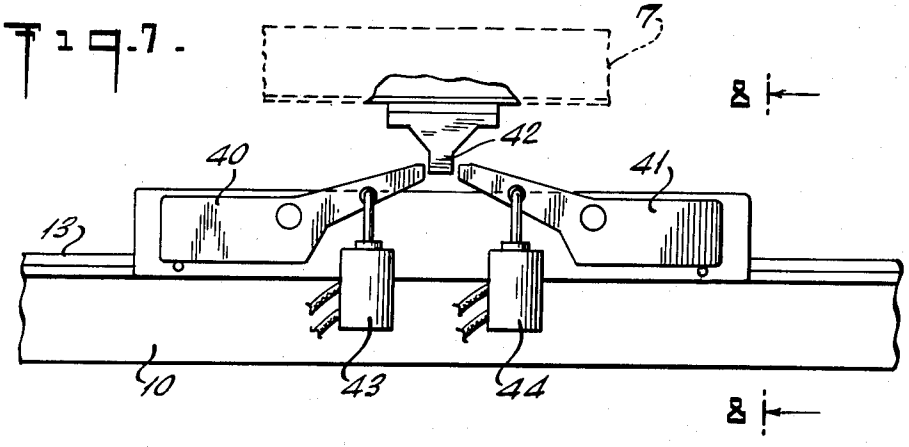


FIG. 8.

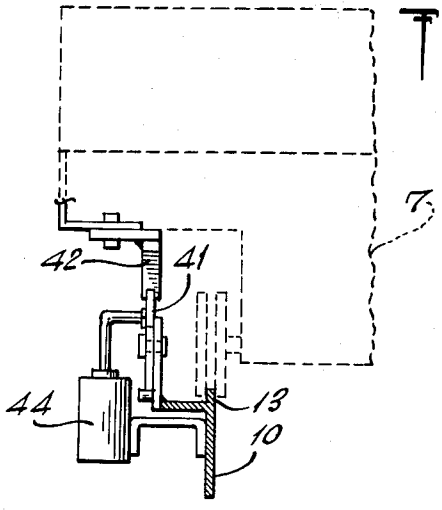
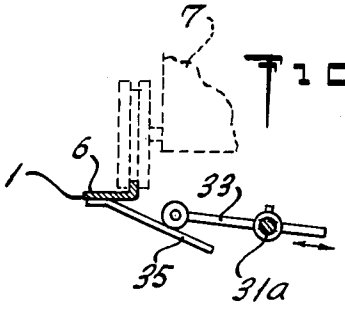


FIG. 9.



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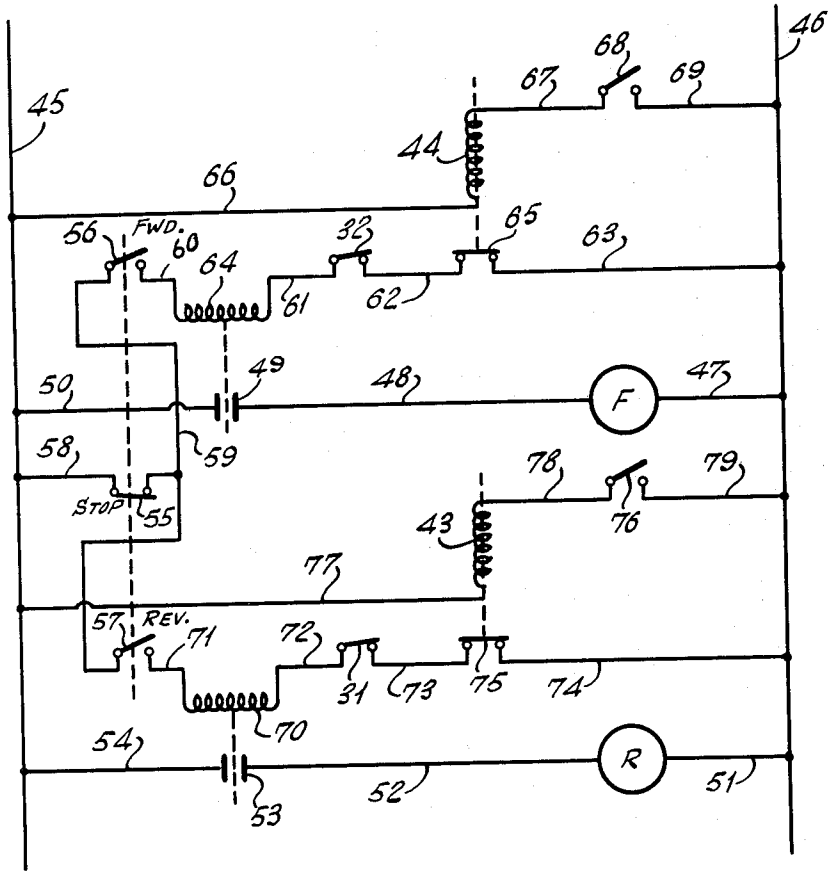
PRINTING APPARATUS COMPRISING TWO TABLES AND PRINTING MACHINE TRANSFER MEANS

Original Filed April 22, 1963 6 Sheets-Sheet 6

Fig. 10.



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United States Patent Office 3,256,809 Patented June 21, 1966

3,256,809

PRINTING APPARATUS COMPRISING TWO TABLES AND PRINTING MACHINE TRANSFER MEANS

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Original application Apr. 22, 1963, Ser. No. 274,512. Divided and this application Jan. 27, 1964, Ser. No. 343,439

5 Claims. (Cl. 101—123)

This application is a division of copending United States application Serial No. 274,512, filed Apr. 22, 1963.

This invention relates to printing apparatus and more particularly to apparatus for printing long lengths of ware each length being supported horizontally on one of a plurality of associated longitudinal work tables.

In the past such wares have been printed manually by the screen process of printing in which a screen is placed over an area, usually called a block, which is to be printed, and a manually operated squeegee is drawn across the screen to deposit the printing paint on the block or area to be printed. The screen is then moved to an area one block removed from the last printed block and the process repeated until the end of the ware length is reached. Thereafter the operator moves the screen back to the original end of the table and begins to print the alternative blocks. This procedure is used to allow the first printed block time to dry sufficiently such that printing an adjacent block will not smear the edge portions.

Subsequently, the process was automated by the provision of a printing machine indexed to print alternate blocks, automatically movable to succeeding alternate blocks and automatic as to paint feed and squeegee operation.

This machine, however, simply automated the previously described manual operations, printing alternate blocks on one traverse of the table and then moving backward the length of the table to begin to print the previously passed-over blocks.

Thus, while this machine increased production and cut labor cost, certain disadvantages were inherent. One disadvantage is the cost of the machine and the requirement of one machine for each table. Another disadvantage is the loss of effective use of the speed of the machine in that the drying time of the print paint was greater than the time required by the machine to print one table length of material. No suitable means were found to decrease the paint drying time to match the machine printing time and extension of the tables was impractical because of building limitations. The tables normally are about 85 yards in length. A further disadvantage is that the machine must remain idle after the completion of printing on a ware and until the ware is removed and a new ware accurately positioned on the table. Another disadvantage is that for safety it is desirable to have one man watch each printing machine in operation. Otherwise should a machine mis-index, run out of paint or fault in some way a complete length of ware could be destroyed.

It is an object of this invention to provide an improved apparatus for printing lengths of ware associated with elongated work tables.

A further object is to provide an improved apparatus for printing lengths of ware and which avoids or minimizes the disadvantages mentioned above.

With this view in mind, the invention departs from the prior concept of reciprocal motion of one machine associated with a particular table and provides means for operation of one machine in a continuous printing circuit including at least two tables.

Other objects and advantages of the invention will be set forth in the following specification and claims will be

ascertainable from the appended drawings which illustrate, by way of example, the principles of the invention as the same are incorporated in a presently preferred embodiment thereof.

Referring to the drawings:

FIGURE 1 is a plan view of apparatus incorporating my invention in a preferred form and indicating one position of the several elements in operation;

FIGURE 2 is a plan view similar to FIGURE 1 indicating another position of the elements in operation;

FIGURE 3 is an enlarged side view showing details of a preferred power driven transfer means and its interlocking relation with the end of an associated table;

FIGURE 4 is a plan view of the apparatus shown in FIGURE 3;

FIGURE 5 is an enlarged plan view of the transfer means indicating one preferred manner in which the transfer means is moved and guided;

FIGURE 6 is an enlarged end elevation view partly in cross-section of a work table supporting the printing machine;

FIGURE 7 is an enlarged side elevation of stop means for positioning the printing machine on the transfer means;

FIGURE 8 is an enlarged end elevation view partly in cross-section taken on line 8—8 of FIGURE 7;

FIGURE 9 is an enlarged side elevation of limit switch means taken on line 9—9 of FIGURE 3, and

FIGURE 10 is a schematic diagram of a control circuit for operation of the transfer means.

Referring to FIGURES 1 and 2 of the drawings there is shown tables **1** and **2** having positioned respectively thereon wares **3** and **4** which are long lengths of ware such as fabrics to be printed. Table **1** has attached thereto longitudinally disposed guide tracks **5** and **6** on which is movably supported an automatic self-propelled printing machine **7** adapted to tranverse the length of table **1** from its end **1***a* to its opposite end **1***b* and to print on the ware alternate or preselected blocks of design depending upon the selected indexing of the machine. In this arrangement for automatic printing, the printing machine is adapted to print only in its forwardly moving direction, i.e., toward end **1***b* of table **1**. After printing selected blocks in one pass over the ware, the machine is then reversed to move back to its starting position, i.e., end **1***a* of table **1**, and is then indexed to print the blocks which were not printed on the first pass. Indexing of the machine is accomplished by stops (not shown) positioned on table **1** and cooperative automatic timing mechanism (not shown) for controlling the dwell time necessary for printing at each stop position. The machine **7** prints only in one direction of travel and does not print on it reverse to its initial starting position. Machines of this type are conventional, one such machine being described and disclosed in United States Patent No. 3,106,890 and sold in the United States by Societe Alsacienne de Constructions Mechaniques Mulhouse, France. Each machine is powered by an electric motor **7***a* mounted in the machine and receiving power from an electrified track (not shown) mounted on the associated table.

In accordance with applicant's invention, as shown in the preferred embodiment of FIGURES 1 and 2, table **2** is positioned adjacent and longitudinally parallel with table **1** and is also provided with two tracks **8** and **9** affixed to the table **2** and dimensioned to guide machine **7** there along. Table **2** is also provided with indexing stops (not shown) as described for table **1**. In addition, applicant provides a transfer means indicated in FIGURES 1 and 2 as the transfer tables **10** and **11** having respectively guide tracks **12** and **13** on tables **10** and **14** and **15** on table **11**, the pairs of guide rails **12** and **13**

and **14** and **15** being parallel and spaced for alignment with the guide tracks **5** and **6** and **8** and **9**, respectively, of the tables **1** and **2**.

As shown in FIGURES 1 and 2, table **10** is supported on one side by caster wheels **16** and **17**, operating on a circularly curved track **18** and is supported on the other side by caster wheels **19** and **20** which, as will be described in detail later, follow a circularly curved track **21**.

In order to guide the transfer table **10** from the position shown in FIGURE 1 at the end **1***b* of table **1** to the position shown in FIGURE 2 at the end **2***b* of table **2** a pivoted guide arm **22** (FIGURES 1, 2, 4 and 5) is rigidly secured as by welding or other means to the side of table **10** adjacent the center line **23** between the tables **1** and **2**. The other end of arm **22** is curved downwardly to engage a pivot socket **22***a* mounted on the flood and to thereby provide a pivot point on the center line **23** from which the table **10** is guided in its movement to the position shown in FIGURE 2. In the guiding of table **10** from its position shown in FIGURE 1 to the position shown in FIGURE 2, the table is also rotated 180° in its movement such that the guide rails **12** and **13** of table **10** will be aligned with the guide tracks **8** and **9** of table **2**.

Referring to FIGURE 4, the transfer table **10** is provided with a reversible motor drive mechanism **24** mounted on brackets **25** and **26**, connecting the side frame portions of the transfer table **10** and is supplied with electrical energy through a retractable electric line **27**, best seen in FIGURE 3 and through a conventional stop, forward and reverse push button station **28** which controls the operation of the reversible motor **24**. As shown in FIGURE 3, reversible motor **24** is connected to drive a wheel **29** spring biased as by spring **30** to provide traction between the wheel **29** and the track **21**. Thus, operation of motor **27** in the forward direction causes the drive wheel **29** to move along the track **21** in a circular arc to pivot the table **10** about the pivot **22***a* to the position of table **10** as indicated at end **2***b* of table **2** in FIGURE 2. The table **10** is moved back to its original position adjacent table **1** by pressing the reverse button of push button station **28** and may be manually stopped at any point by depressing the stop button of the station **28**.

To automatically stop movement of the table **10** when its guide rails **12** and **13** are aligned either with the guide rails **5** and **6** of table **1** or guide rails **8** and **9** of table **2** any suitable limit switch and stop means is provided. In the preferred embodiment, for example, (see FIGURES 3 and 4), I provide a limit switch **31** bolted or otherwise fixed to one end of the innerside of the frame of the table **10** and having an operating arm **33** projecting beyond one end of the guide rail **13** to engage an inclined surfaced stop member **35** fixed by welding or other suitable means to the adjacent end of guide track **6** of table **1**. Limit switch **31** is electrically connected as by cable **38** to the reverse drive mechanism **24** to interrupt power to the drive mechanism when the arm **33** of switch **31** is pivoted by engagement with the inclined surface of stop member **35**. Thus, when the table **10** is rotated in a counterclockwise direction as viewed in FIGURE 4, the arm **33** of switch **31** is operated by the inclined stop **35** to stop movement of the table **10** when its guide tracks are aligned with the guide tracks of table **1**. To provide for more accurate alignment should the need arise in a particular installation, the arm **33** may be made adjustable on the shaft **31***a* of switch **31** by securing the arm thereto with a set screw such that the arm **33** may be set to engage the stop at selected points along is inclined surface. Also, if desired, the drive means **24** may be equipped with brake mans responsive to interruption of current to the drive means.

To provide for stopping the table **10** when it is moved clockwise from the position shown in FIGURE 1 to the position shown in FIGURE 2, I provide a similar limit switch **32** having a projecting arm **34** and fixed to the

frame of table **10** adjacent the other end of guide track **13** as shown in FIGURE 4 and an additional inclined surface stop member **36** fixed to table **2** adjacent the end of its guide track **8** as shown in FIGURE 2. The switch **32** is connected by cable **39** to the drive means **24**. Thus, transfer table **10** may be positioned as shown in FIGURE 1 to receive and support the printing machine **7** and thereafter swung to the position shown in FIGURE 2 to reverse the heading of machine **7** and position the machine to be moved to table **2**.

To avoid the possibility of machine **7** rolling off the table **10** during transfer, I provide opposed depressible lock means **40** and **41** adapted to cooperate with stop means **42** on the machine **7** to fix the position of the machine on table **10** during transfer. The lock means **40** and **41** may be depressed manually or by the solenoid means **43**, **44** or by any other suitable means.

Insofar as operation of the reversible drive means **24** and the solenoids **44**, **43** is concerned, any suitable conventional control circuit may be employed. FIGURE 10 illustrates one suitable control circuit wherein the forward and reverse windings of the reversible drive motor mechanism **24** are indicated diagrammatically by the circles F and R, respectively. The forward winding F is supplied with suitable electric power from supply lines **45** and **46**, one side of winding F being connected by line **47** to line **46** and the other side thereof being connected by line **48**, normally open power contacts **49** and line **50** to supply line **45**. The reverse winding R is also supplied with power from the supply lines **45** and **46**. Thus one side of winding R is connected by a line **51** to line **46** and the other side thereof is connected by a line **52** to one side of normally open power contacts **53**, the other side of which is connected by a line **54** to power supply line **45**.

To control the operation of the power contacts **49** and **53** and hence the power supply to the windings F and R, the previously mentioned push button station **28** includes a normally closed stop contactor **55**, a normally open forward contactor **56** and a normally open reverse contactor **57** interlocked in the usual manner to prevent closing both the forward and reverse contacts at the same time.

One side of the stop contacts **55** is connected by a line **58** to line **45**, the other side being connected by common line **59** to one side of the contacts **56** and **57**. The other side of forward contacts **56** is connected by lines **60**, **61**, **62** and **63** in series with an operating coil **64** for the contacts **49**, the limit switch **32** (shown also in FIGURE 4) and normally closed contacts **65** operated by coil **44** (shown also in FIGURE 3). One side of coil **44** is connected by line **66** to supply line **45**, the other side being connected by line **67**, a normally open position release switch **68** and a line **69** to the supply line **46**.

The control circuit for operation of the reversing power contacts **53** is similar to the circuit described above for operating the forward power contacts **49**. Thus, an operating coil **70** for the contacts **53** has one side connected by line **71** to the normally open switch **57** and its other side connected by lines **72**, **73** and **74**, in series with the normally closed limit switch **31** (shown also in FIGURE 4) and normally closed contacts **75**, to the supply line **46**.

Coil **43** (also shown in FIGURE 3) is connected between the supply lines **45** and **46** and in series with a normally open position release switch **76** by lines **77**, **78** and **79**.

In operation of the above described circuit power to either field winding is interrupted by opening the normally closed stop switch **55**. Closing the forward switch **56** closes the stop switch **55** and supplies power to coil **64** to close the power contacts **49** providing the limit switch **32** in closed and the position contacts **65** are closed. Limit switch **32** is open only when the support table has reached the limit of its travel and position con-

tacts **65** are open only when switch **68** is depressed to move the printing machine off the transfer table. Operation of the drive mechanism in reverse is responsive to closing reverse switch **57** the effect of which is controlled by the limit switch **31** as regards travel of the support table and position contacts **75** controlled by the position release switch **76**.

Transfer table **11** shown in FIGURES 1 and 2 and located at the opposite end of tables **1** and **2** from transfer table **10** need not be described in detail since in this preferred embodiment it is simply a duplication of table **10** and its associated stops, limit switches and controls.

Operation

In accordance with applicant's invention, the above described apparatus provides for closed circuit operation of automatic printing machinery with attendant advantages as have been mentioned.

Thus, with printing machine **7** at end **1***a* of table **1**, table **1** is indexed for the printing of selected blocks such that adjacent blocks are not printed on the same pass. For example, the machine may be indexed to print every other block, which we shall call the odd blocks. The machine **7** then is propelled normally by electric drive contained therein and automatically prints the odd blocks. Having reached end **1***b* of table **1** the machine may be manually pushed onto the transfer table **10** and locked in position by the lock means **40, 41**. Thereafter the "forward" push button of station **28** is pushed to rotate the table **10** to the position shown in FIGURE 2, the lock means **40, 41** is released and the machine is pushed onto table **2**. The machine having thus been rotated 180° is in a position to print in its normal direction of travel on table **2**. Table **2** is indexed for odd block printing and the machine moves along table **2** toward its end **2***a*. While the machine is printing on table **2**, the printed blocks on table **1** are being allowed time to dry.

When the machine reaches end **2***a* of table **2** it is then rolled onto the aligned guide tracks of transfer table **11**, locked in position as described with respect to table **10** and the reverse button of a control station (not shown) identical with station **28** is pushed to rotate table **11** for alignment of its guide tracks with the guide tracks of table **1**. The printing machine is now rolled onto table **1** and the closed circuit is completed.

The machine then prints the even numbered blocks on table **1**, thereafter is transferred by table **10** to table **2** and proceeds to print the even numbered blocks on table **2**. During the printing of the even numbered blocks on table **2** the printed ware on table **1** is replaced with a new unprinted ware such that when the machine **7** is transferred back to table **1** by transfer table **11** conditions have been established for continuous use of the machine on table **1**.

While the machine is printing on the new ware of table **1** the printed ware of table **2** is replaced by a new ware and the process thus becomes one continuous operation wherein the printing machine has no idle time. Each of the tables **10** and **11** are operated back to receiving position of one table when they have discharged the machine to the other of the tables.

Modifications

In the preferred embodiment disclosed above adjacent parallel tables have been employed on the basis that this arrangement is economical of floor space and of movement of an operator tending the machine. It is appreciated, however, that the advantages of closed circuit operation could be obtained even though the tables were not parallel or adjacent. For example, if the tables were not parallel the 180° pivot of the transfer tables would be modified to accommodate the non-parallel relation of the tables. Insofar as the tables being adjacent is concerned, the pivot point could be moved to provide for a transfer from one table to a table, say two tables removed therefrom.

Also the tables need not be limited to a pair since continuous operation could be obtained from three tables in a triangle, four tables in a rectangle, etc. or a pair of in-line tables could be used with an adjacent pair of in-line tables and still provide the advantages of continuous circuit and continuous printing.

It is also appreciated that automatic printing machines now on the market are designed to print on operation only in one direction, in view of the fact that operation of such machines has heretofore been limited to operation on one table and it is thus desirable to return the machine to the starting end of the table for the second pass, since the blocks at that end have had the most time to dry. However, for the situation where it is desirable to have the machine print in either direction of travel it becomes merely a matter of repositioning the general stop and limit switch means.

With the above in mind and for machines adapted to print in either direction, it will not be necessary to rotate the machine 180° in its transfer to an associate table. Under those circumstances the transfer means need be provided only with guide means for sideward movement in order to effect alignment of its tracks with the tracks of associated tables which could be accomplished with linear guide means, such as rails, positioned normal to the longitudinal axis of the elongated work tables. This arrangement would also provide closed circuit continuous operation and its attendant advantages.

From the above description it should be apparent that applicant's invention provides each of the advantages mentioned earlier in the specification, to wit:

Initial cost is reduced by enabling one machine to serve a plurality of work tables. Operating costs are reduced by eliminating delays otherwise required for drying time and ware changeover time. Also since safety requires one operator for each machine to keep constant watch for misprinting, loss of print paint or other fault, the operator cost per yardage of printed material is reduced by avoiding delay time in operation of the machine.

While I have illustrated in the attached drawing and described in the specification, by way of example, a preferred embodiment of the invention, it will be apparent to those skilled in the art from a reading of the specification and reference to the drawings that various changes and modifications may be made without departing from the true spirit and scope of the invention, and it is intended that all such changes and modifications be included in the attached claims.

I claim:

1. In printing apparatus of the type wherein

a ware to be printed is positioned on the upper horizontal surface of an elongate work table

having longitudinally disposed guide tracks for guiding a unidirectionally traversable printing machine along and above said horizontal surface comprising

a second elongate work table disposed in coplanar relation adjacent to said first mentioned work table,

a transfer means disposed to supportingly receive said printing machine at the end of its travel along said first mentioned work table,

means for selectively displacing said transfer means from its printing machine receiving location at the terminal end of said first mentioned work table to a printing machine delivering location at the initial end of said second work table,

and means responsive to the proximity of said transfer means to said second work table for deactivating said displacing means.

2. Printing apparatus as set forth in claim **1** wherein said second work table is disposed in close parallel relationship and said transfer table is rotated 180° in its displacement from the terminal end of said first mentioned work table to the initial end of said second work table.

3. Printing apparatus as set forth in claim 1 including means to lock said printing machine on said transfer means during displacement thereof.

4. Apparatus as set forth in claim 1 wherein said transfer means includes a reversible motor drive mechanism mounted thereon to effect selective displacement thereof and a pivotal guide means connected to said transfer means and to a fixed object to determine the path of travel of said transfer means for selected alignment thereof with said guide tracks.

5. Apparatus as set forth in claim 1 wherein said transfer means comprise a wheeled supporting platform, a pair of guide and support tracks supported by said platform and spaced for selective alignment with the guide means associated with each table, and means connected to said movable platform and adapted to guide said platform in a 180° arc about a pivot point located substantially on a center line between the parallel tables for swinging said platform from an initial position in which the guide tracks thereof are aligned with one table to a position in which

the guide tracks thereof are aligned with the guide tracks of an adjacent of the tables while the platform is simultaneously rotated 180° to face in the opposite direction from its initial position.

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