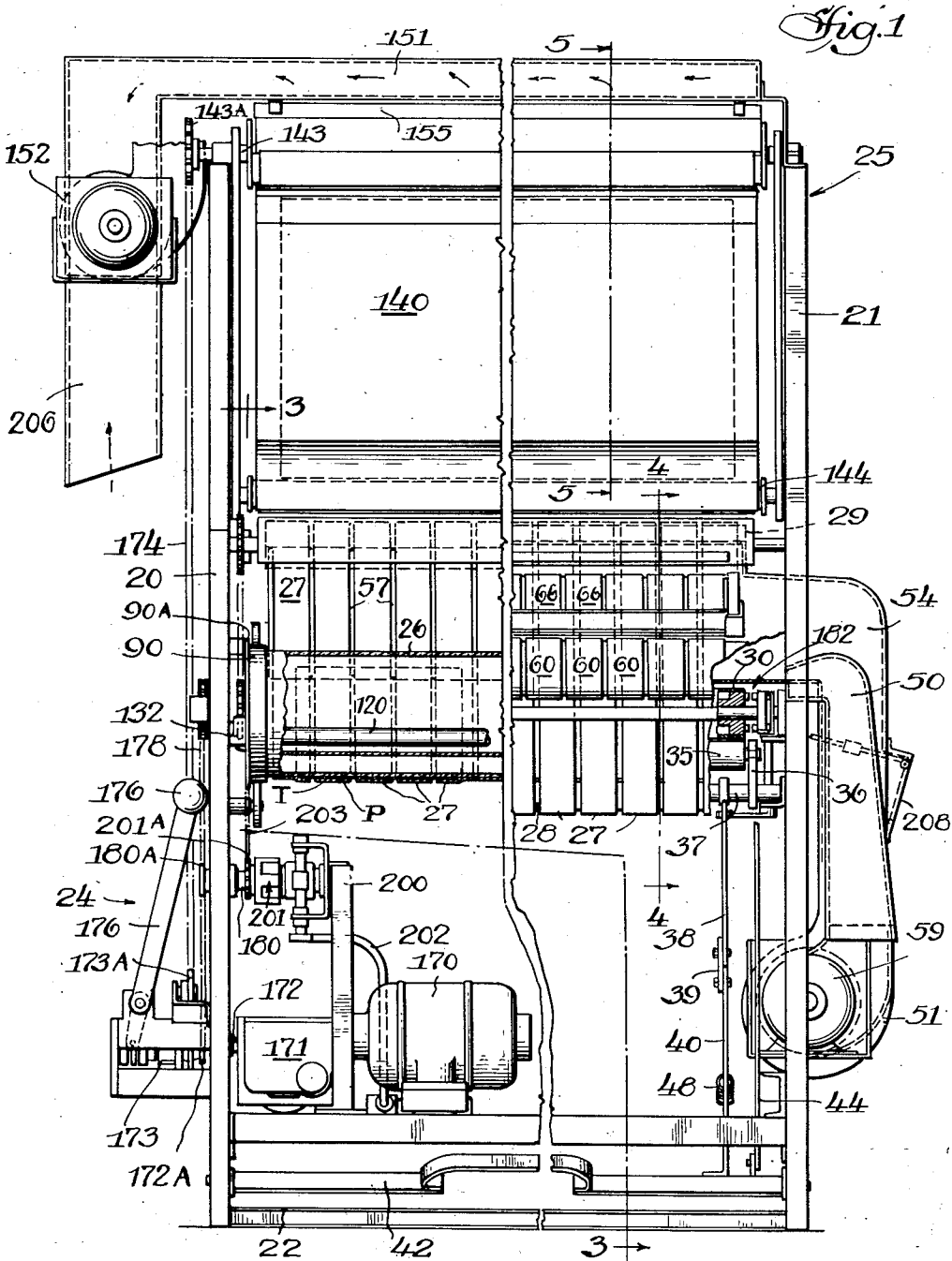


2,641,980

CYLINDRICAL PHOTOPRINTING MACHINE

Filed April 4, 1947.

8 Sheets-Sheet 1



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CYLINDRICAL PHOTOPRINTING MACHINE

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8 Sheets-Sheet 2



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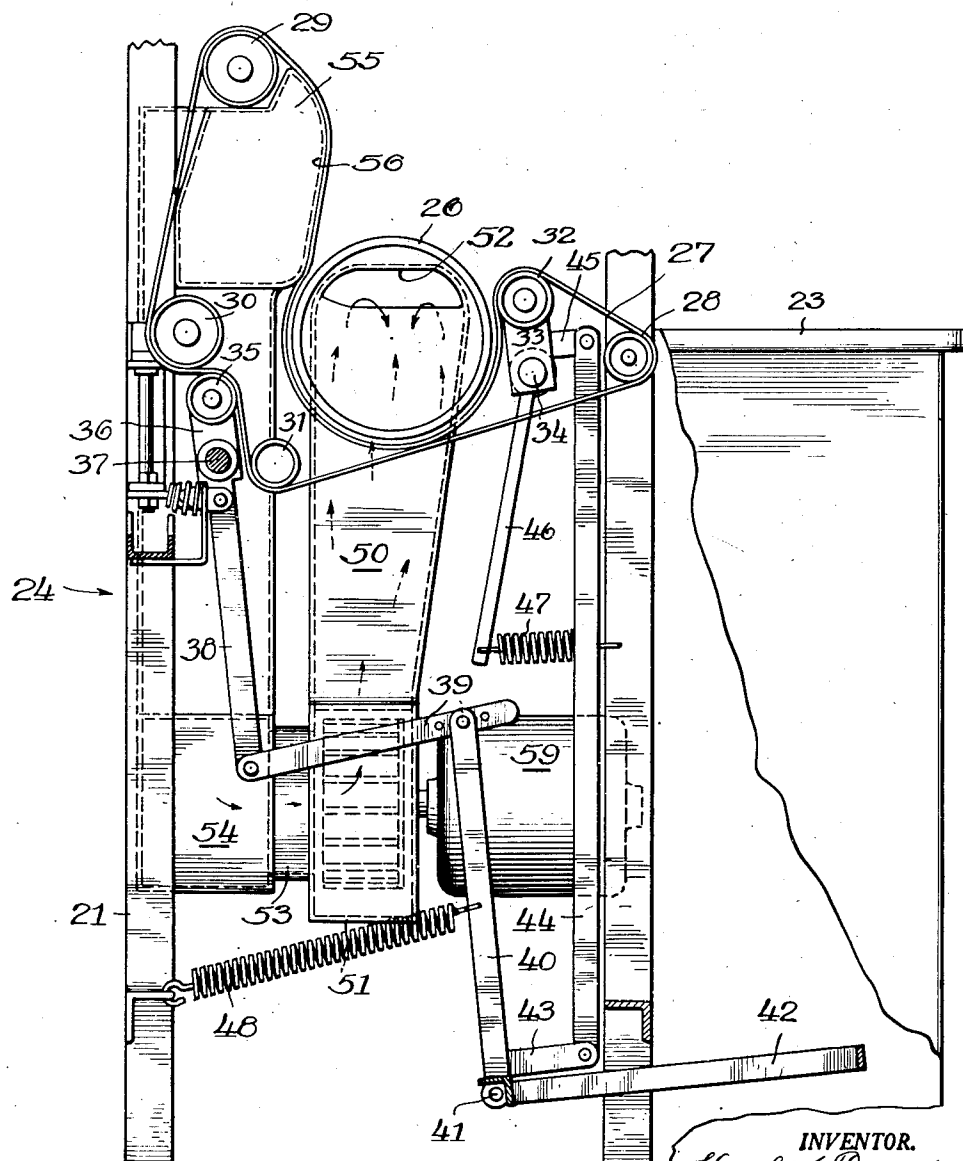
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CYLINDRICAL PHOTOPRINTING MACHINE

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8 Sheets-Sheet 3

Fig. 3



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CYLINDRICAL PHOTOPRINTING MACHINE

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8 Sheets-Sheet 4

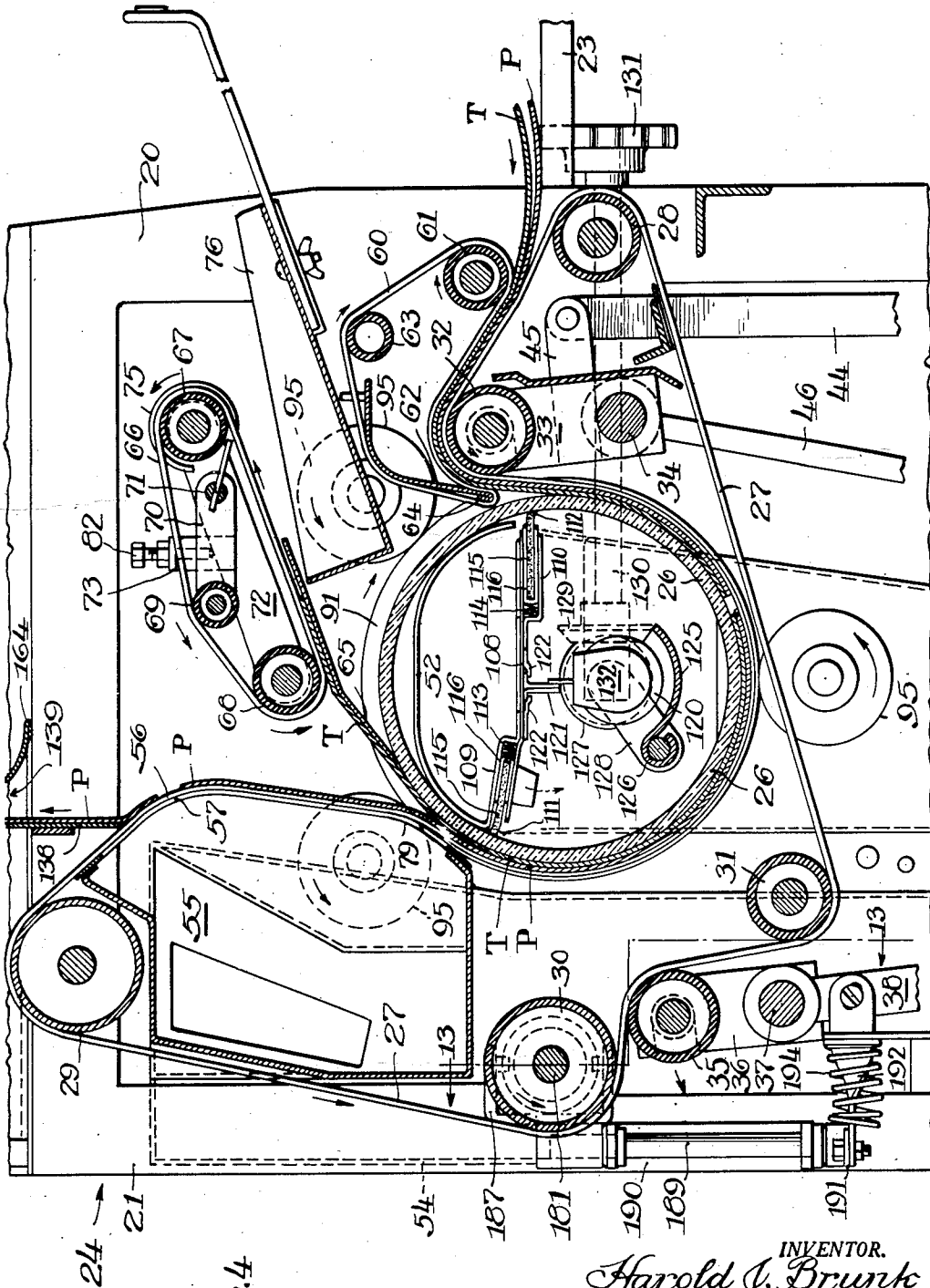


Fig. 4

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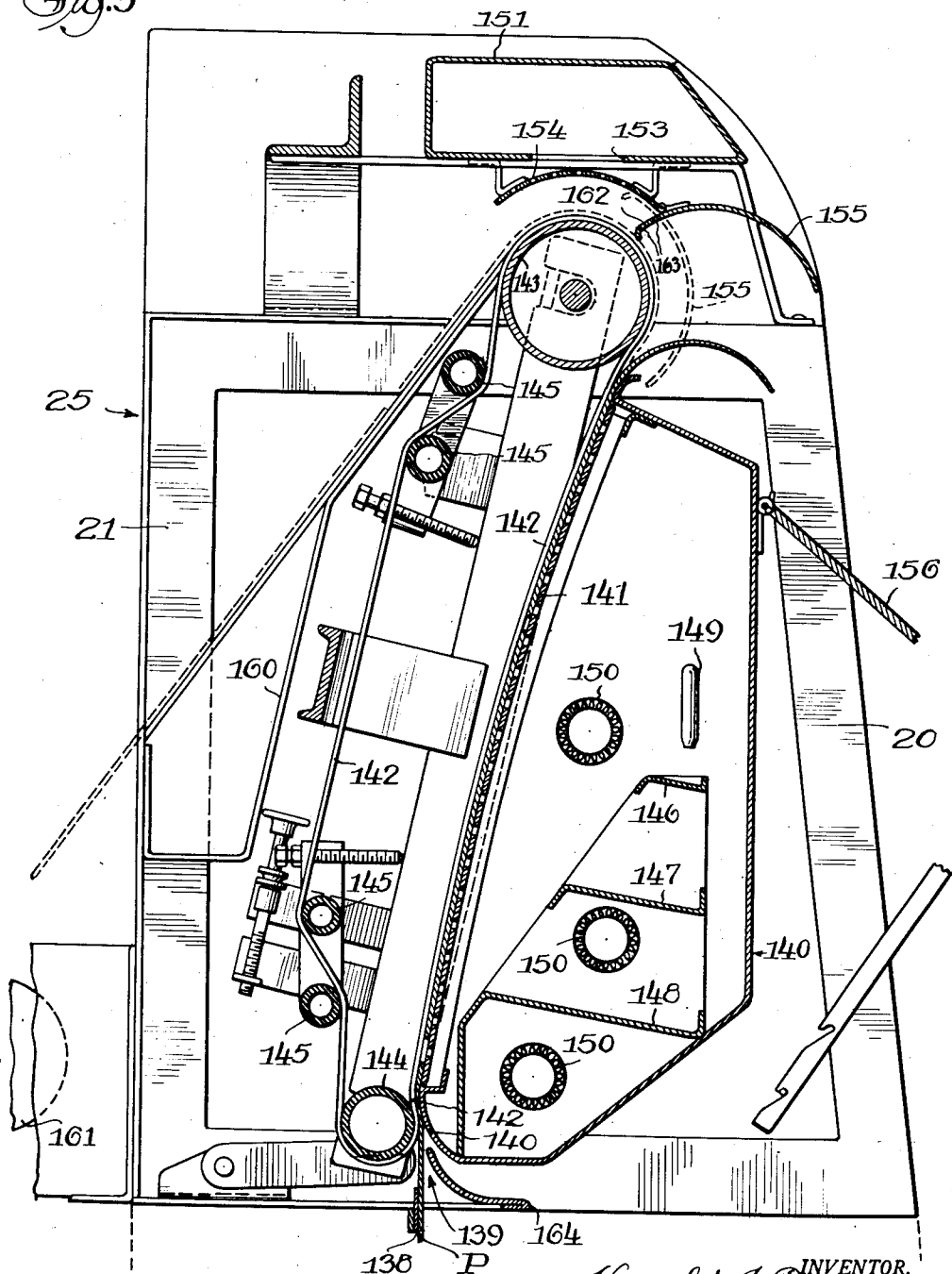
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CYLINDRICAL PHOTOPRINTING MACHINE

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8 Sheets-Sheet 5

Fig. 5



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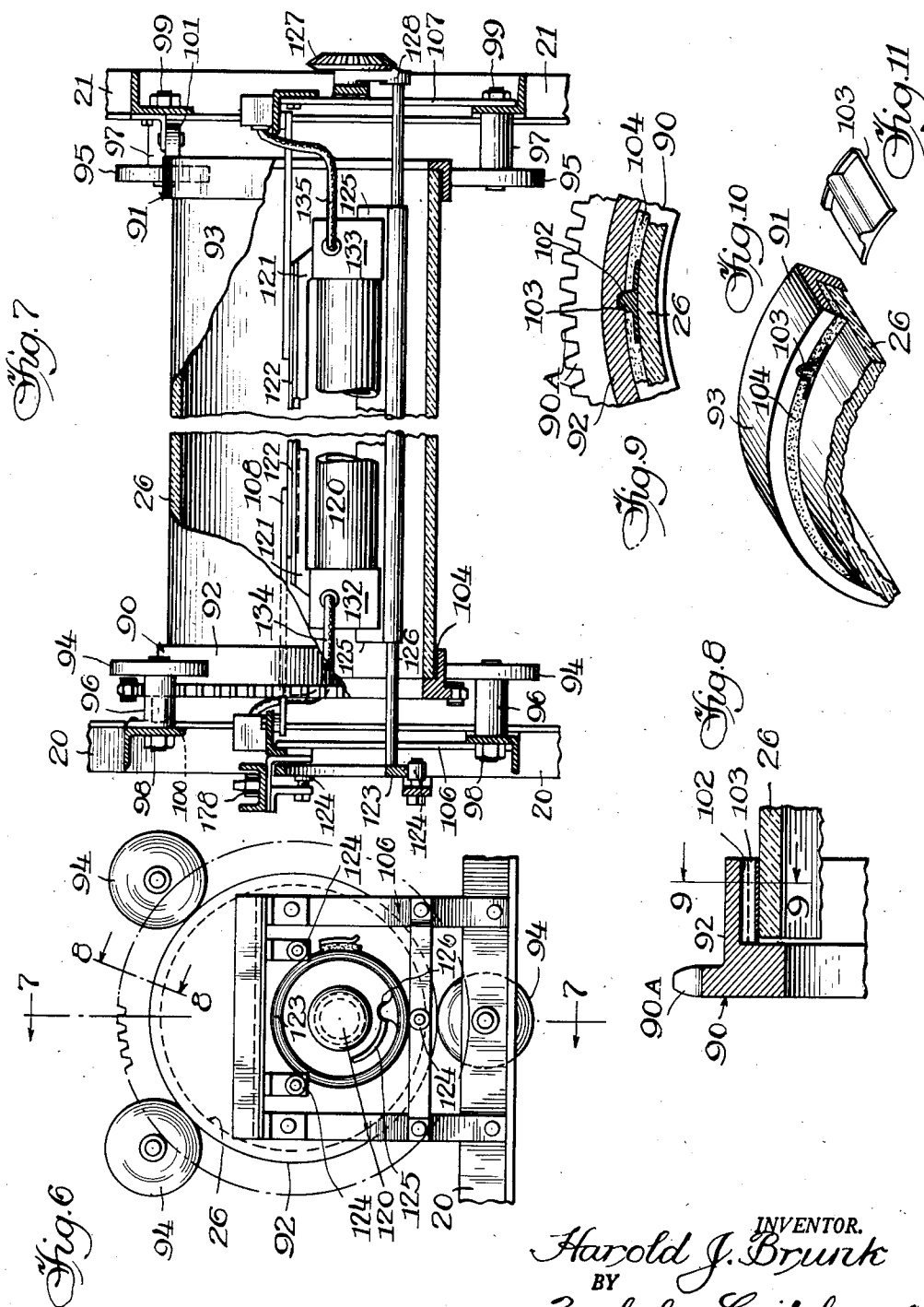
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CYLINDRICAL PHOTOPRINTING MACHINE

Filed April 4, 1947

8 Sheets-Sheet 6



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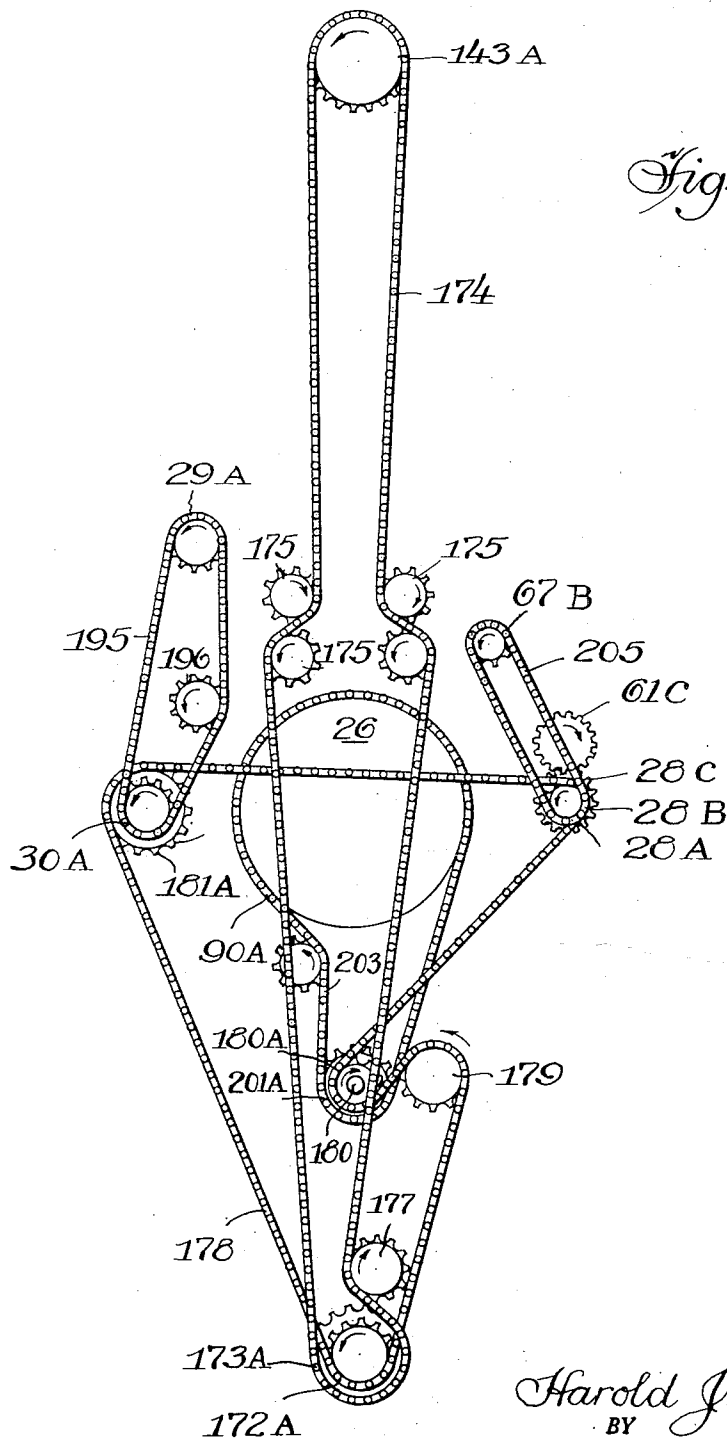
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CYLINDRICAL PHOTOPRINTING MACHINE

Filed April 4, 1947

8 Sheets-Sheet 7



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CYLINDRICAL PHOTOPRINTING MACHINE

Filed April 4, 1947

8 Sheets-Sheet 8

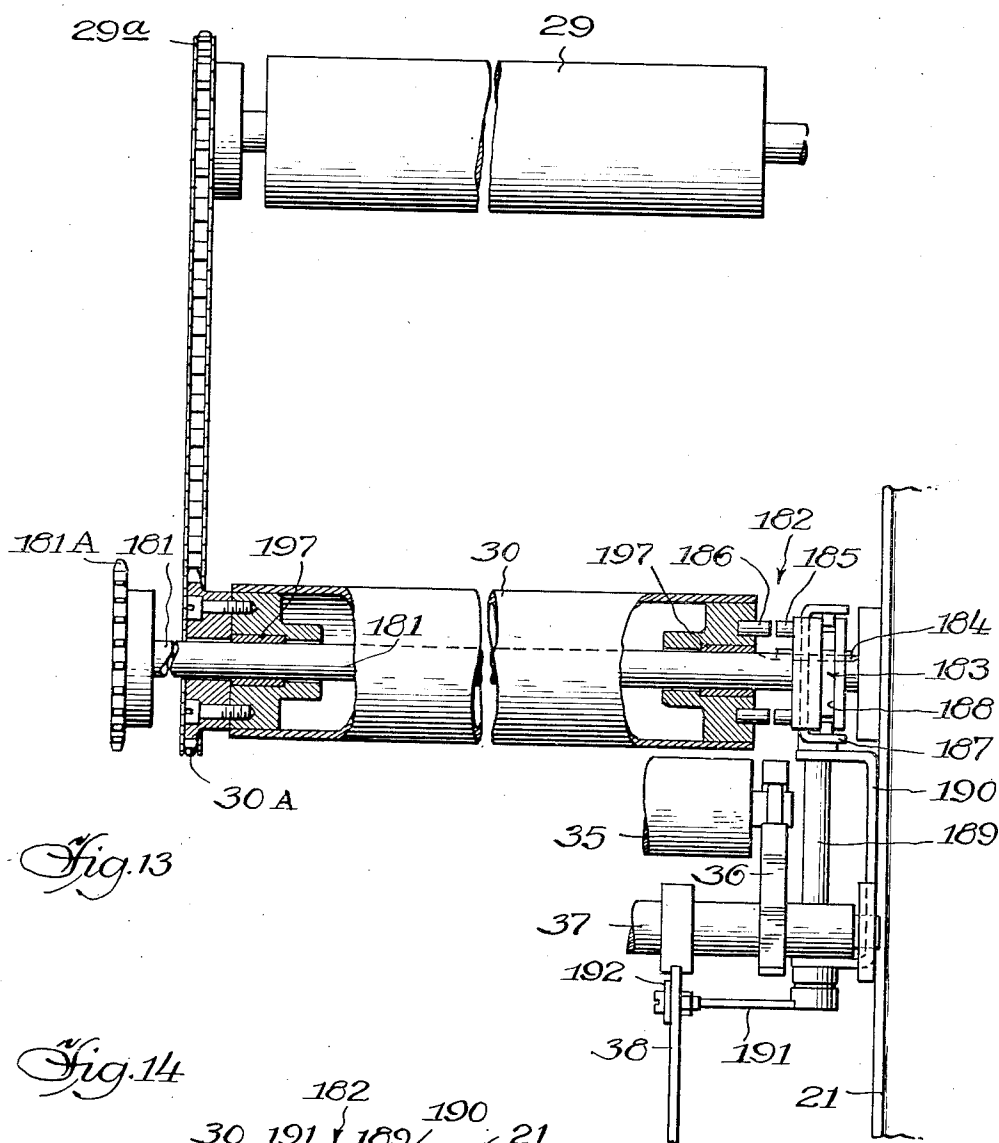


Fig. 13

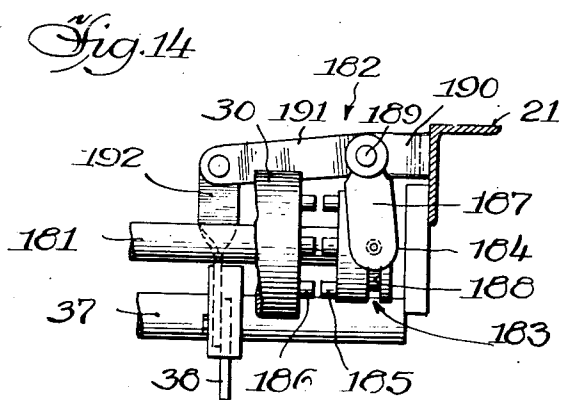


Fig. 14

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UNITED STATES PATENT OFFICE

2,641,980

CYLINDRICAL PHOTOPRINTING MACHINE

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tion of Delaware

Application April 4, 1947, Serial No. 739,448

6 Claims. (Cl. 95—77.5)

1

This invention relates to an improved machine for reproducing tracings and the like.

Machines of this type comprise printing mechanism, a processor, or developing mechanism, and means for conveying the print from the printer to the developer so that the entire reproduction process can be carried on continuously. Difficulty is frequently experienced in causing separation of the tracing from the print at a point between the printer and the developer, since the two tend to adhere to each other with the result that the print may be discharged with the tracing and not carried through the developer, or that the tracing may be carried through the developer with the print. Furthermore, the action of the machine is unpredictable in this respect since the electrostatic force which causes the adhesion varies from time to time due to atmospheric conditions. The result is that constant attention is necessary, which often requires a second operator when the machine is operating at full capacity. A further disadvantage in the use of a machine of this type is that it is not practical to cause it to operate at full speed, for if conditions are such that the prints and tracings adhere to each other, it is not possible for the operator to manually separate the two when the machine operates at a speed of more than 5 to 10 feet per minute, especially where the construction of the machine is such that the length of the path between the printer and the developer is less than several feet.

It is an object of this invention to provide a machine for reproducing tracings and the like which is characterized by improved uniformity of operation with respect to the separation of the prints and the tracings.

In the embodiment of the invention shown herein, the invention has been applied to a machine for reproducing tracings by the so-called dry diazo-type process, although the invention, for the most part, is equally applicable to machines for use in the wet diazo-type process, or in a blue print process. The difference in such machines resides generally in the particular type of processor or developer, as it is referred to herein, which is employed. Furthermore, certain aspects of the invention are equally applicable to any printer of this general type, irrespective of whether or not it operates in conjunction with a developer.

A further object is to provide a reproduction machine of increased operating speed. The chief difficulty in providing a so-called high speed machine, that is, one operating up to a speed of 30 feet per minute, is the difficulty in obtaining a

2

sufficiently intense light source. The present invention contemplates the use of a high pressure mercury vapor tube which is generally considered preferable to arc lamps and other presently known sources of actinic light insofar as maintenance is concerned, and insofar as space considerations in the design of the machine are concerned. However, high pressure mercury vapor tubes radiate so much heat that the prints and tracings are likely to be scorched, and the life of the conveyor belt or tape is considerably diminished. Therefore, when high pressure mercury vapor tubes are used, a tube of lower wattage, and hence lower intensity, must be selected which in turn cuts down the operating speed of the machine as compared with a machine which employs arc lamps or the like.

Although various means have been proposed for cooling the mercury vapor tube, in order to permit the use of a higher wattage tube, the cooling means suggested in the prior art are not practical for the reason that these tubes operate at or above a critical temperature. If the tube itself is cooled below this critical temperature, the mercury will be condensed and the light will go out.

The present invention provides a novel method of removing the heat developed by these tubes without cooling the tube below its critical temperature. Therefore, one is enabled to use a higher wattage tube than that formerly used, and hence a more intense light source is provided which permits increased operating speed as compared with the prior art machines.

Another object is to provide in a printer of the type embodying a revolving glass cylinder, which defines the path of the tracing and print during exposure, an improved mounting for the mercury vapor tube within the revolving cylinder which permits easy removal of burned out tubes and replacement thereof.

Other objects are to provide improved means of mounting the cylinder in the machine, improved means of associating the glass portion of the cylinder with its associated parts, and improved means disposed within the cylinder for regulating the amount of exposure, whereby the effective intensity of the light source may be regulated mechanically.

Still another object is to provide an improved means for releasing the tension of the belt or tapes which convey the print and the tracing through the machine, so that the tracing and paper, or either, can be withdrawn from the machine practically instantaneously, if desired.

Still further objects are to provide an im-

proved machine in which the parts are arranged so as to provide a path for the prints which is devoid of abrupt bends, except for such bends as are necessary for effecting print and tracing separation, thereby avoiding the tendency to impart a curl to the prints and tracings, and to provide a path in which the prints and tracings move in the natural direction, that is, away from the operator, and in which they are fed to delivery trays which are within easy reach of the operator. In this connection, an improved arrangement is provided whereby the tracings are stacked in the delivery tray in the same order in which they are fed into the machine. Also, an alternative delivery means is provided at the rear of the machine, together with means to guide the developed prints into either said first mentioned delivery tray which is within reach of the operator, or into the delivery means at the rear of the machine.

Other objects, features and advantages will become apparent as the description proceeds.

With reference now to the drawings, in which like reference numerals designate like parts,

Fig. 1 is a front elevation of a preferred embodiment of this invention, the machine being shown with the housing removed, and also with certain parts of the mechanism on the left hand side of the machine being removed to better illustrate the construction;

Fig. 2 is a right hand view of the machine shown in Fig. 1;

Fig. 3 is an enlarged sectional view of a portion of the machine taken along line 3—3 of Fig. 1, certain parts being omitted for the purpose of clarity;

Fig. 4 is a more detailed enlarged sectional view of the machine taken along line 4—4 of Fig. 1;

Fig. 5 is a detailed section of the upper portion of the machine taken along line 5—5 of Fig. 1;

Fig. 6 is an end view of the printing cylinder and its associated parts;

Fig. 7 is a section taken along line 7—7 of Fig. 6;

Fig. 8 is a detailed section taken along line 8—8 of Fig. 6;

Fig. 9 is a detailed section taken along line 9—9 of Fig. 8;

Figs. 10 and 11 are fragmentary detailed views of certain of the parts shown in Fig. 7;

Fig. 12 is a diagram of the driving means, which would correspond roughly with a left end view of the machine, with all parts omitted except the driving means;

Fig. 13 is a section taken along line 13—13 of Fig. 4; and

Fig. 14 is a plan view of a portion of the mechanism shown in Fig. 13.

In Figs. 1 and 2, the reference numerals 20 and 21 designate generally the left and right frame members of the machine, and the reference numeral 22 designates generally the base which connects the two frames, the remaining cross members, for the most part, being not shown.

At the front of the machine is provided a table 23 at which the operator stands. The lower portion of the machine constitutes the printer 24, and the upper portion constitutes the developer 25. Within the printer is a rotatably mounted glass cylinder 26, around which are disposed a series of tapes 27. Sensitized print paper, hereinafter referred to as "prints," and designated on the drawings by the reference letter P, and tracings, designated by the reference letter T, are maintained in superimposed position against the

surface of the cylinder 26 by the tapes 27, and are advanced through the printer by said tapes. The tapes are arranged in side by side relationship and are tensioned around a front roller 28, an upper rear drive roller 29, a lower rear drive roller 30, and an idler roller 31. Also provided is a front idler roller 32 which is pivotally mounted by a pair of arms 33 on a cross shaft 34. A rear idler roller 35 is pivotally mounted by a pair of arms 36 on a shaft 37, as shown in Figs. 4 and 13. The shaft 37 is rotatably mounted with respect to the left and right frames 20 and 21, and the arms 36 are keyed to the shaft, as is also a lever 38, which extends downwardly from the shaft as shown in Fig. 3. A link 39 connects the lower end of lever 38 with the upper end of a crank 40, the crank being pivotally mounted on a cross rod 41, and including a foot treadle 42 which projects forwardly at the lower part of the machine.

By stepping on the foot treadle 42, the crank will be rocked in a clockwise direction, thereby causing rotation in a counterclockwise direction of the rear idler roller assembly which includes the pivotally mounted idler roller 35 and the lever 38, thereby releasing the tension on the tapes 27. A tension spring 43, disposed between the crank 40 and the frame of the machine urges the crank in a counterclockwise direction and serves to maintain the idler 35 in tape tensioned position.

Means are also provided for shifting the position of pivotally mounted front idler 32 so as to release the tension on the tapes at this point simultaneously with the tension release at the rear of the machine. This means includes an arm 45 which projects forwardly from and is secured to the right hand one of the arms 33 in which the idler 32 is journaled. A link 44 connects arm 45 with a portion 43 of the crank 40, as shown in Fig. 3. Thus, the front idler assembly, which includes the idler 32 and the supporting arms 33, is rocked in a clockwise direction when the foot treadle 42 is depressed. The shaft 34 is suitably journaled with respect to the side frames of the machine, and the arms 33 are keyed to the shaft as is a downwardly projecting lever 46. A tension spring 47 between lever 46 and a front portion of the frame serves to maintain the front idler assembly in tape tensioned position. Thus, it will be seen that depression of the foot treadle will release the tension on the tapes both in front and in back of cylinder 26. Means hereinafter described also disconnect the rear drive rollers 29 and 30 from the driving mechanism simultaneously with the tension release to increase the effectiveness of the tension release, thereby permitting the prints and the tracings to be withdrawn from the machine, in the event of inadvertent insertion.

At the right end of the machine is disposed a duct 50 which leads from a blower 51 forwardly to the right end of cylinder 26, the duct being provided with an opening or nozzle 52 which serves to direct a blast of air in a lateral direction in just the upper portion of the cylinder. The intake of the blower comprises an intake duct 53 which connects with a second vertically disposed duct 54 which in turn leads from a suction box 55 which is disposed transversely of the machine, somewhat above and behind the cylinder 26. The suction box 55 is provided with a curved front wall 56 having a plurality of slots 57 formed therein. These slots are spaced from one another by a distance equivalent to the width of the tapes 27, and suitable guiding means, not shown, are provided to insure that the slots are not covered by the

tapes, as the tapes are advanced across the front wall of the suction box.

Operation of the blower will cause air to be drawn through the slots 57 into the suction box, and then through the ducts 54, 53, the blower 51 and the duct 59, from which is blown a blast of air that serves to cool the cylinder 26. The air passing through the slots 57 serves to maintain the prints against the tapes, or stated conversely, the suction through the slots maintains the prints against the tapes so that they are fed upwardly by the tapes to the developer as will be hereinafter described. A motor 59 is provided for the blower 51.

As shown in Figs. 1 and 4, a series of feeding tapes 60 is provided for cooperation with the tapes 27 in order to convey the superimposed tracings and prints from a feeding point, just rearwardly of table 23, to about a point where the tracings and prints will be engaged by the cylinder 26. The feeding tapes 60 are tensioned between a drive roller 61, a sheet steel guide 62, and an idler roller 63. The sheet steel guide is curved, and serves to separate the return span of the feeding tapes from the feeding span. The lower portion of the sheet steel guide is provided with a beaded edge 64 which is disposed between idler roller 32 and cylinder 26, and over which beaded edge the tapes 60 slide. It will therefore be seen that the provision of the sheet steel guide permits the feeding tapes to follow a concave path which complements the convex path of the tapes 26 as they pass over the idler 32. In other words, the idler 32 also serves to define the path of the feeding tapes. The geometry of the arrangement is such that as the idler 32 is rocked into tension released position with respect to tapes 27, the tension on tapes 60 is also released. Thus, in the event that the leading edges of a tracing and print have inadvertently been inserted into the feeding tapes 60 and the tapes 27, by depressing the foot treadle 42, the tension on both sets of tapes will be released, thereby permitting withdrawal of the print and tracing.

A tracing stripper 65, suitably disposed above the cylinder 26, and comprising a plate terminating in bronze fingers which bear against the surface of the rotating cylinder, is provided to strip the tracing from the cylinder and to guide the leading edge thereof to a point where the tracing is engaged by a plurality of delivery tapes 66. A plurality of delivery tapes 66, arranged side by side as shown in Fig. 1, are provided, and these are tensioned between drive roller 67, idler roller 68 and a tension roller 69. Rollers 67 and 68 are mounted on suitable brackets 72 which are spaced from each other by a cross rod 71. The tension roller 69 is pivotally mounted about the cross rod by means of arms 70. A bracket on one of the arms 70 carries an adjusting screw 82 which bears on the adjacent bracket 72, as shown in Fig. 4 so that by tightening up the adjusting screw, the delivery tapes may be tensioned. It is understood that the same construction is provided at the opposite end of the delivery tape assembly from that shown in Fig. 4.

Also carried on cross rods 71 are a plurality of stripper loops 75 which partially surround the drive roller 67. These not only serve to maintain the lateral spacing of the tapes, but also serve to separate the tracing from the tape with the result that the forward edge of the tracing will drop downwardly into delivery tray 76. It will be observed that the forward edge of the tracing stripper 65 extends beyond the rear edge of the

delivery trap 76, so that by the time that the trailing edge of the tracing is cleared of the tracing stripper, it will drop into the tray on top of previously delivered tracings. Since the tracing, in passing from the feeding point to the delivery tray has been inverted, the stack of tracings in the delivery tray are arranged, with respect to their cylinder contacting surfaces, in the same order in which they have been fed into the machine. In other words, assuming that an operator is making a number of prints of perhaps ten different tracings, he can initially take these tracings one by one from a stack placed on the table 23, and after he has gone through the stack and is ready to run them through a second time, he removes the stack which is found in the tracing delivery tray, and inverts it and places it on the table, and the tracings will be in the same order in which they were initially.

In reproducing machines of this type, it has been found the tracings and the prints frequently adhere to each other, presumably due to an electrostatic force which is generated as the prints and tracings are maintained in contact with each other as they pass around the cylinder. In order to effect separation, the lower portion of the wall 56 of the suction box is provided with a curve, as indicated by the reference numeral 79. Thus the print, which is caused to adhere to the tapes 27 by the suction created in the suction box 55, will be caused to follow the curved path which the belt takes as it passes over the curved portion 79. The radius of the curved portion is sufficiently small with respect to the stiffness of the minimum thickness of tracing paper commonly used as to cause a slight separation of the leading edge of the tracing from the print. In the event that the print is in the form of a cut sheet, the leading edge of which is coextensive with, or overlaps slightly, the leading edge of the tracing, the air draft or air blast which blows downwardly into the slots 57 will catch the separated leading edges of the tracing and the cut sheet, and with a wedging action, will serve to accentuate or increase the separation to such an extent that the combined weight and stiffness of the tracing will be sufficient to effect further separation as the tracing and print are advanced beyond the contact zone. The combination of the air blast, the suction, and the change of direction in the print path have been found to be very effective in causing separation under most conditions, so long as the leading edge of the tracing does not overlap the leading edge of the print.

When the print is in the form of a web, the effect of the air blast is missing, except along the side marginal portions. However, separation of the tracing from the print web is always more readily effected than when cut sheet prints are used due to the inability of the print to follow the tracing.

Although it has been found that separation can be effected by the means herein described with much greater uniformity than with the means of the prior art, additional means to assist in the separation are provided when atmospheric conditions are especially adverse. This means consists in causing the cylinder 26 to rotate at a different speed than the speed at which the print and tracing are carried around the cylinder by the web. This differential movement has been found to cause what is believed to be an electrostatic force between the tracing and the glass of the cylinder which is greater than the force be-

tween the tracing and the print. Thus, as the tracing and the print leave the contact zone, and the print is caused to follow the path of the belt, by means of the suction, the tracing will tend to remain in contact with the glass of the cylinder until such time as it is separated therefrom by the tracing stripper 55. Although the differential movement herein referred to may be the result of causing the cylinder to move either slower or faster than the movement of the tracing, it has been found that it is preferable to cause the cylinder to move faster. At other times, that is, when the differential movement is not desired, the cylinder is caused to rotate by its contact with the tapes, and therefore, it moves at the same rate of speed. The manner in which the cylinder is mounted, and the optional driving means therefor which cause the differential movement, are pointed out hereinafter. The manner in which the cylinder is mounted is shown in Figs. 6 to 11, inclusive. A sprocket ring 90 is secured to the left end of the glass cylinder 26, and a plain ring 91 is secured to the right end. These rings are provided with skirt portions 92 and 93, respectively, which are preferably machined so as to provide a smooth cylindrical surface. These skirt portions are engaged by three supporting rollers 94 and three supporting rollers 95, respectively, with the result that a low friction centerless means of rotatably supporting the cylinder is provided. The supporting rollers 94 and 95 include hub portions 96 and 97, respectively, which are rotatably mounted on stub shafts 98 and 99 which project from suitable portions of the left and right frames 20 and 21, respectively. End thrust rollers 100 and 101, respectively, mounted in suitable brackets engage the end surfaces of rings 90 and 91, respectively, so as to define the lateral position of the cylinder 26. Thus, there is no danger of such lateral shifting of the cylinder as to cause skirt portions 92 to become disengaged from their respective supporting rollers.

The glass cylinder 26 is cushioned from the inner surfaces of the skirt portions 92 and 93 by means of a strip 104 of felt or like material. The felt may be cemented to the skirt portion and to the cylinder by a suitable cement, such as litharge glycerin or sodium silicate cement. In order that the felt mounting will not be subjected to a shearing action, especially when the cylinder is being driven at a differential speed, keys 103 are provided to lock the rings 90 and 91 directly to the cylinder 26. Such a key is shown in Fig. 11, and it will be observed that it is provided with a base which conforms generally to the curvature of the cylinder so that the key may be cemented thereto by a suitable cement, such as sodium silicate cement. A ridge portion of the key projects upwardly into a groove or keyway 102 formed in the ring, as shown in Figs. 8 and 9 with respect to the ring 90, and in Fig. 10 with respect to ring 91. It will be observed that the felt strips 104 are interrupted to permit engagement of the key with the groove 102. By means of this construction not only is the glass cylinder 26 protected from shock, but also the torque is transmitted directly from the rings to the cylinder, or vice versa without exerting such stress on the felt cushion members as would tend in time to destroy their cushioning effect.

As pointed out above, heat is removed from the glass cylinder 26 so as to avoid scorching of the tracings, prints and tapes, by means which do not tend to reduce the temperature of a high

pressure mercury tube lamp 120 below its critical operating temperature. This heat removal is accomplished by dividing the cylinder transversely into two portions by means of a partition 108. The cooling air blast which emerges from the duct opening 52 is caused to flow through the upper portion, to cool that portion of the glass cylinder which is being rotated above the partition 108, whereas the mercury tube 120 is disposed in the lower portion and is not subjected to the cooling effect of the air blast. Thus, sufficient heat is removed from any particular portion of the glass cylinder as it rotates above the partition as to avoid scorching during its subsequent rotation below the partition. That portion which is below the partition may be termed the contact zone, and that portion above the partition may be termed the heat removal zone. The partition is suitably supported by frames 106 and 107 which may be bolted to the side frames 20 and 21, respectively. The partition itself, at its marginal portions is provided with spaced strips 109 and 110, respectively, as shown in Fig. 4, thereby forming slots. Seals 111 and 112 are disposed in the slots formed by spaced strips 109 and 110, and are urged outwardly against the inner surface of the glass cylinder 26 by means of springs 113 and 114, respectively. The seals are provided to prevent the air blast in the heat removal zone from leaking into the contact zone, and may comprise any suitable flexible seal, which will withstand the temperatures of this particular environment. As shown, each seal comprises a felt strip 115 which is mounted in a suitable holder 116, against which springs 113 or 114 may bear to urge the seal outwardly.

The tube 120 is supported by a T strip 121, which is slidably received in guides 122, as shown in Fig. 4. The guides are formed on the under side of partition 108. The T strip is suitably secured to the terminals 132 and 133 of tube 120, conductors 134 and 135 connecting the terminals to suitable supply conductors, not shown. It will be seen from Fig. 7 that by disconnecting the conductors, the whole assembly, including the T strip, the terminal members and the tube may be slid to the left, as viewed in that figure, and removed from the cylinder.

A ring 123, shown in Figs. 6 and 7, is rotatably supported by three guide rollers 124 which are mounted on frame 106. At the right hand end of the cylinder, a beveled gear 127 is rotatably mounted on frame 107, and includes an arm 128. A rod 126 is supported at one end by arm 128, and at the other end by ring 123, and a shutter 125 is carried on the rod. Thus, the angular position of the shutter with respect to the tube 120 may be regulated.

It will be observed that tube 120 is eccentrically mounted with respect to the cylinder. Hence the distance between the tube and the path of the print and tracing varies with the result that the intensity of the light source with respect to the print and tracing varies, according to the inverse square law, depending upon the position of the particular portion of the print and tracing which is being considered. Thus, when the shutter is in the position shown in Fig. 4, it will block the more intense light radiations, whereas the shifting of the shutter to one side or the other of the vertical median plane of the tube and cylinder assembly will cause the blocking of the less intense radiation. Thus, an effective means of adjusting the average amount of radi-

ation received by any particular portion of the print and tracing as it travels through the contact zone is provided.

As shown in Figs. 2 and 4, a bevel gear 129, carried on a shaft 130, meshes with the bevel gear 127, so that the position of the shutter may be regulated by rotation of a control knob 131 which projects from the front of the machine. The use of the ring 123 to support the shutter at its left end, provides a means which will not obstruct the path of the tube assembly as it is slid out of the cylinder for replacement purposes, in the manner pointed out above.

The developer 25 is disposed immediately above the printer 24, and the parts are so arranged that the feeding point 139 of the developer is disposed above the wall 56 of the suction box 55, so that prints which are carried upwardly by the tapes 27 may be stripped therefrom and guided directly into the developer at the feeding point. In this connection a scraper 138 is provided to strip the prints from the tapes and guide them to the feeding point. The scraper may desirably terminate in fingers which extend into the space between the several tapes 27 to facilitate the stripping.

As indicated previously, the developer may be of any type which is required for processing the type of prints which the machine is adapted to make. The machine shown is adapted to make diazo type prints, and in this connection an ammonia gas developer is provided which is of the same general type as described in my Patent No. 2,384,155. This developer comprises a sheet metal closure 140, which is suitably supported in the upper portions of frame members 20 and 21. The rear wall 141 of the closure is perforated, as shown in Fig. 5, and a belt 142 is caused to slide over said perforated rear wall to expose a print to the ammonia fumes which are generated within said closure.

The belt 142 is tensioned around a top driving roller 143, a bottom roller 144, and two sets of tension adjusting rollers 145. The perforated wall is preferably curved as shown in the drawing, to permit uniform contact of the print and the wall.

Disposed within the closure are ammonia trays 146, 147 and 148 which are arranged one above the other and which drain from one into the other, as pointed out in said prior patent. An ammonia supply pipe 149 extends into said closure and terminates above the upper tray 146 so that ammonia water may drip into the uppermost tray.

Heating elements 150 are provided which serve to heat the ammonia water to release the ammonia gas therefrom, and which also serve to maintain the various metal parts which form the closure and which are disposed within the closure at a temperature which will prevent condensation of any water vapor. The ammonia gas thus released passes through the perforated wall and impinges upon the coated surface of the print, or upon those portions of the coated surface which are exposed by the perforations, to develop the latent image thereon. The perforations are of such shape and are so arranged with respect to each other that in the course of its passage across the plate, every portion of the coated surface of the print will be subjected to the developing action of the ammonia gas.

Arranged across the top of the machine, and above the developer, is a duct 151 which communicates with the intake side of a motor driven

blower 152. The lower wall of the duct 151 is provided with an opening 153 which serves to remove from the developer any ammonia gas which escapes between the perforated wall and the belt, and which also serves to remove the major portion of the ammonia gas which emanates from the developed print. A perforated screen 154 is disposed across the opening 153 and serves to guide the developed print around the upper driving roller 143 and the belt from which it will be delivered into the rear print delivery tray 160. In the event that the print is in the form of a web, a rewind delivery roll 161 may be provided, as shown in Fig. 2.

A front print delivery tray 156 is also provided for the convenience of the operator, and a shiftable deflector 155 is provided so that the operator may, at his option, cause the developed prints to be delivered to the front print delivery tray 156. As shown in Fig. 5, the shiftable deflector 155 is hingedly mounted to the front edge of the perforated screen 154. The shiftable deflector comprises a portion 162 which, when the deflector is in its operative position, as shown by solid lines in Fig. 5, engages the surface of the belt 142, and strips the print from the belt. The remainder of the deflector serves to deflect the strip leading edge of the print downwardly into the front delivery tray 156. The portion 162 is provided with perforations 163 which serve to avoid obstruction of the upwardly directed air stream flowing into the duct 151. Suitable means are provided to maintain the shiftable deflector in its solid line operative position. At other times the deflector is maintained in the dotted line position shown, in which it cooperates with the perforated screen 154 in guiding the leading edge of a print around the top driving roller 143 and into the rear delivery tray. When in its dotted line position, the deflector also serves to canalize the air stream to provide more effective removal of the ammonia gas from the print surface.

It will be observed that the feeding point of the developer 139 is formed by the bite of the belt 142 and a curved wall portion of the closure 140, and that the scraper is aligned with this bite. An additional guiding element 164 is provided in front of the scraper 138 which permits undeveloped prints to be fed manually into the developer, when continuity of printing and developing is not desired.

Fig. 12 shows more or less diagrammatically, the means by which the various elements of the printer and developer are driven in timed relationship to each other so as to provide continuity of operation. A motor 170, provided in the lower portion of the machine, drives a drive shaft 172 through reduction gearing contained in gear box 171. A sprocket 172A is mounted on the drive shaft 172 and is continuously driven thereby. A second sprocket 173A is mounted coaxially with sprocket 172A and is driven through a releasable clutch 173. The developer 25 is driven by a chain 174 which extends between sprocket 173A and a sprocket 143A which is mounted at one end of the top driving roller 143. The chain also engages various idler sprockets 175 and 177. The rewind delivery roll 161 may be suitably driven from one of the idlers 175 by means not shown. The arrangement is such that the developer belt 142 is caused to move at the same surface speed as the tapes 27 of the printer. A clutch handle 176 is provided for releasable clutch 173 so that the developer may be disen-

gaged from the printer when it is desired to use only the printer.

The driving mechanism for the printer comprises a chain 178 which is driven by the drive shaft sprocket 172A, and which passes around an idler 179, and drag shaft sprocket 180A, and sprocket 28A which is mounted at one end of the front roller 28, and a sprocket 181A which is keyed to one end of a shaft 181, upon which shaft is mounted the lower rear drive roller 30.

As shown in Fig. 13, the roller 30 is mounted on shaft 181 by means of sleeve bearings 197. Rotation is imparted from the shaft 181 to the roller 30 by means of a clutch designated generally by the reference 182, and which is disposed at the opposite end of the shaft 181 from the sprocket 181A. The clutch 182 comprises a clutch plate 183 which is caused to rotate with the shaft 181 by means of a key 184. Driving pins 185 extending from the clutch plate 183 are adapted to engage between correspondingly positioned driving pins 186 which project from the end surface of roller 30. Means are provided to shift the clutch plate 183 in and out of driving position, which means are operated by the tension release device previously described.

The key 184 permits axial shifting of the clutch plate by means of a yoke 187 having pins which engage a groove 188 in the clutch plate. The yoke 187 is mounted on and rotates with a vertical shaft 189 which is journaled in a bracket 190, secured to frame 24. The lower end of the shaft 189 carries a lever arm 191 which is connected to the lever 36 by means of a link 192, these parts also being shown in Fig. 4. The compression spring 194, surrounding link 192, is confined between a portion of the frame and the lever arm 191 to urge the clutch into engaged position. Thus when the foot treadle 42 is depressed, thereby rocking the rear idler roller assembly, which includes rear idler roller 35, in a counterclockwise direction, the link 192 will be pulled forwardly, thereby rocking the assembly, including the vertical shaft 189 and the yoke 187 so as to disengage the clutch 182. Since the upper drive roller 29 is driven from the lower drive roller 30, there will be no pull exerted on the tapes 27 which would serve to counteract the release of the tension on the tapes, both in front of and at the rear of the cylinder 26. This is important, since the mere release of the belt tension may not be sufficient to permit withdrawal of the prints and tracings after they have come into engagement with the glass cylinder. This is for the reason that continued rotation of the rear drive rollers 29 and 30 will exert a snubbing action on the tapes which will tend to maintain sufficient tension on those portions of the tapes which are in contact with the rotating drum to prevent withdrawal. Furthermore, by the present arrangement, when the drum is not being positively driven, the rotation of the drum will be stopped, merely by pressing the foot treadle.

The upper rear drive roller 29 is provided with a sprocket 29A so that the upper roller may be driven from the lower roller 30 by means of a chain 195 which extends between sprocket 30A and a sprocket 29A secured to the roller 29.

The drag shaft sprocket 180A is secured to a drag shaft 180 which is journaled in left frame 20 and in a suitable support 200 in the lower part of the machine. A sprocket 201A is concentrically mounted with respect to drag shaft 180, and is releasably connected thereto by means of a clutch designated generally by the reference

numeral 201. A clutch lever 202 is provided for operating the clutch. A chain 203 connects sprocket 201A with the teeth 90A of the sprocket ring 90 of the cylinder 26. Thus, by operation of the clutch lever 202, the cylinder may be positively driven, or it may be caused to idle, in which event it is driven by the tapes 27. The sizes of sprockets 180A and 201A are such that the cylinder is caused to rotate at a different surface speed from that of the tapes 27, for the purpose of building up an electrostatic force to facilitate the separation of the print from the tracing as pointed out above. Other advantages of this differential speed of rotation are pointed out in my Patent No. 2,364,514, and particularly the differential rotation prevents the printing of undesired images on the paper, which images may be caused by irregularities or aberrations in the glass cylinder.

A spur gear 61C, suitably mounted at one end of the drive roller 61 for the feeding tapes 60, meshes with and is driven by a spur gear 28C mounted at the corresponding end of front drive roller 28. The gearing is such that the feeding tapes 60 will be driven at the same speed as the tapes 27.

A sprocket 67B, mounted at one end of the drive roller 67 for the delivery tapes 66 is engaged by a chain 205 which chain also meshes with a sprocket 28B, carried by front drive roller 28. The arrangement is such that the delivery tapes 66 will be driven from the drive roller 28 at the same speed as that of the tapes 27.

Thus, it will be seen that the motor 170, through the various chains and sprockets above mentioned, drives all of the drive rollers for tapes 27, namely rollers 28, 29 and 30; it drives the feeding tapes 60, the delivery tapes 66, and optional means are provided so that it may also drive the cylinder 26. As indicated above, the developer is driven from a motor 170 through a clutch 173.

The operation of the machine has been described in detail in connection with the descriptions of the various parts and subassemblies of the machine. However, in order that the operation may be fully understood, a brief resume will be given.

Energization of the motor 170 will cause the tapes 27, 60 and 66 to be driven. Thus, a superimposed print and tracing which are fed between tapes 27 and 60, at the feeding point of the machine, will be advanced into contact with the glass cylinder 26, and will be advanced around the contact zone of the cylinder. The cylinder may be driven by the tapes 27, in which event it rotates at the same surface speed as the tapes, or the cylinder may optionally be driven at a different speed by operation of the clutch lever 202. It being assumed that the circuit is established through the high pressure, mercury vapor tube 120, the illumination thereof will cause the formation of a latent image on the print P. The degree of exposure may be regulated by regulating the position of the shutter 125, and it may also be regulated by suitable means, not shown, for regulating the speed of the motor 170.

As the print and tracing leave the contact zone, the path of the tapes 27 depart from the surface of the cylinder 26, and the print is caused to follow the tapes, due to the suction created within the suction box. It will be observed that the print will adhere to the tapes even though the path of the tapes overhangs beyond the vertical. Separation of the tracing from the print is caused

by a combination of two factors. The first factor is the provision of means for effecting a change of direction of the tape path, which change may be characterized as comparatively abrupt with respect to the stiffness of the tracing. The second factor is the down draft which will catch the leading edge of the tracing and accentuate the effect of the first mentioned factor. A still third factor which causes separation is the differential movement of the cylinder with respect to the tracing, and means are provided for optionally bringing this third factor into play when the first two factors do not accomplish the desired result.

As a result of the above factors, the tracing is caused to follow the path of the cylinder, from which it is stripped by stripper 65 and guided to the delivery tapes 66, and is then deposited in the tracing delivery tray 76 in the proper order.

The print is carried upwardly across the front wall of the suction box, and is stripped from the latter and fed into the developer. The developed print may be delivered either to the front or the back of the machine at the option of the operator, and when the print is in the form of a continuous web, means may be provided at the rear of the machine to roll up the web so that it may be handled conveniently.

The suction which causes the print to follow the tapes 27, and the correlative down draft which assists in the separation, are created by blower 51, which also delivers a blast of air into the heat removal zone of the cylinder 26, thus providing means for cooling the cylinder and permitting the use of a higher wattage mercury vapor tube than has previously been used in this type of machine. The emerging blast from the open end of the glass cylinder may be picked up by a branch conduit 236, which, together with the developer exhaust, may be removed from the building by means of the developer blower 152.

As shown in Figs. 1 and 2, a counterweighted damper 208 may be provided in the wall of the duct 54 in order to prevent diminution of the cooling blast in the event that the print is of such width as to cover substantially all of the slots in the wall 56. Thus, alternative and automatically operating intake means may be provided when the normal intake is blocked by the width of the print. The suction provided by the blower is a low pressure suction, and the volume of air moving through the blower is relatively high. Thus, the slot area can be comparatively great, thereby rendering the arrangement effective irrespective of whether small prints or large prints are used. As an example, the blower 51 may be one which delivers about 900 cubic feet of air per minute, and creates and develops about a 4 ounce vacuum in the suction box. The total slot area may approximate 20 square inches.

Since the developer belt and the printer tapes are driven by the same motor, motor 170, they are synchronized which permits continuity of printing and developing. Clutch handle 176 provides a convenient means for disengaging the developer when it is desired only to print.

The usual control may be provided for the circuit, including motor 170, and the circuit including the printer blower motor 59, may be controlled by the same control means.

A second circuit may be provided for the mercury vapor tube 120 and a thermostatic control for this second circuit is preferably provided to cause this circuit to be opened when the temper-

ature of the cylinder rises beyond a predetermined degree, as would occur when the cylinder is declutched and the tape tension released.

The developer blower 152, and the developer heating elements 150 are preferably controlled separately from the other controls mentioned for the reason that it may at times be desirable to operate the printer without the developer. The usual thermostatic control for the heating elements of the developer may be provided. Suitable means, such as needle valve 207, indicated in Fig. 2, may be provided for regulating the ammonia supply to the developer trays 146, 147 and 148.

Depression of the foot treadle 42 will permit the operator to withdraw a print and tracing from between the tapes 27 and 60, or even from a position in which the leading edges of the print and tracing are confined between tapes 27 and the cylinder 26.

Although only a preferred embodiment of the invention has been shown and described herein, it will be understood that various modifications and changes may be made in the construction shown without departing from the spirit of the invention. The foregoing description and the accompanying drawings are illustrative only and the invention is defined only by the appended claims.

I claim:

1. In a machine for the reproduction of tracings or the like, the combination of a transparent cylinder providing a printing surface, means for rotatably supporting said transparent cylinder, and means for causing a print to be advanced around said transparent printing surface and thence in an upwardly direction, said means including a suction box disposed above said cylinder and provided with a substantially vertically disposed perforated wall having a convexly curved portion disposed opposite said cylinder to form a bite, a plurality of tapes disposed over said transparent printing surface and said perforated wall, means for driving said tapes to cause rotation of said transparent cylinder so that a superimposed print and tracing confined between said tapes and said printing surface will be advanced toward said suction box, said suction box being disposed so that said perforated wall contacts that side of said tapes which is opposite from the side which contacts said printing surface, and means for maintaining a negative air pressure within said suction box whereby said print will be caused to adhere to said tapes as said tapes move upwardly across said perforated wall.

2. A machine for the reproduction of tracings including a rotatably mounted printing cylinder, tapes for advancing a print and a tracing around a portion of the periphery of the cylinder, and means for separating the leading edges of said print and said tracing at about the point that said tapes leave the surface of said cylinder, said means comprising a convexly curved guide for said tapes disposed opposite said cylinder for creating a change in the direction of the path followed by said tapes after said tapes leave the surface of said cylinder, means for establishing a current of air directed toward said curved guide, said curved guide constituting a curved portion of the perforated wall of a suction box and said means for establishing a current of air comprising means for removing air from said suction box.

3. A machine for the reproduction of tracings including a rotatably mounted printing cylinder, tapes for advancing a print and a tracing around

a portion of the periphery of the cylinder, and means for separating the leading edges of said print and said tracing at about the point that said tapes leave the surface of said cylinder, said means comprising a convexly curved guide for said tapes disposed opposite said cylinder for creating a change in the direction of the path followed by said tapes after said tapes leave the surface of said cylinder, means for establishing a current of air directed toward said curved guide, said curved guide constituting a curved portion of the perforated wall of a suction box, and said means for establishing a current of air comprising a blower having an air intake and means connecting said intake with one end of said suction box, and a baffle disposed longitudinally of said suction box to concentrate the flow of air through that portion of said perforated wall which is curved.

4. In a machine for the reproduction of tracings or the like having printing means including a convexly curved transparent glass printing surface, the combination of belt means passing over said surface, a stationary suction box having a convexly curved surface portion which is oppositely spaced from said curved printing surface by a distance sufficient to permit said belt means and a pair of superimposed sheets to pass between said curved surfaces thereby providing a bite, means for evacuating said suction box, said curved surface portion thereof and said belt means being provided with openings so as to cause a current of air to be directed into said bite, means providing a path for said belt means including both of said curved surface portions whereby as the belt means advances, the contact between one side of said belt means and said transparent printing surface will be broken and the opposite side of said belt means will contact the curved surface of said suction box to cause the leading edges of a pair of superimposed sheets to be exposed to said air current in order to separate the same, the suction within said suction box causing the leading edge of one of said sheets to adhere to said belt means after initial separation and thereafter serving to strip the same from the other of said sheets.

5. In a machine for the reproduction of tracings or the like having printing means including a

rotatable glass printing cylinder, the combination of belt means passing over said surface, a stationary suction box having a convexly curved surface portion which is oppositely spaced from said cylinder to provide a bite through which said belt means and a pair of superimposed prints can pass, means for evacuating said suction box, said curved surface portion thereof and said belt means being provided with openings so as to cause a current of air to be directed into said bite, said cylinder and said curved surface portion providing a path for said belt means whereby as the belt means advances, the contact between one side of said belt means and said cylinder will be broken and the opposite side of said belt means will contact the curved surface of said suction box whereby the leading edges of a pair of superimposed sheets will be exposed to said air current in order to separate the same, the suction within said suction box causing the leading edge of one of said sheets to adhere to said belt means after initial separation and thereafter serving to strip the same from the other of said sheets.

6. A machine for the reproduction of tracings or the like as claimed in claim 5, including means for rotating said cylinder in the same direction as the movement of said belt means, but at a peripheral speed which is different from that at which said belt means is advanced whereby the tendency of the sheet adjacent said cylinder to adhere to said cylinder is accentuated.

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