March 24, 1959 F. O. TRUMP 2,878,742

DRY TYPE DEVELOPING TANK APPARATUS

Filed Jan. 16, 1956

FIG. 1.

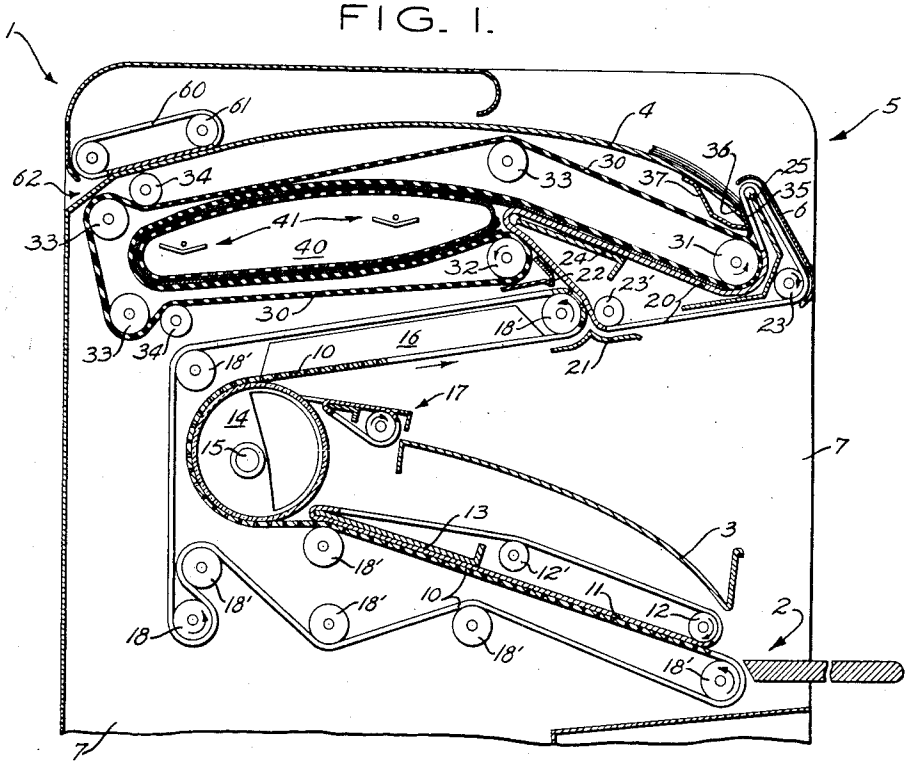


FIG. 2.

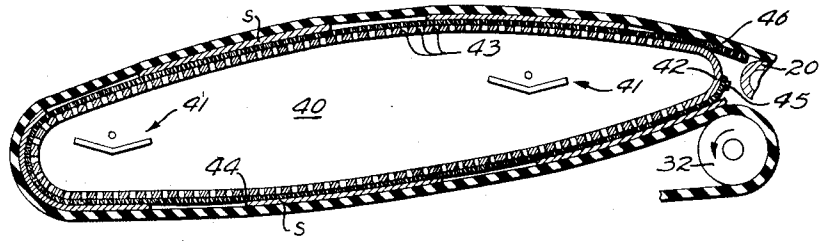


FIG. 3.

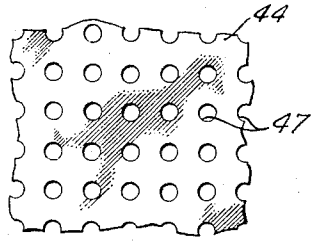
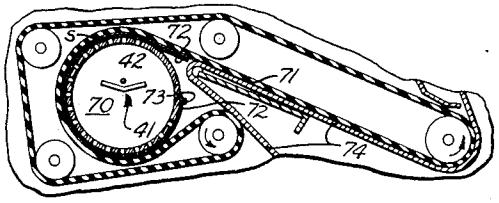


FIG. 4.



INVENTOR.
FREDERICK O. TRUMP
BY Chapin & Neal
ATTORNEYS

United States Patent Office 2,878,742 Patented Mar. 24, 1959

2,878,742

DRY TYPE DEVELOPING TANK APPARATUS

Frederick O. Trump, West Springfield, Mass., assignor to Technifax Corporation, Holyoke, Mass., a corporation of Massachusetts

Application January 16, 1956, Serial No. 559,195

4 Claims. (Cl. 95—94)

This invention relates to improvements in the tank apparatus of a dry type white-print developing machine. Machines of this general character are adapted to print and then develop sheets of sensitized material through exposure to the gases of ammonia and the like. Commonly such machines are known as diazo-type developers since paper sheets coated with diazo-type compounds are often most generally utilized in obtaining prints from the machine. Many other specialty compounds and materials are used, however, and sensitized layers or sheets having extremely delicate emulsion surfaces may be passed through such machines for development of printed matter of various types.

It is an object of the invention to provide an improved tank apparatus in a machine of the character described which will enable a greatly increased degree of control over the conditions necessary for proper development of a wide range of sensitized sheet materials.

Another object of the invention is to provide a machine of increased versatility in that it is capable of more successfully handling the printing and development of a wider range of materials particularly those which require an extended period of exposure to the developing gases in order to obtain a satisfactory print. More specifically the new machine utilizes the maximum developing area possible with a closed vapor generating tank of the type disclosed.

Yet another object is to provide a tank structure having a developing zone capable of handling sensitized sheets at a faster rate of travel, such faster rate being made desirable by the greatly increased speed of printing lamps now commercially available. This object is accomplished without excessively increasing the over-all bulk of a tank or expanding the over-all dimensions of the entire machine. Thus, without sacrificing compactness of the tank or machine as a whole the new structure makes possible a faster rate of delivery for this type of apparatus.

Other objects and advantages of the invention will be seen from the following disclosure of an embodiment thereof.

In the drawings,

Fig. 1 is a vertical section of a machine embodying the invention;

Fig. 2 is an enlarged view of the developing tank unit shown in the assembly of Fig. 1;

Fig. 3 is a fragmentary magnified detail view of a perforated liner or screen member which forms one side of the developing zone of the tank assembly shown by Fig. 2; and

Fig. 4 shows an alternative form of tank assembly.

Referring to Fig. 1 the machine is encased in a housing 1 having a combined front and top wall access opening indicated by numeral 5. At the lower edge of the opening a feed board station is shown at 2 for feeding sheets into the apparatus. Recessed in the housing and above the feed board 2 a tracing stacking tray is shown at 3. Tray 3 is for return of original tracings from which the

copies are to be made by the machine. A stacking tray 4 accessible from the top is at the exit end of the apparatus for stacking the printed sensitized sheets as they are received from the developing mechanism. The trays 2 and 4 and the shield 6 across the front side of the delivery belt system at the exit end of the developer conceal the operative mechanism from view at the front side of the housing. As will be readily understood the various parts of the mechanism are supported between the side walls 7 of the housing in suitable bearing and mounting structure (not shown). Conventional motor drives (also not shown) for the belt assemblies as will be described are preferably located in the lower section of the housing. The housing is adapted to rest on the floor with the top thereof at a height of approximately six feet so that the trays and feeding station are located at a convenient operator working level.

At the entrance end 2 of the apparatus a continuous web of sensitized material or, as is more often the case, a series of sensitized sheets may be fed between a perforated conveyor belt 10 and an auxiliary conveyor belt 11. A tracing or the master sheet bearing printed matter for reproduction is superimposed on the sensitized surface of the copy sheet which is facing upwardly and is conveyed along with the sensitized sheet between the belts. As shown, the auxiliary belt 11 is endless, being driven by the roller 12 and wrapped around the end of a tension sheet 13, an idler roll being indicated at 12'.

The feeding run of the printing belt 10 is directed from the entrance 2 upwardly to the lower side of a rotatably mounted printing cylinder 14 of conventional glass construction having a lamp shown at 15. The belt is tensioned around the cylinder for approximately 180°, and then directed forwardly in the housing and upwardly toward the entrance end of the developer mechanism. Along the delivery portion of the belt 10 from the cylinder 14 to the take off end is a suction tank 16 which maintains the sensitized sheets against the underside of belt 10 for delivery to the developer. A pick-off assembly for stripping the master sheet or tracing from the cylinder 14 is shown at 17 for depositing the "originals" on the tracing stacking tray 3. The driving roller for belt 10 is shown at 18 with the series of rollers for travel of the same, being designated by numeral 18'.

The sensitized sheets are carried by belt 10 into contact with a delivery belt 20 which is tensioned against the belt 10 as it reverses its direction around the end roller 18'. A guide at 21 serves to direct the sensitized sheet at the entrance between the belts 10 and 20 and a pick off member is shown at 22 to insure separation of a sheet from belt 10 to guide it against belt 20 to the entrance end of a blanket or sealing sleeve 30 of the developer.

The delivery belt 20 is driven by a cylinder or roller 23. Inwardly of the housing the belt is turned on roller 23' and upwardly thereof a tensioning member 24 provides an upward delivery run urging belt 20 against belt 10 at the roller 18' as well as against the sealing sleeve 30 and its roller. From the tip of tension member 24, the belt again runs against the sleeve 30 and delivers the developed sheets from the tank to the exit end for stacking on tray 4. Belt 20 is upwardly and inwardly directed around the end driving cylinder 31 of the sealing sleeve and reversely around the tip end of a second vertically disposed tensioning member at 25.

The sealing sleeve 30 conveys the printed sheets around the surface of the perforated developing tank 40 and back to the delivery conveyor belt 20 for stacking on the tray 4. The sleeve 30 is driven by cylinder 31 spaced from the exit end of the tank and by the cylinder 32 adjacent the entrance end. Guide rollers are shown at 33 and tension rollers at 34 on the outer or return run of the sleeve.

In order to assist in the disposal of developed sheets

onto the stacking tray 4 a stacking plate member 35 is provided. At its lower edge the plate serves as pick-off member to prevent a sheet following sleeve 30 on its return run. At its upper edge the plate 35 serves as a marginal flange at 36 for the front edge of the tray 4. In this manner the sheets stacked on the tray 4 cannot interfere and block the leading edge of a sheet emerging from the developer. A mounting plate at 37 fixed to the underside of tray 4 holds the plate 35 in position.

Referring now to Fig. 2 the tank 40 is a closed vapor generating tank with heater and tray elements at 41 for evaporating ammonia, for example, as may be fed to the tray in predetermined amounts according to the size of the tank, the speed of development, and material being treated. The tank as shown is preferably elliptical to form a squat compact developing zone. At the entrance and exit ends of sleeve travel around the tank the wall portion as at 42 is imperforate. Over the major portion comprising the remainder of the tank the wall is perforated by closely spaced holes as at 43 for the passage of the developing vapors through to the developing zone. The developing zone is provided around the perforated tank wall by a liner or screen indicated at 44 and the sealing sleeve 30 blanketing the entire perforated area of the tank.

The screen 44 is suitably affixed as at 45 to the tank wall portion at 42 adjacent the entrance end and is positioned to lie against the perforated tank wall with the free end of the screen at 46 extending beyond the adjacent exit end leading from the tank. The end 46 extends to the junction of the sleeve and delivery belt 20 and assists in the transfer of the sensitized sheet to the final delivery belt transfer to the tray 4.

Screen 44 is also perforated and as shown by the magnified fragmentary view of Fig. 3 is provided with a multiplicity of closely spaced holes 47 through which the developing vapors may be admitted to the surface of the sensitized sheet for developing action as the sheet is frictionally advanced by the sleeve 30. The screen 44 is of synthetic plastic material chemically inert to the vapors and of high heat resistance with self-lubricating qualities to render the surface over which the sheets pass with the sensitized surface in contact therewith of an extremely slippery character having a negligible coefficient of friction. The sensitized sheets, indicated by the letter *s*, are exposed to the developing vapors during travel past the perforated tank area and are subjected to the gases along both major sides of the ellipse defined by the tank.

At the end of the tank between the upper and lower walls the perforated surface is provided with a curvature of at least 180° over which the direction of the path of the sheets can be reversed. Thus the tank may be "flattened" in form to insure a length of travel in the developing zone adequate to properly expose the sheets to the vapors as well as to reduce the over-all height of the tank.

The tank is preferably elliptical in transverse cross section as shown. Alternatively, the tank may be cylindrical as indicated by the tank 70 of Fig. 4. The tank may also be otherwise defined and it has been found that by providing a surface curvature of at least 180° the sheets can be reversely directed to permit the closely spaced adjacent relation of entrance and exit paths to and from the tank and the handling of the developed sheets for delivery to the tray 4. The sleeve 71 (Fig. 4) is shown closely spaced at the entrance and exit ends after the manner of sleeve 30 of Fig. 1. A screen 72 is attached to the imperforate wall section as at 73 and a delivery belt at 74 is shown in a similarly disposed relation to the sleeve for delivery of sheets to and from the developing zone of the circular tank.

The screen 44 which faces or lines the outer surface of the tank of Fig. 1 may be a solid monoplanar sheet of polytetrafluoroethylene such as that commercially available under the trade name "Teflon." In sheet form the screen can be removed for inspection or replacement without dismantling the sleeve 30 from the tank. The outer surface of the tank might be also otherwise lined as by spraying with a thin film of polytetrafluorethylene for a permanently affixed type of facing. A sprayed coating may be utilized successfully but it has been found that the removable sheet is preferred not alone for its removability but also because the more closely spaced perforations of the sheet 44 provide a more complete and even diffusion of developing vapors in the zone through which the sheets *s* pass between the sheet 44 and sleeve 30. At each opening 47 of the sheet vapor emanating from the openings of the tank wall passes through to the developing zone side thereof to spread out over the edges of each opening 47 and produce a halo-like effect around the edges. The "haloing" effect at each opening intersects the haloes of each adjacent opening to produce the even and complete diffusion of vapors over the entire surface area and eliminates patterning on the background of the sheets being developed. The openings of the sheet 44 are preferably on the order of 0.20 of an inch in diameter at spacings of .031 of an inch in a sheet of approximately .010 of an inch. This is in contrast to the size of the openings in the wall of tank 40 which may be on the order of .1875 of an inch in diameter with a spacing of .250 of an inch.

The polytetrafluoroethylene sheet as previously mentioned is of a non-sticky, chemical and heat resistant character and in particular the surface over which the sheets pass to be developed is of an extremely slippery and self-lubricating nature. It has been discovered that sheets having the most delicate of emulsions may be conveyed by the sleeve in a reversely turned path such as that at the end of the tank around the 180° curvature.

It will be noted that not only does the elliptical tank of the preferred form as shown by the drawings utilize the maximum possible developing area of this type of closed vapor generating tank but also it makes possible provision for a delivery of developed sheets at the front of a machine without an intricate conveyor belt mechanism. The delivery is made furthermore with the printed side of the sheet facing the operator. The trailing or tail end edge of each sheet regardless of the sheet size is always in the same position nearest the operator.

It is well recognized in the trade that prior machines of this general type have been objectionable from the standpoint of the mechanics of handling the sheets and delivery for an operator's convenience. Many such factors have necessarily been subordinated because of the additional expense involved as well as the problem of increasing the overall size of the machine with prior conventional tanks which have used only one side of a closed vapor tank.

In the apparatus as shown by Fig. 1, the developed material as it emerges from the developer is guided by the sleeve 30 and belt 20 to the stacking tray 4 with the coated side of the sheet facing in an upward position in full view of the operator. The tail edge regardless of the size of the sheet will thus always be closest to the operator and permit easy removal in spite of a large size or the stacking of different sizes. On conventional machines, as will be recognized, the image faces downwardly and prevents quick observation as to the quality of the print while the operator is busy feeding material into the machine. Here the operator may observe the condition and clarity of each print as it emerges onto the tray. It may be noted also that the tray extends from the front of the machine to the rear wall and thus a print of a size equal to the depth of the housing can be stacked for front face up delivery without adjustment on the part of the operator. In the event a sheet of greater depth is passed through the machine a "kicker" belt is provided at the extreme end of the tray 4. This belt shown at 60 on rollers 61 and serves by pressure against tray 4 to frictionally draw long sheets from the cabinet

through a slotted port at 62 for deposit on a platform or table (not shown) at the rear of the machine.

In connection with the large developing zone of the new machine it is known that of necessity the developing capacity is dependent on the amount of time the sensitized sheet material may be exposed to the vapors. In the apparatus illustrated where the printing and developing operations are adapted to be synchronized the developing area is of sufficient size to give development in one pass through the developing zone in most instances. With the introduction of high wattage printing lamps the printing speed has been stepped up from 30 to 100 feet per minute for diazo-type materials yet heretofore no corresponding increase in developing exposure area has taken place without necessitating an increased overall machine size according to the conventional design. It will be seen the new design as disclosed will more than double the developing area for exposure without increasing the size of the machine. The practically negligible or almost zero frictional characteristics of the polytetrafluoroethylene liner surface permits a smooth travel of the sealing sleeve and sensitized sheet while completely avoiding any binding action around the 180° or more curvature.

What is claimed is:

1. Dry type developing apparatus, comprising a developing tank having upper and lower portions interconnected at one end by a convexly curved portion, a sealing sleeve embracing the said tank portions and movable to convey sensitized material along said tank portions and in so doing reversing the direction of travel of the sensitized material through an angle of at least about 180°, said tank portions being perforated at least substantially throughout the area embraced by said sleeve to expose the sensitized material to developing vapors at least substantially throughout the length of its travel along the periphery of said tank, and solid, fixed perforated means, having the anti-friction characteristics of polytetrafluoroethylene, interposed between said tank

portions and said sleeve to facilitate passage of sensitized material along said tank and particularly around the curved portion thereof, said anti-friction means being chemically stable with respect to the developing vapors.

2. Apparatus as in claim 1 wherein the tank is elliptical in form and the sleeve departs from the upper and lower tank portions at the end opposite that of the curved portion at closely adjacent points.

3. Apparatus as in claim 1 wherein the tank is circular in section and the sleeve embraces the tank at closely adjacent points at the end opposite the said curved portion thereof, and at closely adjacent points.

4. Apparatus as in claim 1 wherein the anti-friction means comprises a thin perforated sheet of polytetrafluoroethylene secured to the tank adjacent the point where the sleeve first embraces the lower portion thereof, said sheet extending beyond the upper portion of said tank embraced by said sleeve.

References Cited in the file of this patent

UNITED STATES PATENTS

1,795,220	Langsner	Mar. 3, 1931
1,820,280	Langsner	Aug. 25, 1931
1,841,482	Langsner	Jan. 19, 1932
1,980,188	Cullen et al.	Nov. 13, 1934
2,478,850	Trump	Aug. 9, 1949
2,499,840	Trump	Mar. 7, 1950
2,515,144	Trump et al.	July 11, 1950
2,563,666	Veyret et al.	Aug. 7, 1951
2,589,748	Trump	Mar. 18, 1952
2,630,744	Wilde	Mar. 10, 1953
2,641,980	Brunk	June 16, 1953
2,649,303	Fuller	Aug. 18, 1953

FOREIGN PATENTS

598,921	Great Britain	Mar. 1, 1948
667,376	Great Britain	Feb. 27, 1952
702,792	Great Britain	Jan. 20, 1954