Oct. 29, 1957 J. L. WALKER, JR 2,811,088

APPARATUS FOR DEVELOPING PHOTO-SENSITIVE PRINTS

Filed Jan. 23, 1953 3 Sheets-Sheet 1

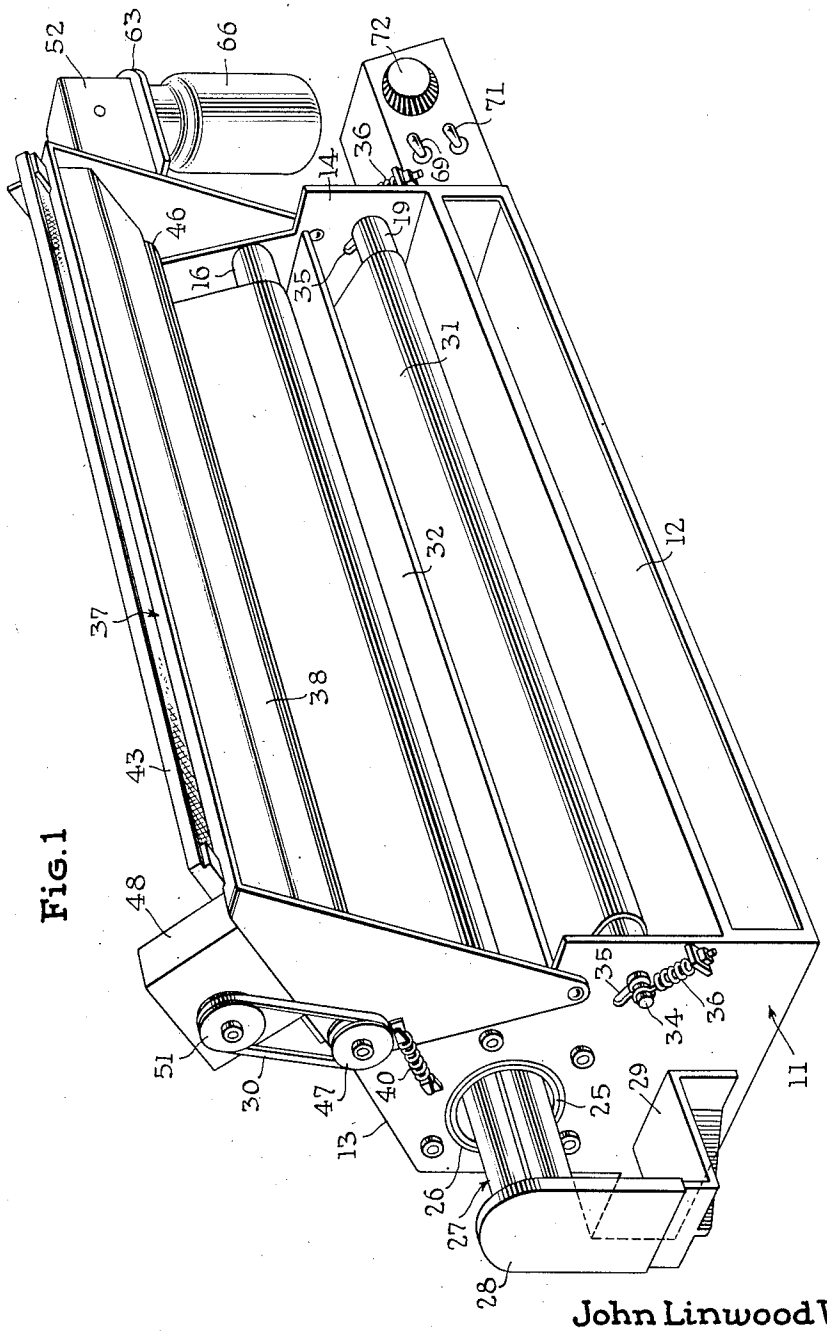


Fig. 1

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Fig. 3

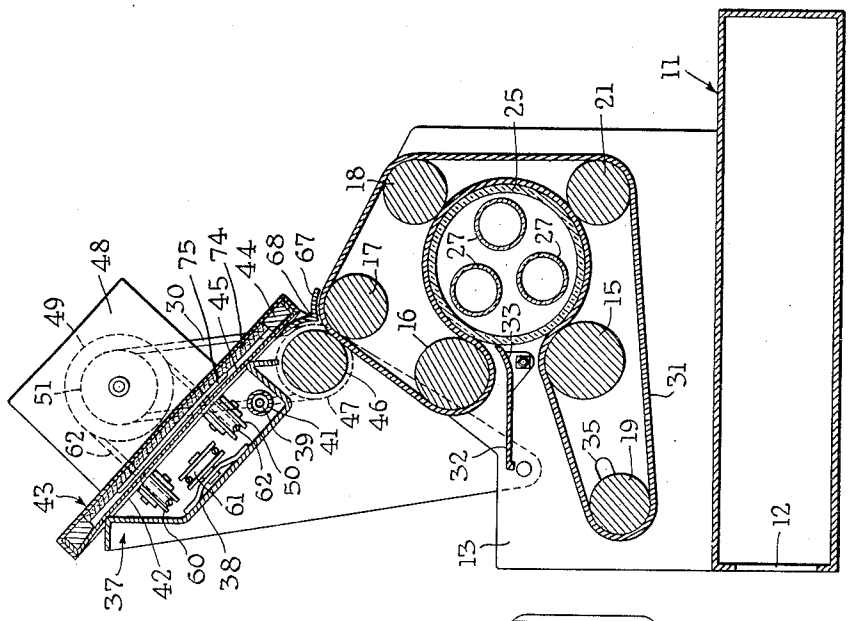
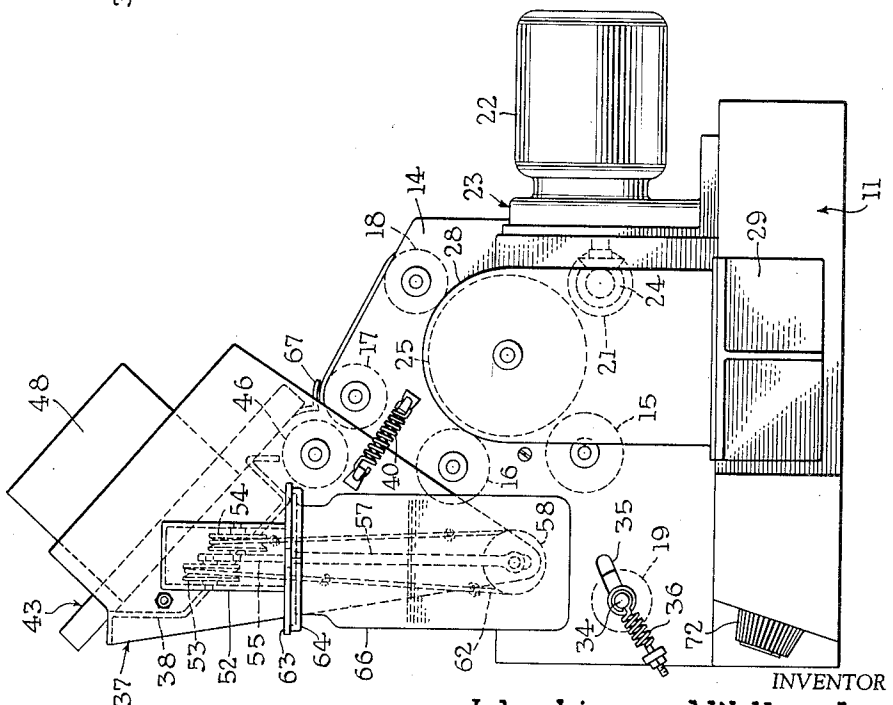


Fig. 2



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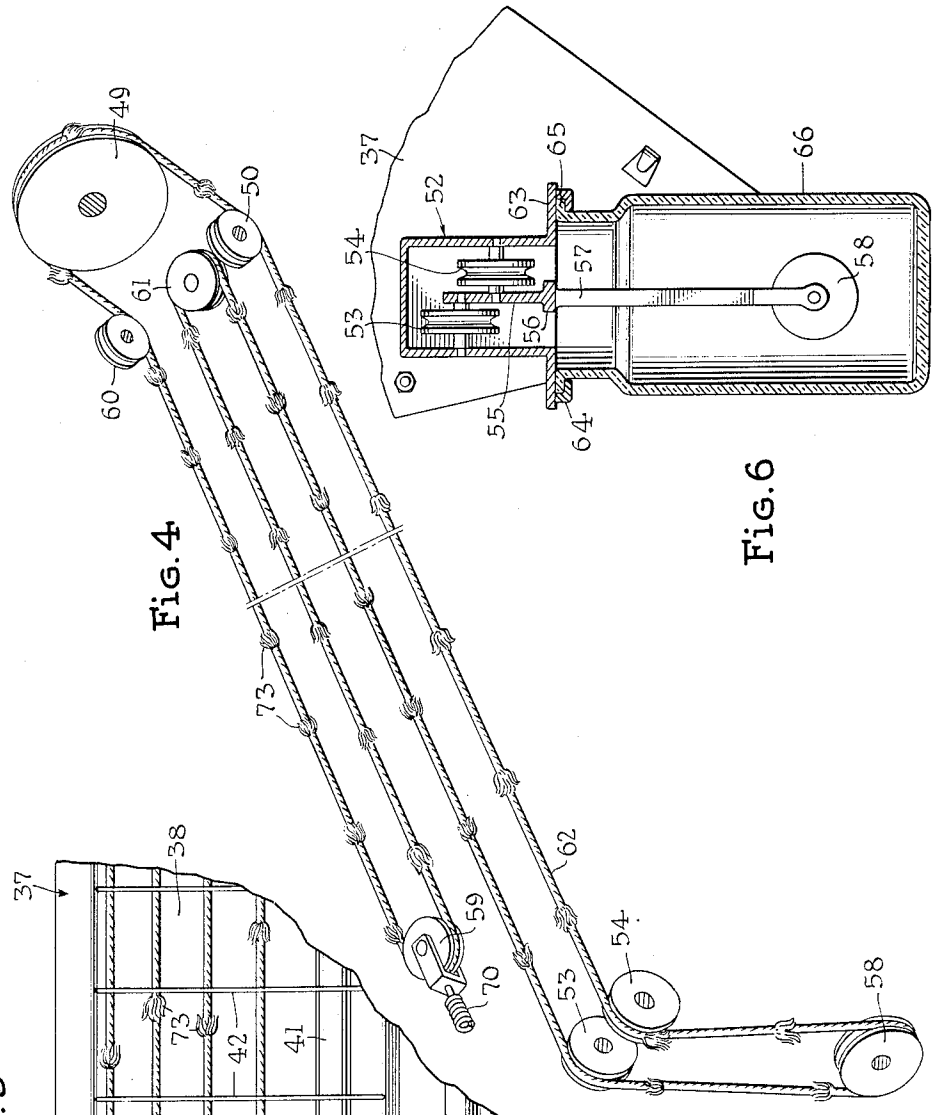


Fig. 4

Fig. 5

Fig. 6

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APPARATUS FOR DEVELOPING PHOTO-SENSITIVE PRINTS

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Application January 23, 1953, Serial No. 332,929

8 Claims. (Cl. 95—94)

This invention relates to machines for use in the photographic reproduction of translucent printed material. The process used in the exposing and developing steps is not new, and the invention relates to the apparatus.

The photo-sensitive paper is exposed by the action of a light source, the matter to be reproduced being interposed between the light source and the photo-sensitive paper. The developing step is carried out by subjecting the exposed paper to the action of a reactant gas atmosphere. Developers of this type commonly use a paper which after exposure may be developed by being passed through an atmosphere of ammonia and water vapor. The invention will be described as it is embodied in an ammonia and water vapor developer, but it will be understood that the use of the apparatus is not limited to the use of any particular developing atmosphere.

Basically the machine comprises a main exposing section and a developing section. The main section includes a plurality of driven rollers on which is carried an endless fabric belt. This belt may be a one piece belt or it may comprise several sections arranged side by side. The latter arrangement is useful because there is less tendency for the belt to drift toward the ends of the rollers.

Located centrally of the driven rollers is a rotatable transparent cylindrical element which is journaled in the main section of the apparatus and encloses a suitable light source. The material to be reproduced and the photo-sensitive paper are placed on the fabric belt and carried around the transparent cylindrical element and returned to an intermediate station at which the material being reproduced is removed, and the exposed photo-sensitive paper is directed into the developing section of the machine.

The developing section comprises a shallow trough which is provided with a cover of a particular conformation which will be more fully described. Traversing back and forth through the shallow trough is a plurality of passes of endless absorbent cord. This cord passes through a solution of ammonia and water and this solution is diffused from the cord to the interoir of the trough.

A heater element is provided in the trough to raise the temperature therein and assist the diffusion of the vapors. It is possible to obtain a very uniform developing atmosphere in the trough. There is little or no tendency for developing liquid to accumulate in the trough and hence there is no need to provide a drain or recirculation connection. The speed at which the developing liquid is vaporized is materially increased by the use of the diffusing cord because the surface area of the liquid is increased over what it would be if the liquid were sprayed into the trough as is characteristic of presently available machines of this type.

The trough cover is provided with a fabric facing which is treated so that it is not affected by the developing atmosphere. This fabric facing lies quite closely on the outer surface of the paper being developed and

serves to inhibit the escape of the vapors into the atmosphere of the room in which the machine is being used. It has been found desirable to insulate the outer surface of the cover and to place a heating element between the insulation and the fabric facing. This heater serves two purposes: one is to assist diffusion of developing liquid, a second and more important purpose is to prevent condensation of liquid on the inner face of the fabric facing.

A machine built in accordance with the present invention is compact and simple. The compactness of the machine is such that it is portable, and therefore well suited for use in the field. The machine is particularly suited for use in the field, because it need not be level. Many machiness of this type use a distributing gutter through which liquid flows by gravity, and the inclination of this gutter must be carefully maintained. An added advantage of this machine is the fact that no circulating pump is needed whereby the construction of the device is simplified and cost is reduced.

A preferred embodiment of the invention will be described having reference to the accompanying drawings in which:

Fig. 1 is a perspective view of a machine embodying the invention.

Fig. 2 is an end view looking at the right hand end of the machine as seen in Fig. 1.

Fig. 3 is a transverse section.

Fig. 4 is a diagrammatic showing of the diffusion means.

Fig. 5 is a fragmentary top plan view of the right hand end of the trough with the cover removed.

Fig. 6 is a fragmentary detail view partly in section.

All statements of direction refer to the machine as it appears in the particular figure referred to.

Referring first to Figures 1, 2, and 3, the apparatus comprises a main frame 11 having a base in the form of a rectangular prism which is open at its front face as shown at 12. Projecting up from the base are end walls 13 and 14. A plurality of parallel idler rollers 15, 16, 17, 18, and 19 extend between the end walls 13 and 14 and are journaled therein at their opposite ends. The arrangement of the idler rollers is best shown in Fig. 3.

A driven roller 21 is also journaled at its ends in the end walls 13 and 14 and is driven by a variable speed motor 22 through suitable reduction gears 23 and bevel gears 24. Located centrally of the rollers 15, 16, 18, and 21 is a transparent cylindrical member 25. The member 25 is rotatable and journaled at its ends in the end walls 13 and 14, as indicated at 26. Extending axially through the member 25 is a plurality of fluorescent tube lights 27 mounted in sockets 28 which are carried by the brackets 29.

As is best shown in Figures 1 and 3, an endless belt 31 is arranged to pass around and between the driven and idler rollers and the transparent member 25.

Arranged between the rollers 15 and 16 is a deflector member 32 which is mounted with its upward curved inner edge 33 close to the outer surface of the member 25.

The roller 19 is laterally adjustable by springs 36 whereby the desired tension in the belt 31 may be maintained. This adjustment feature is best shown in Figure 1. It will be seen that the spring 36 is biased between the end wall 13 and the spindle 34 of the roller 19 which extends outward through the end wall 13. The springs 36 at the opposite ends of the machine are independently adjustable whereby the axial alinement of the rollers 19 may be shifted within limits. The axial alinement of the roller 19 is adjusted so that the belt 31 has little or no tendency to drift off to one side or the other.

Hingedly mounted on the base **11** is a developing portion **37**. A roller **46** is journaled between the end walls of the portion **37** and is biased against the belt **31** and the portion **37** and the base **11**. Portion **37** also includes a shallow trough **38** which is trapezoidal in transverse section, as is best shown in Figure 3. The trough **38** is inclined and a heater element **39** is mounted in the lower corner thereof. The heating element **39** is enclosed by a tubular member **41**. A plurality of transverse wires or ribs **42** extend across the open face of the trough **38**. The open face of the trough is closed by means of a removable cover **43**. This cover comprises a marginal frame **44** on which is disposed a fabric covering **45**. The cover is provided with insulation **74** and a heater element **75** which is arranged between the insulation **74** and the fabric covering **45**. A pulley housing **48** projects from the portion **37** and encloses a driven pulley **49**. Pulley **49** is mounted on a common axle with a driven pulley **51**. Pulley **51** is connected by a belt **30** to the pulley **47** which in turn is connected to the roller **46**.

A second pulley housing **52** projects from the opposite end of the developing section **37** and encloses the pulleys **53** and **54**, the axes of which are vertically offset, as is best shown in Figure 6. The inner ends of the axles on which the pulleys **53** and **54** are mounted are sustained by a web **55** carried by a spider **56** connected to the housing **52**. A supporting arm **57** extends downward from the spider **56** and sustains at its lowermost end a pulley **58**.

The housing **52** is provided at its lower edge with a flange **63** on the lower face of which are hingedly mounted sections **64** and **65** of a split collar. The sections **64** and **65** are provided with an inturned flange adapted to engage the projecting flange of the bottle or receptacle **66**.

Fixedly mounted in the trough **38** are pulleys **50**, **60**, and **61**. An additional pulley **59** is also mounted in the trough **38**. This mounting includes spring **70** which is adjustable, see Figure 5.

As is best shown in Figure 4 an endless cord **62** is arranged to pass around the pulleys **58**, **54**, **50**, **49**, **60**, **59**, **61** and **53** in the order stated. The cord **62** consists of an absorbent material and may, if desired, be provided with a plurality of tufts **73**, which serve to increase the amount of liquid absorbed.

A deflector **67** provided with a central ridge **68** is arranged parallel with the rollers **46** and **17**. The deflector **67** is so located relative to the rollers **46** and **17** that the exposed photo-sensitive paper is guided across the open face of the trough **38** beneath the cover **43**.

Switches **69** and **71** are provided to control the operation of the tube lights **27**, heater elements **39** and **75**, and the motor **22**. The speed of the motor **22** may be varied by adjusting a rheostat, the knob of which appears at **72**.

In operation the photo-sensitive paper is placed on the upper face of the belt **31** between rollers **15** and **19**. The material to be reproduced is placed on top of the photo-sensive paper. Switches **69** and **71** being closed, the two sheets are carried inward toward the cylindrical member **25** and pass around it, the light passing through the paper which is being reproduced. When the sheets reach the deflector **32** they move outward along its upper surface. It will be seen that the photo-sensitive sheet is now uppermost. Its forward edge may be lifted by the operator and inserted between the roller **46** and the belt **31** as it passes over the roller **17**. As the photo-sensitive sheet continues its upward journey it strikes the deflector **67** and is guided beneath the cover **43** across the open face of the trough **38**. The bottle **66** having been filled with developing liquid prior to starting the machine the atmosphere within the trough **38** will be filled with ammonia and water vapor. The treated coating

which remains on the photo-sensitive paper after its exposure is developed by this atmosphere.

It will be apparent from Figure 3 that the fabric covering **45** lies closely upon the upper face of the photo-sensitive sheet and serves to provide an effective seal against escape of the ammonia and water vapor into the room.

It will be seen that the only element which traverses the open face of the trough is the exposed photo-sensitive paper. This means that there is little tendency for the developing vapors to be carried out into the room atmosphere. This results in a saving of developing liquid and also makes it unnecessary to provide special ventilation means in the room where the machine is being used.

The photo-sensitive paper is pushed across the open face of the developing trough in contrast to existing machines in which a conveyer belt, similar to the belt **31**, is used for this purpose. One of the reasons that a conveyer belt has been required in existing machines is the fact that the lateral dimension of the trough is quite large and it was, therefore, impossible to push the free edge of the paper across the trough. The improved way in which the developing atmosphere is produced in the trough of the present invention has enabled the lateral dimension of the trough to be reduced to a considerable extent.

The production of the developing atmosphere by the diffusion of vapors from the endless cord results in the speedy production of the developing atmosphere and its easy maintenance at the required strength. Therefore, a machine built in accordance with the present invention is capable of operation at relatively high speeds whereby the time required for exposure and developing is materially shortened. The quality of the print may be controlled by varying the speed of the motor and the output of the heaters **39** and **75**.

The light source, which is used to expose the photo-sensitive paper, is preferably one which gives forth light of relatively short wave length. The particular type of light used is a matter of choice and the invention is not limited to the use of any particular light source. Because of the reduction in the size of the trough, mentioned above, a machine built according to the invention can be made quite compact and, therefore, portable. The expense of the machine is considerably less than that of similar machines available on the market today because the use of a circulating pump to deliver developing liquid and the use of conveyer means in the developing section are eliminated.

What is claimed is:

1. Apparatus for exposing and developing photosensitive sheet material comprising an exposing section and a developing section, said exposing section comprising a rotatable transparent cylindrical member; a plurality of circumferentially spaced parallel rollers proximate to said member; a taut endless belt passing outwardly around all of said rollers and having a reversely folded section passing inwardly of said rollers, and partially encircling said member; a light source extending axially through said member; means to drive one of said rollers, said sheet material being received during exposure between said belt and said member; and said developing section comprising an open faced trough; a cover therefor; said sheet material after exposure being received between the open face of said trough and said cover; a driven pulley and an idle pulley sustained by said trough; an endless absorbent cord passing through said trough and sustained by said pulleys; a receptacle for vaporizable developing solution through which said cord passes; and heating means in said trough whereby vaporization of the solution absorbed by said cord is aided.

2. Apparatus for developing exposed photosensitive sheet material by exposure to reactant vapors comprising in combination a trough; a cover on the open face thereof having its edges spaced slightly from the edges of the trough whereby sheet material can be passed be-

neath the cover across the open face of the trough; a receptacle for liquid developer mounted at one end of said trough; guiding means in said receptacle and in said trough; an endless absorbent cord carried by said guiding means so as to make a plurality of passes through said trough and through said receptacle; means for imparting longitudinal motion to said cord, said guiding means being so located in said trough that the cord is maintained spaced from the sheet material as it is passed across the open face of said trough.

3. The combination defined in claim 2 in which said cover comprises a marginal frame and a fabric facing carried thereby; and a heater sustained by said frame and on the outer face of said fabric cover and in heat exchange relation therewith.

4. The combination defined in claim 2 and a heater in said trough in heat exchange relationship with said cord.

5. The combination defined in claim 3 and a heater in said trough in heat exchange relationship with said cord.

6. The combination defined in claim 2 and a pair of parallel mating rollers carried by said trough and having their axes transverse to the direction of movement of the sheet material, said rollers serving to propel said sheet material across the open face of said trough.

7. Apparatus for developing exposed photosensitive

paper by the action of reactant vapors comprising in combination means defining an enclosure having openings therein through which exposed paper may be passed through the enclosure; a reservoir mounted on a side wall of said enclosure and adapted to receive a vaporizable developing solution; a driven porous strand adapted to pass through said reservoir and said enclosure; and means guiding said strand through said enclosure and reservoir and arranged so that the strand and the paper are spaced from one another.

8. The combination defined in claim 7 and a heater in said enclosure in heat exchange relationship with said cord.

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