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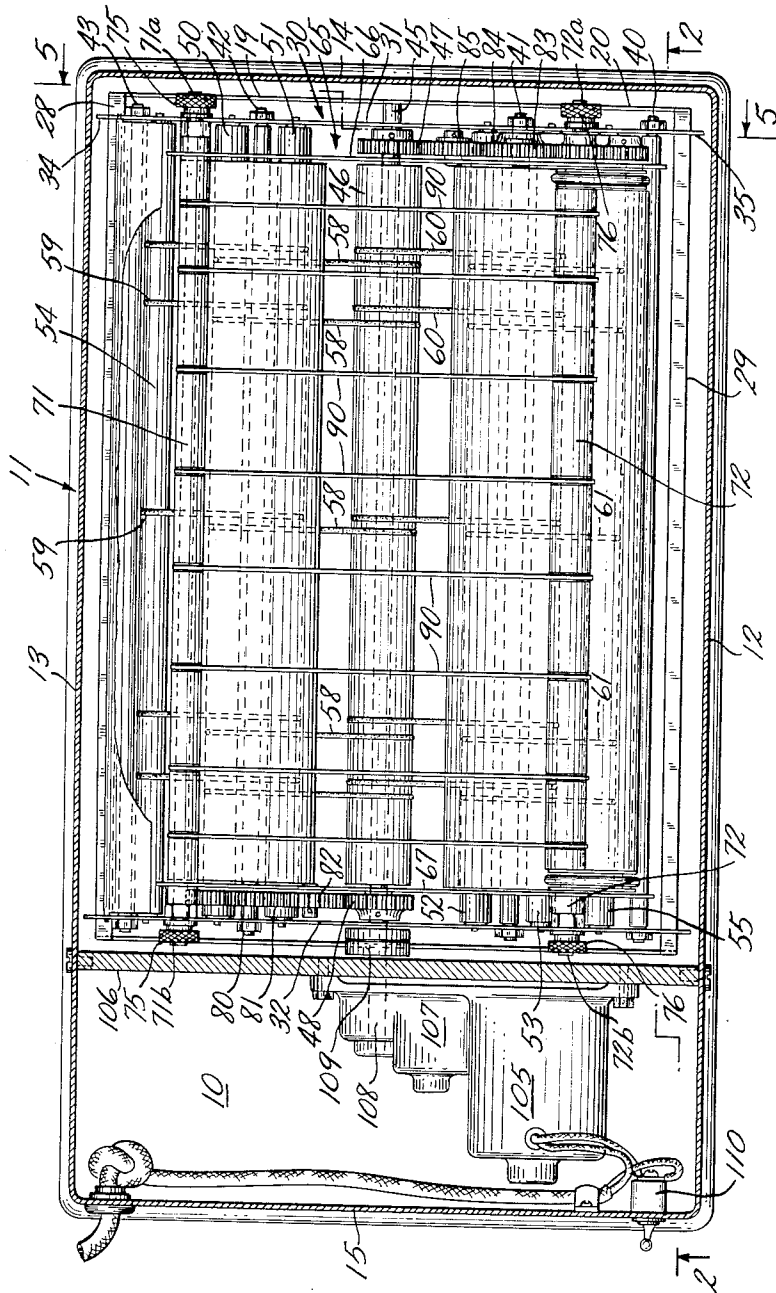
2,685,831

DEVELOPING MACHINE

Filed March 11, 1953

2 Sheets-Sheet 1

FIG. 1.



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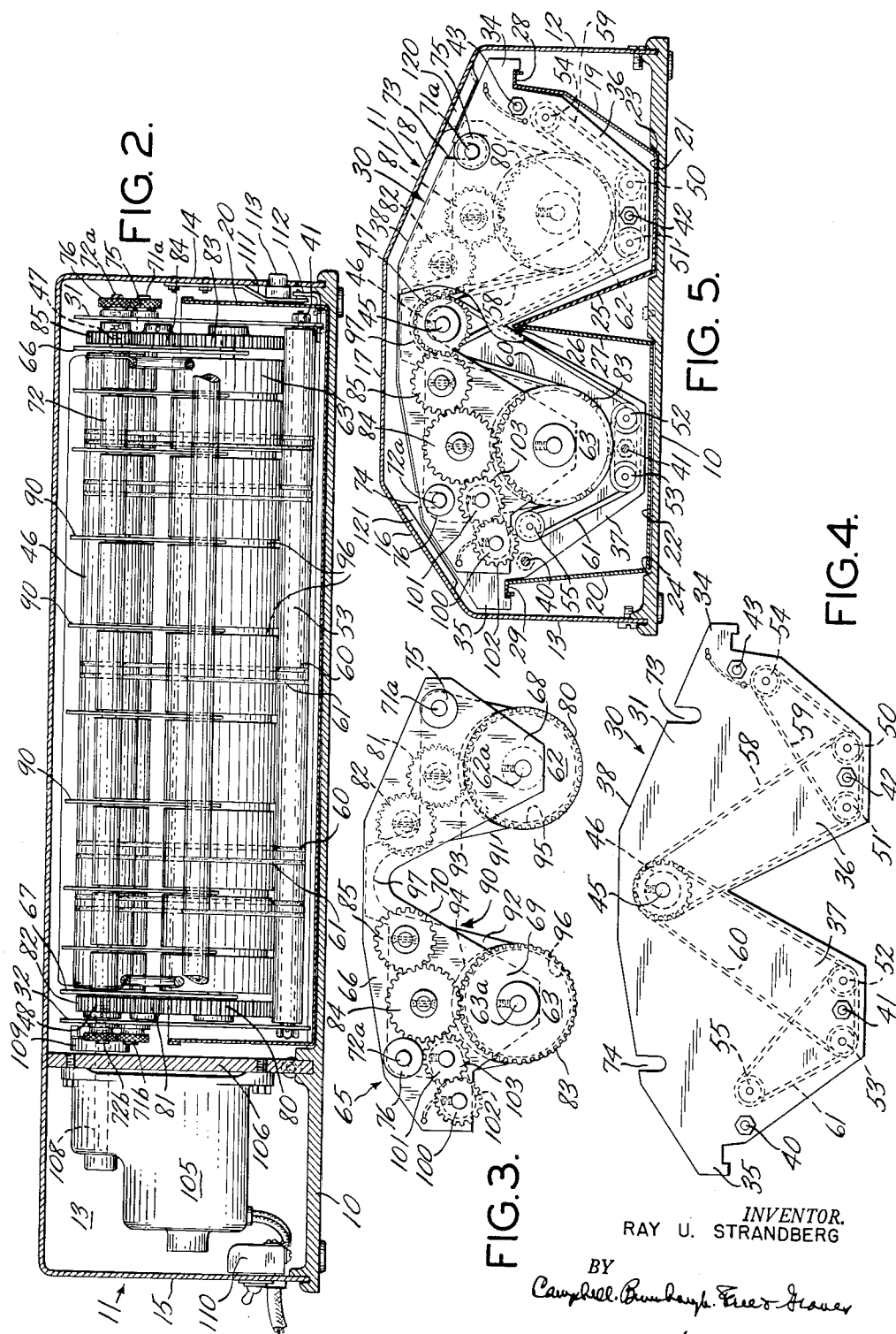
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UNITED STATES PATENT OFFICE

2,685,831

DEVELOPING MACHINE

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9 Claims. (Cl. 95—94)

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This invention relates to photographic equipment and it relates particularly to developing apparatus for use with photocopying or photoprinting apparatus.

A great many different types of developing apparatus have been provided heretofore for use in the developing of film, paper and the like and, in recent years, there has been considerable activity in the development of photocopying and developing apparatus for use in offices and the like for the reproduction of letters, papers, drawings, etc.

The prior developing apparatuses include rolls, belts and the like which are associated in such a manner as to convey the exposed photographic material through the developing and fixing solutions. The designs of these prior devices have been such that the emulsion on the paper may not be uniformly exposed to the developing and fixing solution. Moreover, the prior devices are so constructed that it is difficult to take them apart for cleaning or repair. Inasmuch as the majority of offices utilizing such equipment do not have facilities for repair and maintenance of the developing and photoprinting apparatus, they have not been as satisfactory as would be expected.

The present invention provides a simple form of developing and fixing apparatus which is suitable for use in developing and fixing of photographic film, photocopying papers, such as the azo and diazo papers that are commonly used for copying work, and other photosensitive materials. The apparatus embodying the invention is a small, compact unit which is driven electrically to advance the photosensitive material through the developing and fixing solutions and to bring the surfaces thereof uniformly into contact with the solution. The apparatus is arranged so that there is a minimum of transfer of the developer into the fixing solution or vice versa, and the need for refilling or replenishing the tanks is reduced to a minimum. However, the apparatus is so constructed and arranged that it can be easily disassembled for cleaning and repair or replacement of parts of the apparatus as may be required. The apparatus is compact and can, of course, be used with any suitable type of camera or copying apparatus and it may also be used in conjunction with a drier to facilitate the drying of the copy material after it has been developed and fixed.

For a better understanding of the present invention, reference may be had to the accompanying drawing in which:

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Fig. 1 is a plan view of a typical apparatus embodying the present invention, with the cover or housing therefor in section;

Fig. 2 is a view in section taken on line 2—2 of Fig. 1;

Fig. 3 is an end view of a second cooperating frame supporting rollers for cooperation with the belts to immerse the paper or the like;

Fig. 4 is an end view of one of the frame members of the apparatus in which the conveyor belts are mounted; and

Fig. 5 is a view in section taken on line 5—5 of Fig. 1 with parts broken away to disclose details of construction.

The apparatus disclosed herein is of relatively small size suitable for developing, for example, sheets of photosensitive paper having a width of eight to ten inches. However, the apparatus may be larger to handle wider sheets or smaller to handle narrow strips of paper or film or the like, as may be required. The apparatus includes a base plate 10 which may be formed of metal, plastic or the like. Fixed to the base plate is a cover 11 which is hollow and has opposite side walls 12, 13 and end walls 14 and 15, forming a complete enclosure. The top of the cover has angularly related flat surfaces 16, 17, 18 to give a generally dome-shaped configuration to the cover.

The base plate 10 supports a pair of trough-like tanks or receptacles 19 and 20 to receive developer and fixer, respectively. The shape of the tanks is not very important, although, as shown in Fig. 3, they may have opposite side walls which converge downwardly toward narrower bottoms 21 and 22, which fit in suitable recesses 23 and 24 in the base plate. The inner side wall 25 of the tank 19 may be provided with an edge flange 26 which hooks over the adjacent side wall 27 of the tank 20 so that liquid from the tanks will be diverted either into the tank 19 or the tank 20 and will not drip onto the base plate.

The outer sides of the tanks 19 and 20 are provided with reinforcing flanges 28 and 29 which are used to support a frame member 30 forming the support for a conveyor system to convey the paper or the like through the developing and fixing tanks 19 and 20.

As best shown in Figs. 3 and 4, the frame 30 consists of two substantially identical end plates 31 and 32. Inasmuch as the end plates 31 and 32 are essentially the same, only one of them will be described. The end plate 31 has a pair of hook-shaped extensions 34 and 35 on its opposite ends which hook over the flanges 28 and 29, respectively, of the tanks. The plate has down-

wardly extending generally trapezoidal legs 36 and 37 which conform generally to the cross-section of the tanks 19 and 20, respectively, and extend down to almost the bottom of the respective tanks. The upper edge 38 of the plate 31 conforms generally to the shape of the top of the cover 11.

The two plates 31 and 32 are connected by means of a plurality of spacer rods 40, 41, 42 and 43 to hold them in spaced apart relation. The frame 30 can be dropped into the tanks 19 and 20 with the legs 36 and 37 disposed within the tanks. The frame 30 serves as a support for a series of conveyor belts which aid in conducting the photographic material through the tanks 19 and 20. As shown in Figs. 2 to 4, a shaft 45 is located substantially centrally of and extends between the plates 31 and 32 at the top center thereof. The shaft 45 carries a roll 46 (Fig. 1) which substantially spans the space between the end plates 31 and 32. A pair of gears 47 and 48 are mounted on the shaft 45 at opposite ends of the roll 46.

Adjacent the lower ends of the legs 36 and 37 on the frame are mounted a pair of small rolls 50, 51 and 52, 53, respectively. These rolls extend substantially the full distance between the end plates 31 and 32, as shown in Fig. 1. Outwardly on opposite sides of the pairs of rolls and above them are other guide rolls 54 and 55. As shown in Fig. 3, the guide rolls 54 and 55 are just below the tops of the flanges 23 and 29 on the tanks.

The several rolls 46, 50, 51, 52, 53, 54 and 55 serve to support a plurality of narrow flexible belts such as round or flat rubber bands. The roller 46 and the rollers 50 and 51 support a plurality of belts 58. The rollers 54, 50 and 51 support a plurality of other belts 59 interposed between the belts 58. Similarly, the roller 46 and the rollers 52 and 53 support another group of belts 60 while the roller 55 and the rollers 52 and 53 support other belts 61. The belts 58 and 59 have upper flights which converge downwardly toward the bottom of the tank 19. Similarly, the upper flights of the belts 60 and 61 converge downwardly toward the bottom of the tank 20. None of the belts 58 to 61 pass into and out of both of the tanks 19 and 20 so that transfer of the solutions from one tank to the other by the belts is avoided.

The belts 58, 59 and 60, 61 cooperate with a pair of immersing rolls 62 and 63, respectively, which are supported on a second frame member 65. As shown in Fig. 3, the rolls 62 and 63 are so arranged that they flex the belts 58, 59, 60 and 61, respectively, into substantial conformity with the lower surfaces of the roll so that photographic material fed downwardly against the belts 59, the roll 62 down into the tank, then pass upwardly between the belts 58 and the roll 62 around the roller 46. The paper is then fed downwardly between the belts 60 and the roll 63 into the tank 20 and then upwardly between the roll 63 and the belts 61, to discharge, as explained hereinafter.

The rolls 62 and 63 are mounted between the two frame plates 66 and 67 (Fig. 2). The frame plates 66 and 67 are essentially identical and only one of them will be described. The plate 66 has a pair of downwardly extending legs 68 and 69 in which the shafts 62a and 63a supporting the rollers are mounted. The bottom of the plate 66 has an inverted V-shaped notch 70 which extends almost to the top of the plate 66. The

plate 66 also has a pair of spacer rods 71 and 72 which have threaded outer ends 71a, 71b and 72a and 72b to engage in notches 73 and 74 in the corresponding plate 31 of the frame 30. Thumb nuts 75 and 76 are mounted on the ends of the spacer rods 71 and 72 and can be screwed down against the plates 31 and 32, respectively, to secure the frames 30 and 65 together.

Each plate 66 or 67 carries a gear train for driving one of the rolls 62 and 63. Thus, the roll 62 is provided at one end with a gear 80 which meshes with an idler gear 81, the gear 81 in turn meshing with a gear 82 carried on the plate 67.

A similar set of gears 83, 84 and 85 is provided for the roll 63 and these gears may be mounted on the plate 66 or the plate 67, as desired.

In order to prevent the photographic material from adhering to and winding up on the rollers 62 and 63, they may be provided along their lengths with stripper plates 90 which are mounted on the spacer rods 71 and 72 between the end plates 66 and 67, as shown in Fig. 2. The stripper plates 90 have downwardly extending leg portions 91 and 92 having arcuate cut outs 93 and 94 which extend around the periphery of the rollers 62 and 63. The ends of the stripper legs 91 and 92 are received in grooves 95 and 96 in the peripheries of the rolls 62 and 63 so as to make certain that the photographic material will be deflected away from the rolls. The center 97 of each plate 90 has an arcuate shape conforming to the curvature of the roll 46 but of somewhat longer radius of curvature.

When the frame 65 is assembled with the frame 30 and locked in position by tightening the thumb nuts 75 and 76, the gears 47, 48 will mesh with the gears 82 and 85 so that upon rotation of the gears 47, 48 and the roller 46, all of the belts 58, 59, 60 and 61 will move and the rollers 62 and 63 will be positively driven at the same peripheral speed. The stripper plates 90 will separate the paper from the rolls 62 and 63 and the arcuate center 97 of the plates will guide the paper around the roll 46 so that the paper will follow a definite path through the developing and fixing tank without danger of jamming or becoming wrinkled or rippled.

Upon passing the roller 63, the paper may pass between a pair of squeegee rolls 100, 101 disposed above the tank 20 and in alignment with the belt 61. The squeegee rolls may be connected together by means of gears 102 and 103, the latter gear meshing with the gear 84 to effect a positive drive of the rolls 100, 101. It will be seen that the rolls 100, 101 are mounted in the frame 65.

The above-described belt and roller elements are driven by means of an electric motor 105 which is mounted on a partition 106 extending upwardly near the left-hand end of the base member 10. The motor 105 drives a reduction gear 107 having an output shaft 108 which is connected by means of a quick release coupling 109 to the end of the shaft 45 for driving the gears 47, 48. A suitable "on-off" switch 110 may be mounted on the end of the cover 11 to start and stop the motor.

The cover 11 may be releasably connected to the base member by means of a spring catch 111 which engages a lug 112 fixed to the base member 10. A push button 113 is mounted in the end 14 of the cover for releasing the catch to permit the cover 11 to be detached from the base.

In order to feed the paper or the like into the

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developer and keep a minimum of light from entering the apparatus, the top surfaces 16 and 18 of the cover may be provided with light traps 20 and 21 containing felt or rubber fillers through which the paper is fed into and discharged from the apparatus. Such light traps are well known.

The above-described apparatus is highly effective in feeding the paper or the like through the developing tanks. The rolls 62 and 63 come in contact with the paper and the developing and fixing solutions and are roughened or knurled to pick up and transfer the solutions to the paper. The staggered or offset relation of the belts 53 to 61 prevents the surface of the paper from being shielded from contact with the developer or fixer and thereby assures uniformity in developing and fixing the photographic material.

A most important advantage of the apparatus is that it can easily be disassembled and the elements thereof cleaned, washed or otherwise treated without the requirement for any special tools or any particular skill in the disassembly and reassembly of the apparatus.

Accordingly, the device is highly satisfactory and suitable for use by unskilled personnel and assures uniformity of development and fixing of the material under all conditions of use.

It will be understood that the apparatus is susceptible to modification in size and in details thereof without departing from the invention. Accordingly, the form of the invention disclosed herein should be considered as illustrative and not as limiting the scope of the following claims.

I claim:

1. A developing device for photoprinting apparatus comprising at least one tank for receiving developer, a first frame extending down into said tank, a plurality of pairs of rolls on said frame, resilient belts looped around said rolls and having downwardly converging flights extending into said tank, a second frame, at least one large roll carried by said second frame and bearing against and flexing said downwardly converging flights, said second frame being detachably connected to said first frame to enable said large roll to be separated from said belts, and means carried by said frames to rotate said large roll and drive said belts at the same peripheral speed.

2. A developing apparatus comprising a base member, a pair of tanks detachably mounted on said base member in side-by-side relation, a first frame including spaced apart side plates mounted on said tanks and having portions extending downwardly into said tanks, a plurality of rolls extending between and rotatably mounted in said side plates in staggered, parallel relations, flexible belts looped around said rolls to form upper flights converging downwardly into each tank from opposite sides thereof, a second frame, a pair of large rolls thereon in spaced relation to enter said tanks, means to support said second frame with the large rolls thereon disposed in said tanks and in engagement with said converging flights of said belts, and means

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to rotate said rolls and move said belts in unison.

3. A developing apparatus comprising a base member, a pair of tanks mounted on said base member in side-by-side relation, a first frame member having spaced side plates extending downwardly into said tank, large rolls extending between said side plates and disposed in said tanks, a second frame member interposed between said first frame member and said tanks and means including flexible belts supported on said second frame member for guiding photoprinting material around the outside of one of the large rolls down into one of said tanks and then upwardly out of said one tank, then around the other large roll into and out of the other tank, said first frame member being detachably connected to said second frame member to permit their separation.

4. The developing apparatus set forth in claim 3 in which said second frame member includes spaced apart end plates adjacent to and having portions extending down into said tanks, a pair of substantially parallel rolls extending between said portions of said end plates and disposed near the bottom of each tank, guide rolls extending between each end plate at the opposite ends thereof, another guide roll disposed between said pairs of rolls, said guide rolls being disposed above said pairs of rolls, and belt extending around each guide roll and the pair of rolls adjacent thereto for engagement with the peripheries of said large rolls.

5. The developing apparatus set forth in claim 3 in which said second frame member includes spaced apart end plates adjacent to and having portions extending down into said tanks, a pair of substantially parallel rolls extending between said portions of said end plates and disposed near the bottom of each tank, guide rolls extending between each end plate at the opposite ends thereof, another guide roll disposed between said pairs of rolls, said guide rolls being disposed above said pairs of rolls, and belts extending around each guide roll and the pair of rolls adjacent thereto for engagement with the peripheries of said large rolls, and means to rotate said another guide roll and said large rolls to move them and the belts in unison.

6. The apparatus set forth in claim 3, comprising a cover mounted in said base member and enclosing and covering said tanks and frames.

7. The apparatus set forth in claim 3, comprising means to strip the photoprinting material from said large rolls and to direct said material from one tank to the other.

8. The apparatus set forth in claim 3, comprising gearing on said first and said second frame members to rotate said rolls and drive said belts in unison, and a motor to drive said gearing.

9. The apparatus set forth in claim 3 in which said large rolls are roughened to pick up and transfer solutions in said tanks to said photosensitive materials.

No references cited.