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MAGNETIC CONVEYANCE AND TRANSFER SYSTEM
FOR PHOTOGRAPHIC PROCESSING
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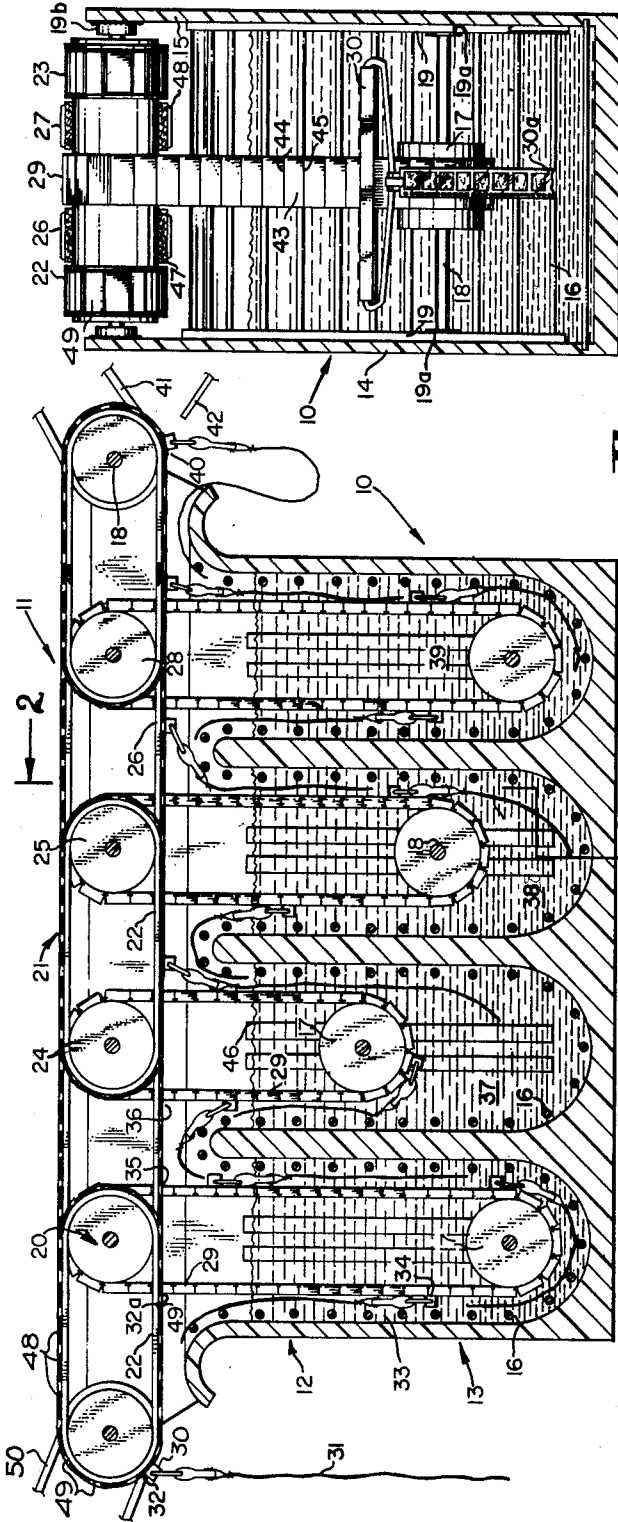


Fig 2

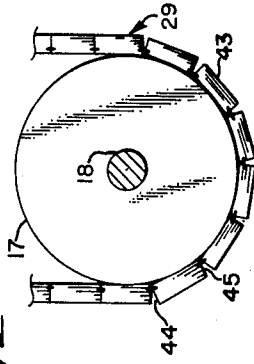


Fig 4

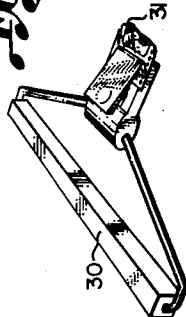


Fig 3

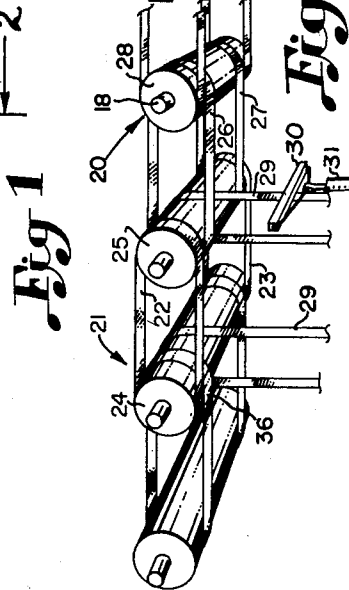


Fig 5

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MAGNETIC CONVEYANCE AND TRANSFER SYSTEM FOR PHOTOGRAPHIC PROCESSING

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3 Claims. (Cl. 95-94)

This invention relates to photographic film processing apparatus and more particularly to an improved means for conveying exposed photographic film through developing solutions.

This invention is an improvement over my co-pending application on Automatic Film Processing Apparatus, Serial Number 69,364, filed on November 15, 1960, now Patent No. 3,023,686.

An object of this invention is to provide a magnetic conveyance system which is particularly adaptable for use in the processing of photographic film strips which require submersion in a plurality of solutions and where submersion in successive solutions is for a varied length of time.

Another object of this invention is to provide a source of continuous motion which may be used intermittently to traverse small sheets of material, such as film strips, through successive solutions while requiring only a minimum of operation surveillance.

A further object of the invention is to provide a continuous source of motion which utilizes individual magnetically attractable elements and which further provides a uniform exposure of the film strips to the solution being traversed.

A still further object is to provide an inexpensive and efficient conveyance means which provides direct contact between the source of motion and the elements being moved, yet which allows easy and simple separation of the element being moved from the source of motion without interrupting the continuous motion of the conveyance means.

Another object of this invention is to provide a magnetic conveyance system which may be easily expanded or contracted in capacity so as to vary the capacity of the conveyance system according to the number of processes through which the element being exposed is subjected.

A still further object is to provide a magnetic conveyance system which is completely independent of the contour of the respective solution containers through which the system traverses, thereby providing more positive motion through the entire developing process.

These and other objects and advantages of my invention will more fully appear from the following description, made in connection with the accompanying drawing, wherein like reference characters refer to the same or similar parts throughout the several views and in which:

FIGURE 1 is a side view of a typical film developing apparatus contemplated by this invention, and having the side wall removed to reveal the relation of the elements;

FIGURE 2 is a full cross-sectional end view of FIGURE 1, taken on line 2-2 with the side wall in position;

FIGURE 3 is an enlarged perspective view of the carrier bar having a partial piece of film secured thereto;

FIGURE 4 is an enlarged detailed view of one of the idler drums utilized in this invention, together with a conveyance belt and its magnetic elements; and,

FIGURE 5 is a perspective view of the magnetic conveyance system, elements of the developing apparatus being removed whereby to more clearly show the principle operation of this invention.

Referring generally to the drawings now and more particularly to FIGURE 1, the film processing apparatus referred to generally as 10 is shown having principally a

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magnetic conveyance system 11 and a tank member referred to generally as 12. The tank 12 is made up of a plurality of individual solution containers 13 which have secured across the side walls 14 and 15, a plurality of spaced roller rods 16. The roller rods are for purposes of keeping film away from the walls of the solution containers as the film is traversing the tank 12.

In detailed description of the magnetic conveyance system 11, and referring to FIGURE 1, each of the plurality of solution containers 13 has an idler drum 17 which is rotatably positioned on a shaft 18 (see FIGURE 2). Shaft 18 in turn, is secured across the solution container at walls 14 and 15. To maintain the shaft 18 in a predetermined vertical position and yet allowing subsequent movement in a vertical direction, the shaft is provided with a guide shoe 19a at either end thereof which is slidably engaged in a vertical track 19 positioned on each wall 14 and 15. Should the idler drum be of sufficient mass and weight, the drum then could, under certain circumstances, be merely hung in suspended relation from the respective drive drum and allowed to freely rotate.

Positioned above each of the idler drums 17 is a corresponding drive drum 20 also mounted upon a shaft 18. In this instance, however, the ends of shaft 18 are rotatably secured at fixed position to walls 14 and 15 by mounting plates 19b. The idler drum 17 and drive drum 20 coact to form a pair of cooperating drums for each solution container.

Positioned about adjacent drive drums 20 is a first flexible belt means or transfer belt 21. As more clearly seen in FIGURES 2 and 5, the transfer belt is actually formed by a pair of coacting belts. For example, transfer belts 22 and 23 coact to form the transfer belt which is positioned around drive drums 24 and 25. Likewise, transfer belts 26 and 27 coact to form the transfer belt between drive drums 25 and 28.

Positioned about each of the coacting drive drum and idler drum pairs is a second flexible belt means, such as dipping belt 29. In this form of the disclosure, the dipping belt 29 consists simply of a single belt as shown in FIGURES 2 and 5. However, with reference to FIGURE 2, it may be seen that the dipping belt could just as well be formed with two separate and individual belts such as are transfer belts 26 and 27 or the transfer belts 22 and 23, in which case the transfer belt between either drive drums 24 and 25 or 25 and 28 would be a single belt such as dipping belt 29. The particular arrangement however is merely a matter of choice.

Providing a novel aspect of this invention is the magnetic means for transfer of the carrier bar, referred to as 30, through the various solutions. The carrier bar 30, as seen in FIGURE 3, is merely a single piece of rectangular metal with means for attaching a film strip 31 thereto. Generally speaking, the basic principle upon which the apparatus operates is that the carrier bar 30, with a film 31 attached thereto, be magnetically attracted to the first transfer belt a position 32. At intersection 32a of transfer belt 21 and dipping belt 29, the carrier bar 30 encounters the vertically positioned dipping belt and will be transferred from the transfer belt 21 to the dipping belt. The dipping belt then, through magnetic attraction, draws the carrier bar and its attached film through the first solution container 33, as shown at position 34 for example. The dipping belt then conveys the carrier bar 30 to the intersection 35 of dipping belt 29 and transfer belt 21. At this point the carrier bar is prevented from going over the drive drum 20 via the dipping belt because it encounters the transfer belt. The transfer belt thus picks the carrier bar 30 off of the dipping belt and transfers it to intersection 36 where again the previous process is repeated such as that at

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intersection 32a. Ultimately, the carrier bar with its film having gone through the remaining solution containers 37, 38 and 39, is finally removed from the conveyance system 11 at position 40 by removal means 41 which thereafter causes the carrier bar to fall upon a gravitation feed means 42 or some such similar device.

Considering then that the entire transfer system depends upon the media of magnetic attraction between the carrier bar 30 and the flexible belts 21 and 29, it is essential that both of the flexible belts have magnetically attractable materials, as well as carrier bar 30. Dipping belt 29 may be built up with a plurality of individual magnetically attractable plate links 43 interlocked with adjacent links at the edges 44 and 45. The links not only allow bending of the dipping belt around the drive drums and idler drums, but in addition, allow lengthening or shortening of the dipping belt according to the desired depth of the idler drum 17 within the solution container 13, which in turn, dictates the time duration in which the film is being conveyed therethrough. For example, the dipping belt 29 which carries film through solution 37 is much shorter than that which carries film through solution 39 and therefore it has its idler drum 17 positioned closer to the surface 46 of solution 37. The plates 43 may be either magnetized slightly or completely unmagnetized, the magnetic condition depending upon whether carrier bar 30 is magnetized or unmagnetized. If the plates are, however, unmagnetized, it is desirable that they have a high susceptibility to magnetic influence.

As shown in FIGURE 2, in this form of the invention, the transfer belts 21 have a continuous flexible material 47 which contacts the drive drums 20 and upon which is secured a plurality of metal plates 48 which may also acquire magnetic characteristics, dependent again upon whether the carrier bar 30 is magnetized or unmagnetized. Preferably, however, and as contemplated in this disclosure, the magnetic blocks 48 are slightly magnetized, as is the carrier bar 30. The plates 43, however, are unmagnetized. Also secured to belt material 47 is a non-magnetic material spacer 49 which provides a smooth continuous surface between blocks 48 upon which the carrier bar will ride. It is desirable to have spacer 49 of a pliable material so that belt 21 may bend around the drive drums.

In the operation of the conveyance system, the carrier bar 30 is magnetically attracted to the plates 48 at position 32 through mutual attraction if both elements are magnetized as is contemplated in this immediate disclosure. When the carrier bar 30 abuts the dipping belt 29 at intersection 32a, the magnetic attraction between carrier bar 30 and plate 48 is greater than the attraction between dipping belt 29 and carrier bar 30. Consequently, the carrier bar will remain attracted to the plate 48 until the transfer belt 21 causes a spacer 49 between plates 48 to match up with the position of carrier bar 30. When this position is acquired, the magnetic bond between the plate and bar is broken wherein there is then only slight magnetic attraction between the two. The plate 48 has continued on around drive drum 20 and thus the principal magnetic attraction will be between carrier bar 30 and plate 43 of dipping belt 29. Again, when the carrier bar arrives at intersection 35, it will encounter the transfer belt 21 rather than going up over the drive drum 20 as previously explained. If a spacer 49 is positioned adjacent the intersection 35, the dominating magnetic attraction will be between carrier bar 30 and dipping plates 43 so that the carrier bar will remain hung in the intersection 35. However, when a plate 48 travels to the intersection 35, a mutual magnetic attraction between the carrier bar 30 and the plate 48 would overpower the magnetic attraction between carrier bar 30 and unmagnetized plate 43, thus causing the carrier bar to adhere to the plate 48 and be transferred to intersection 36. At intersection 36, the same magnetic effects take place as occurred at intersection 32a and

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thus the carrier bar is caused to traverse the entire conveyance system.

Since all of the transfer belts 21 are interconnected upon adjacent drive drums 20, it is clear that powering one of the drive drums will cause rotation of all transfer belts 21 and if the drive drums are identical in size, the transfer belts 21 will travel at the same speeds. As shown at the left of the conveyance system, a drive belt 50 may be positioned around the first drive drum and be connected to a source of drive motion (not shown). The power required of course, will be very minute considering that the only actual power loss, other than friction in the drums, is the conveyance of the carrier bar through the conveyance system.

Although the particular magnetic arrangement described above is most capable of performing the desired function in carrying the carrier bar 30 through the solutions, it is quite apparent that the plates 43 could be magnetized, but to a lesser or equal degree to that of the plates 48, and with no magnetization of carrier bar 30, have the system operate as desired. In this instance, it would be preferred that the plates 48 have a dominating magnetic attraction with carrier bar 30 over that of plates 43 and the carrier bar.

Having thus described this invention, it is recognized that the conveyance system may be operated at operational speed continuously, however, the film may be carried through the solutions at intervals of whatever is desired. Thus, manually fed intermittent use is available without starting and stopping the transfer system each time. Also, the system utilizes a positive attraction between the source of power and the element being conveyed such that the chance of the carrier bar losing its magnetic influence and attraction from the conveyance system is minimized. Another desirable feature is that the drive drum 20 and the transfer belts 21 may be positioned closely adjacent the upper edges of the tank 12 thereby reducing to a minimum the size of the conveyance system.

It will, of course, be understood that various changes may be made in the form, details, arrangements and proportions of the parts without departing from the scope of my invention as set forth in the appended claims.

What is claimed is:

1. In a system adapted for use in development of photographic film having a plurality of fluid baths positioned adjacent each other, comprising, a pair of drums associated with each fluid bath, one of said drums being a drive drum and located exteriorly of said fluid bath and the other being an idler drum located within said fluid bath, both said drive drum and said idler drum having parallel axes of rotation, an endless dipping belt positioned about each said pair of drums, an endless transfer belt positioned about said drive drums, a magnetically attractive carrier bar adapted to have a strip of film attached thereto, one of said belts having first magnetic plates to form a continuous surface, the other of said belts having second magnetic plates intermittently spaced along its length whereby to form free spaces between adjacent second magnetic plates, said second magnetic plates having a predominating magnetically attracting characteristic over that of said first magnetic plates, said first and second magnetic plates being adapted to temporarily attract and retain said carrier bar thereto, and drive means connected to one of said drive drums for powered rotation thereof.
2. A magnetic conveyance system adapted for conveying film strips through photographic film developing solutions contained in a plurality of individual solution containers comprising, a plurality of idler drums one of which is adapted to be positioned in each of said individual solution containers in variable spaced relation to the bottom thereof, means for temporarily fixing the spaced relation of said idler drums to the bottoms of the containers yet allowing subsequent vertical movement, a plurality of drive drums adapted to be positioned above said

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solution containers, each drive drum being positioned above a corresponding idler drum, all of said drums having substantially parallel axes, an endless dipping belt positioned about each said drive drum and corresponding idler drum, said dipping belt having a continuous magnetically attracting surface, an endless transfer belt positioned about adjacent drive drums, said transfer belt having magnetically attracting elements secured thereto at spaced intervals therealong, said magnetically attracting elements having a predominating magnetic influence over that of said dipping belt surface, one of said belts being divided along its length and the other belt being positioned between the parts of the belt divided, and

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drive means connected to one of said drums for powered rotation thereof.

3. A magnetic conveyance system as set forth in claim 2 wherein said dipping belt and said transfer belt are positioned at substantially right angles to each other.

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