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PHOTOGRAPHIC DEVELOPING APPARATUS

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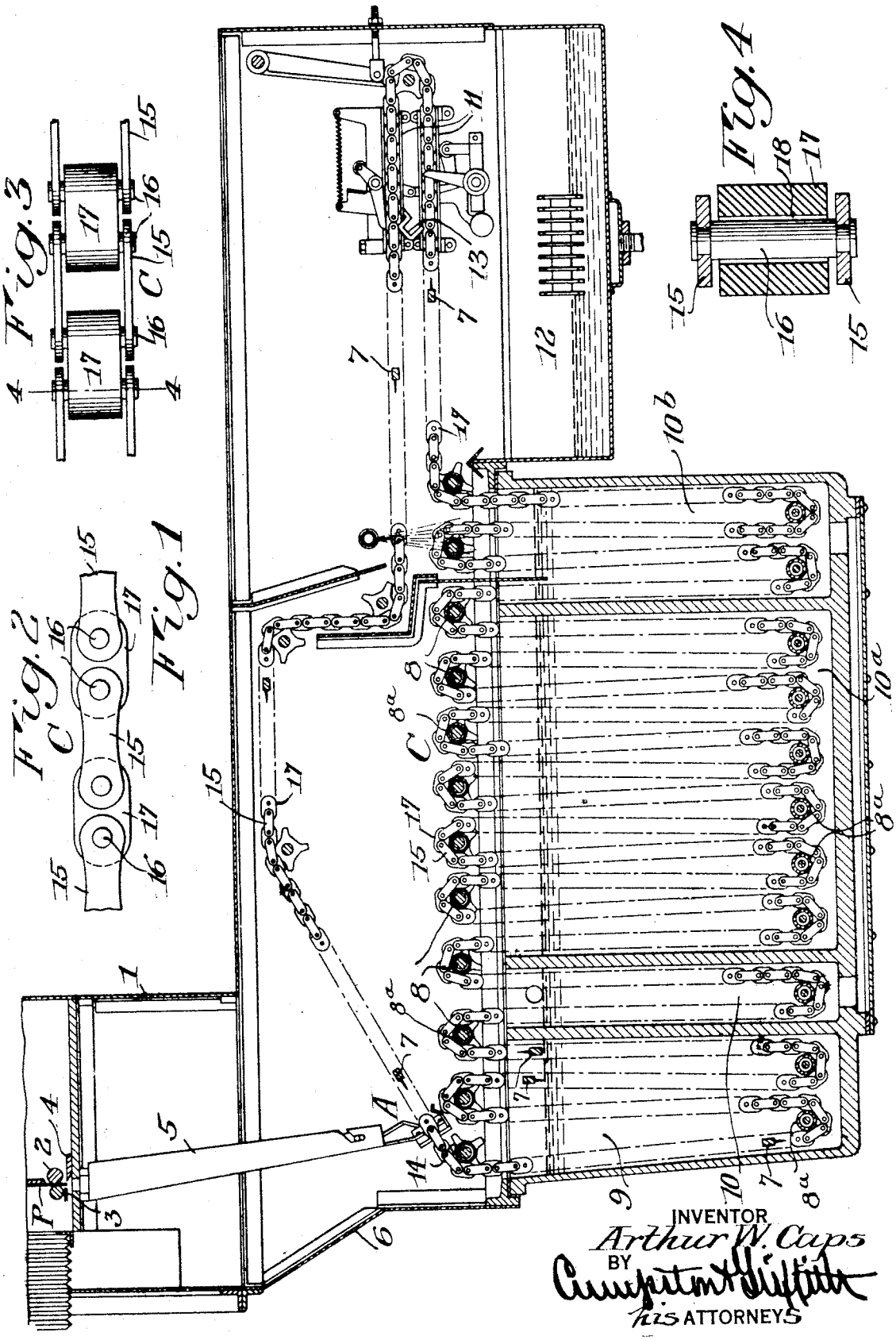


Fig. 1

Fig. 3

Fig. 2

Fig. 4

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PHOTOGRAPHIC DEVELOPING APPARATUS

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My present invention relates to photography and more particularly to photographic print handling apparatus in which a usually metallic conveyor and other usually metallic parts are used to carry and expose photographic prints through and to the various developing, washing, and fixing baths, and the invention has for its object to provide an improved chain, or similarly articulated conveyor element for this purpose so constructed that it will be strong and durable and efficient throughout a long period of use, and particularly adapted to avoid the deleterious effects ordinarily resulting through galvanic or chemical action resulting from the contact of metal parts with the metallic salts or free silver present in solution in the bath or baths. In a broader view, the invention has for its object to accomplish the last mentioned results with respect to all of the mechanical elements which enter into the manipulation of the print and are exposed thereby to the action of the photographic chemicals.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a longitudinal central vertical section, partly broken away at the top, through a photographic exposing and developing apparatus constructed in accordance with and illustrating one embodiment of my invention;

Fig. 2 is a side elevation, enlarged, of a fragment of the chain conveyor used in transporting an exposed print from the exposing mechanism through the devloping apparatus;

Fig. 3 is a top plan view of the same fragment, and

Fig. 4 is a further enlarged section taken on the line 4—4 of Fig. 3.

Similar reference numerals throughout the several views indicate the same parts.

I shall first describe the typical photographic apparatus shown to which my invention is usefully applicable, and then explain the problem which my invention solves, and the details of the improvement itself.

Referring more particularly to Fig. 1, 1 indicates a lower portion of the exposing mechanism or camera body of a well known type of commercial camera, as it is called, used for the purpose of exposing successive sections of a continuous strip of sensitized paper upon which photographs of documents and similar objects are made, which sections are cut off into separate prints or sheets that are then carried through successive developing, washing, and fixing baths in a continuous automatic or semi-automatic progression. Feed rolls for the exposed print or exposed section of film or paper itself indicated at P are shown at 2. These carry the print between knife elements 3 and 4 by which they are severed to drop into a chute 5 below in a dark developing chamber, the casing of which is indicated generally at 6, and upon which the camera or exposing element is mounted. The lower edge of the print emerges and protrudes from the lower end of the chute 5 at a pick-up point indicated generally at A. The details of this arrangement and construction are not important to a disclosure of this invention, and hence are not shown. It is sufficient to say that the point A is in the path of a plurality of pin bars 7 that continuously and successively pass the point A, and pick up the successive prints by means of impaling pins, or other suitable engaging devices with which the bars are fitted.

These pin bars 7 extend transversely between and are connected to and carried by two chain elements indicated generally at C of a continuous chain conveyor. There is one such chain C at each side of the machine, but the one on one side only appears in the section. From the point A the chains and pin bars travel in the direction of the arrows over a preferably metallic drive sprocket 14 and thence over a system of suitable preferably hard rubber sprockets 8 and upper and lower rollers 8a of the same material first downwardly into a developing tank 9, thence rearwardly and downwardly into a washing tank 10, thence rearwardly and downwardly

into a hypo or fixing tank 10*a*, and a chain washing tank 10*b* and finally upwardly and rearwardly on tracks 11 over a final washing and delivery tank 12. At the end of the rearward movement or travel over the bath 12, the trailing print is disengaged by a device indicated generally at 13 acting as a stripper and attendant mechanism, whereupon it falls into the tank 12 and is immersed in the bath by a suitable submerging device (not shown), but these devices 13 are also not important to an understanding of this invention, and hence need not be further explained. The conveyor finally doubles upon itself, as shown over the receptacle 12 and proceeds forwardly again until the print impaling pin bars 7 thereon ultimately reach station A again to pick up another print.

With respect to the baths 9 and 10 and 10*a*, the chain conveyor in carrying the print to the depths thereof is submerged in the liquid for a substantial period. I have found by considerable experimenting that the ordinary metal chains take on a coating of silver, particularly in the hypo solution. On the other hand dielectric substances such as hard rubber become faintly coated with silver in the developing solution. This is particularly noticeable on the hard rubber rollers 8*a* that are carried by the shafts of the sprockets 8 shown in the drawing which become heavily coated with silver over the tanks 9 and 10 but never over the tanks 10*a* and 10*b*.

I have made numerous tests as follows: Place a bright piece of metal in a new developing solution and a new hypo solution. No deposit forms on either one. Then place a bright piece of metal in an old developing solution and an old hypo solution. No deposit has formed on the metal in the developing solution but always forms on the metal in the hypo solution in a very short time. When an ordinary steel, brass, or other all metallic conveyor chain C is used, I have found that what appears to be a galvanic action or a chemical action or an electro-chemical action is set up between the elements of the chain through the medium of the solution particularly the hypo or fixer which results in a deposit of free silver thereon. This approximates the form of the ordinary silver plate, and constitutes a scale or coating that increases the dimensions of the metal parts and causes them to tighten and bind upon each other at points where they have relative movements and frictional contact against each other. This is particularly true with respect to the pins of one link, and their bearings in adjoining links causing the bearing space to become relatively smaller and smaller. The chain thus becomes heavy, stiff, and finally inflexible, so that it rounds the sprockets only with difficulty, if at all, and requires an inordinate amount of power on the part of the driving force.

It is my understanding of the photographic process that when an exposed print enters the developing solution, the hydrochinon changes the silver bromide in the exposed area to metallic silver and when the print is placed in the hypo solution, the hypo thiosulphite dissolves out the unexposed silver which is still in the form of a bromide so that prints will not fade. If I am right about this, then little or no silver goes into the developing solution, and the coating on the rubber roller above the developing tank must result from contact with the surface of the wet print as it passes over. On the other hand, a great deal of silver is taken up in the hypo solution and it is here that a galvanic action seems to take place. If the galvanic action is the direct result of the deposits on the metal, then this action would be greatly accelerated because the hypo solution is acidified with the hardener, usually citric or acetic acid, and it is a well known fact that all plating baths are accelerated by acid solution.

I have discovered that I can break up this galvanic or other action and still produce a strong and serviceable chain by using partly metallic links, and partly nonmetallic links for the articulated elements so that at the points of contact the two materials constitute a non-galvanic couple. In other words, one of the elements is electrically and chemically inert, and therefore, no cathode for the deposit of the metal is presented, and the metallic parts are insulated from each other by a dielectric intervening body.

A preferred form of chain having these characteristics is shown in detail in Figs. 2, 3, and 4, wherein 15 represents link plates of metal connected by the link pins or rivets 16. Alternating with these are block links 17 comprised between the plates 15, and in which the pins 16 have free bearings 18. I prefer to use porcelain or hard rubber for the block links 17, though other inert substances having the same characteristics for the purposes here involved will suggest themselves to those skilled in the art. As shown in Figure 2, the dielectric or block links 17 are quite a little thicker than the metallic plates 15. The reason for this is two-fold. First, that in passing over sprocket wheels or rollers, the rubber blocks touch the sprockets and roller, but the metal links do not come in contact with them at all. At present I prefer to use hard rubber sprocket wheels and hard rubber rollers in every place except the front two drive sprockets which are metal. However, metal sprockets may be used throughout, in which case this chain as I have it constructed, would still be effective, because the rubber blocks would keep the metal links away from the metal sprockets and prevent any galvanic couple. The second reason is that tensile strength of the rubber, porcelain or other similar material is much less than the tensile

strength of the steel therefore, it is advisable to make the rubber blocks wider than the links so as to get more material around the hole and thereby give greater strength to the chain.

Even where the metal deposits do not form through electro plating or otherwise, but where a contact of metal with metal occurs in the presence of a chemical there results a corrosion and consequent erosion as it may be called, of the metal parts, as a result of which they ultimately waste away. Even stainless steel turns black and crystallizes and drops off very much similar to a contact which has been burned by an electric arc or perhaps the copper point of an electric switch that has become burned. The metal turns black as in the cases referred to and has no malleability any more. In other words, it seems that the metal has become a compound of some salt like sulphur or become an oxide. This erosion continues to such an extent that the rollers on a chain eat away and drop off and the sides of the chain become smaller. I find that such deleterious results are also obviated by the interposition of the dielectric contact element. It will be understood that I do not confine myself to the use of rubber or other materials mentioned, and in its broadest aspect the invention is applicable not only in the construction of the chain conveyor, but in the construction of other parts, as aforesaid, which come into contact with each other in the preparation of the photographic chemicals.

I found in tests that a chain performing these functions as a print carrier, and traveling through photographic chemical baths and constructed in accordance with this invention is strong and durable, and has a long life unaffected by the galvanic chemical or similar troubles resulting from chains and conveyors of the type heretofore used. Hard rubber and metal chains that have been running in practice for many months or more show a slight silver coloration on the hard rubber block and a slight coloration on the metal link. These blocks and links have been carefully calipered and there is not sufficient deposit to show any increase in size whatsoever. It appears to be merely coloration and nothing more, therefore, it would seem that by providing metallic and nonmetallic links, the galvanic action has been broken up to such an extent that neither the metal coats in the hypo nor the rubber in the developer. Therefore, the entire chain stays clean.

I claim as my invention:

1. In a photographic developing apparatus, the combination with a receptacle adapted to contain a metallic salt in solution, of a chain arranged to run through the receptacle submerged in the solution and to carry a photographic print, said chain comprising a series of articulated links joined together, some of the links being metallic and separated by other intervening non-metallic links of a material incapable of joining in galvanic action therewith.

2. In a photographic apparatus, the combination with an exposing camera and a developing chamber associated therewith, the latter embodying a receptacle containing a metallic salt in solution and the former embodying means for feeding an exposed sheet of sensitized material into the developing chamber, of a chain conveyor adapted to pick up a print so fed and arranged to carry the same through the container while submerged in the solution, said chain comprising a series of articulated links joined together, some of the links being metallic and separated by other intervening non-metallic links of a material incapable of joining in galvanic action therewith.

3. A chain for the purpose described comprising a series of articulated links joined together by pins and bearings therefor respectively provided on contiguous links, each pin and the bearing surface thereof being respectively composed of different materials together constituting a non-galvanic couple.

4. Photographic print treating apparatus comprising, in combination, a receptacle for holding a bath of photographic chemicals, and a conveying member within said bath for moving a print therein, said member comprising a plurality of metallic portions separated from each other by an interposed dielectric body.

5. Photographic print handling means comprising, in combination, a receptacle for holding a bath of photographic chemicals, and conveying means movable through said bath, said conveying means comprising two cooperating portions to contact with each other, one of said portions being metallic and the other of said portions being of non-metallic electrically inert material.

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