Sept. 23, 1958 E. C. WOODCOCK 2,853,294

WEB PROCESSING APPARATUS

Filed Dec. 23, 1957 4 Sheets-Sheet 1

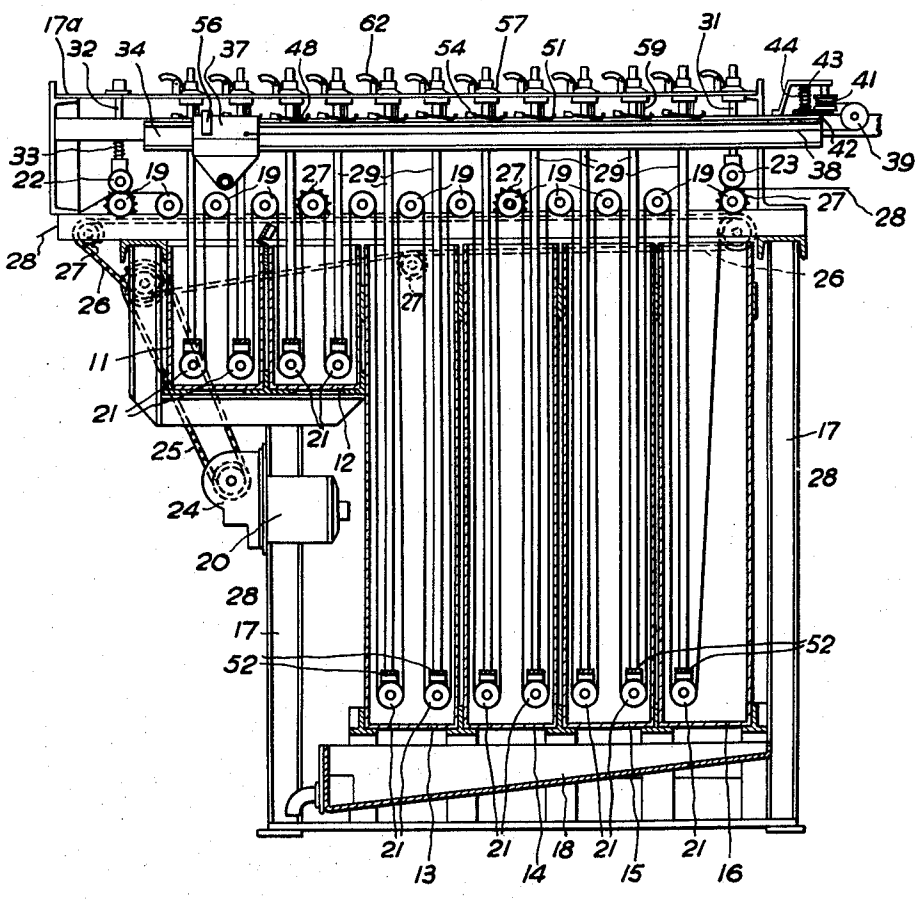


Fig. 1.

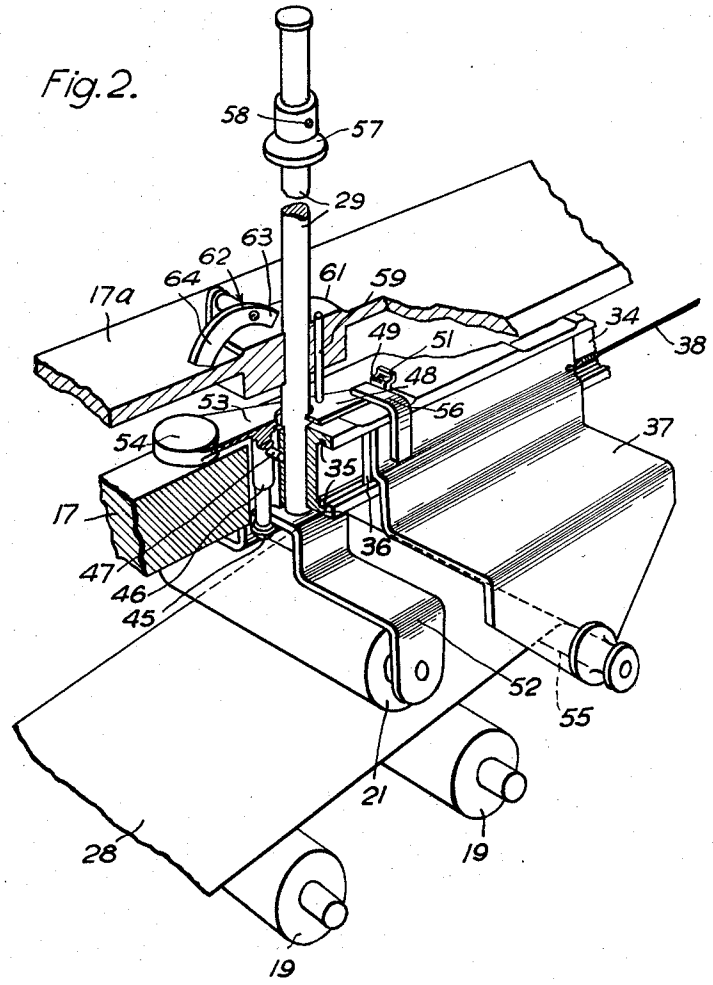
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Fig. 2.



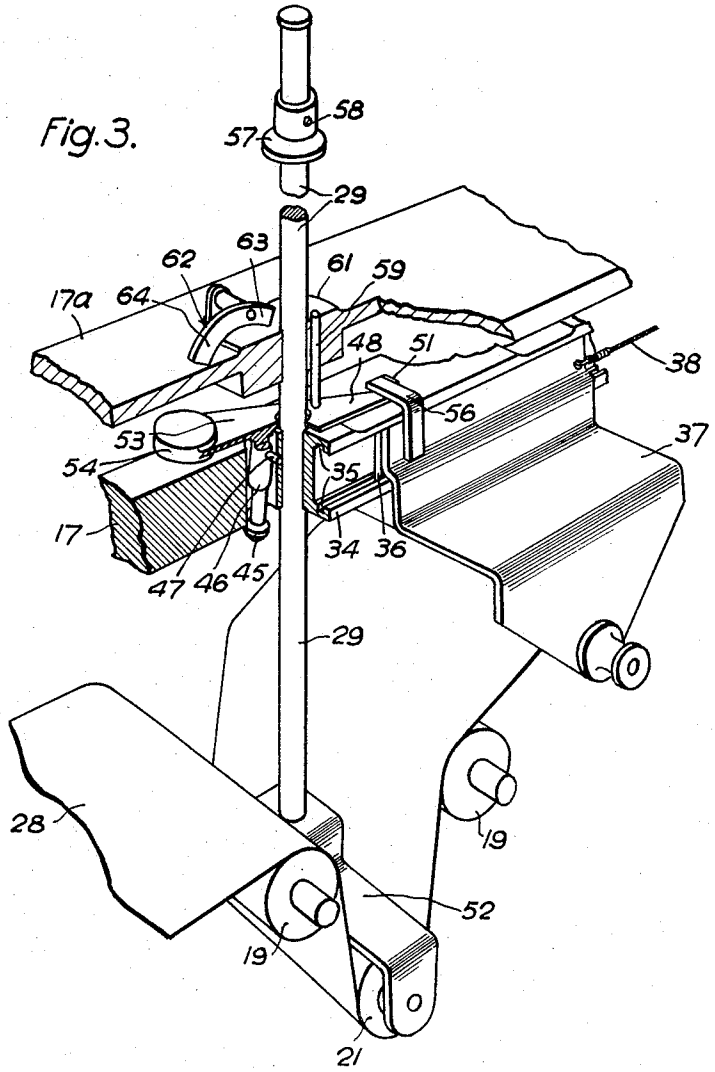
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Fig. 3.



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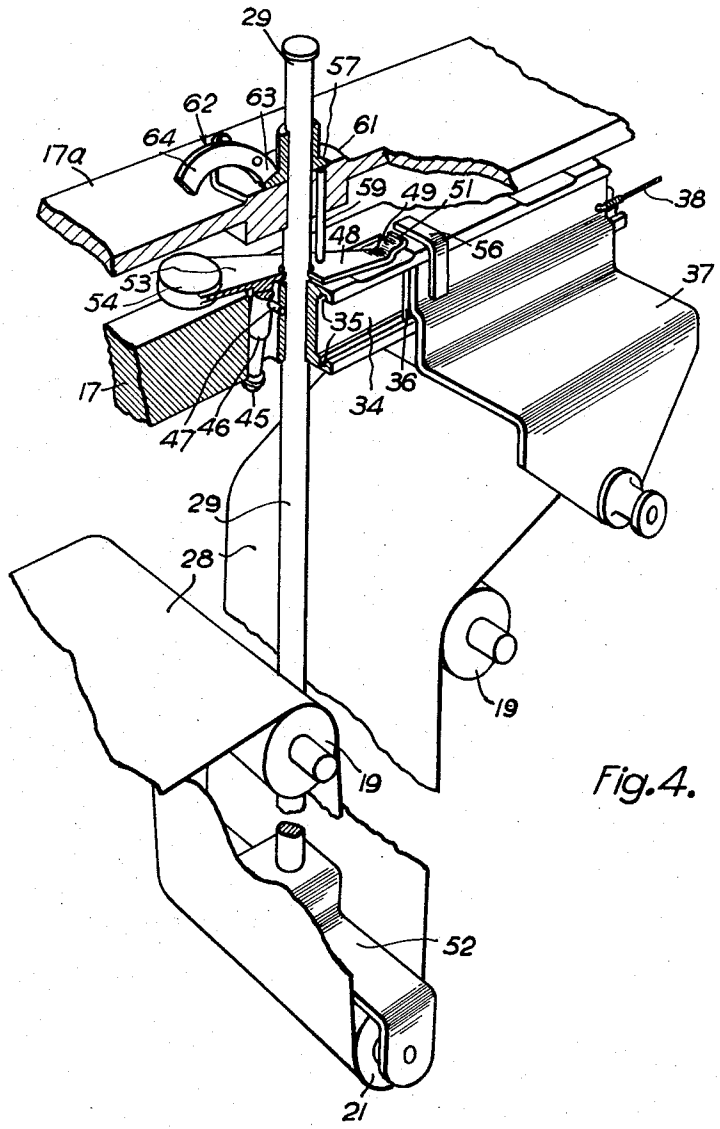


Fig. 4.

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WEB PROCESSING APPARATUS

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Application December 23, 1957, Serial No. 704,836

Claims priority, application Great Britain December 27, 1956

13 Claims. (Cl. 271—2.2)

This invention relates to apparatus for processing webs of the kind in which a travelling web is led up and down over nests of top and bottom guide rollers through one or more tanks or the like in which the processing takes place. A typical example is apparatus for continuous development, fixing and washing of photographic film or paper. It is known to arrange such apparatus so that the bottom rollers are suspended on rods whereby they can be lifted above the level of the upper rollers, the supports for the upper rollers being arranged so that an opening is left through which the web can first be passed without any need to let go of it or carry it round obstructions when first threading up. An arrangement for this purpose is disclosed in British patent specification 577,430. In that apparatus the threading operation was effected manually, and it also involved waste of a length of web or the provision of a pilot web equal to the length of the apparatus.

An object of the present invention is to provide apparatus of the above character with means which automatically effects the threading and which reduces the waste to a very small amount.

According to the present invention in apparatus of the above character there is provided a carriage to which the leading end of the web can be attached and which is guided to move substantially horizontally in a direction at right angles to the axes of the rollers, means for urging the carriage from the end at which the web is fed into the end at which it is fed out, releasable means holding each rod with its roller in the raised position, means actuated by the arrival of the carriage in a position with the leading end of the web beyond an upper roller for releasing said rod-holding means and for checking the carriage at this position so that the rod and roller can then descend at a speed governed by the feed of the web and means actuated by each rod when it reaches its lowest position for releasing said checking means. Thus, starting from the entry end the carriage moves forward until it reaches a position at which it is checked by the rod carrying the first lower roller when the leading end of the web attached to the carriage will have moved beyond the first lower roller. As soon as the carriage is checked the first roller descends at a rate determined by the rate of feed of the web, carrying the web down into the first processing tank. When it reaches its lowermost position it remains there and releases the carriage which now moves forward until it reaches the rod carrying the second roller when the same cycle is repeated and so on until the carriage reaches the end of the apparatus. At this point the operator needs to release the web from the carriage, and it is then fed out of the apparatus for any further treatment which may be desired.

The invention will be further described in greater detail with reference to an example illustrated in the accompanying drawings in which,

Figure 1 is a side view partly in section of the complete apparatus with the web running through it but with the carriage in the position at which it is first checked for the formation of the first loop of web, and

Figures 2, 3 and 4 are perspective detailed views partly in section showing three different stages in the cooperation between the carriage and one of the roller-carrying rods.

The apparatus includes a series of processing tanks 11, 12, 13, 14, 15, 16 supported in a framework 17 and provided with a draining tray 18; there are also a nest of upper guide rollers 19 and a nest of lower guide rollers 21, counter-rollers 22, 23 at the entry and exit ends, and means for driving at least the first upper roller 19 preferably also the last and some of those between, exemplified by a motor 20, gearing in a box 24 and chains 25, 26 the latter engaging sprocket wheels 27. The rollers 19, 21 serve to guide a web 28 to be processed through tanks 11 to 16 in succession. Rollers 21 of the lower nest are carried each by a rod 29 passing through a hole in an upper longitudinal 17*a* in the framework 17 to enable it to be lifted to a level above that of the rollers 19 to permit the web to be threaded in. The counter-roller 23 coacting with the last roller 19 is similarly mounted on a guide rod 31 so that it can similarly be lifted, while the counter-roller 22 is carried by a guide rod 32 by which it can be lifted against the pressure of a spring 33. So far the apparatus is on lines known from the prior British specification 577,430 referred to and no further detailed description is necessary. The apparatus can also be varied in such things as the number and size of the tanks, the number of loops of web which are formed in any tank, and the number of upper rollers 19 which are positively driven and it can also incorporate other known devices such as light trapping covers and means for preventing the carrying over of substantial quantities of solution from one tank into another.

Above the tanks in the general direction of travel of the web, that is at right angles to the axes of the rollers 19, 21 and horizontally extends a bar 34 having vertically opposite grooves 35 which guide a vertical plate 36 forming part of a carriage 37 which is constantly urged towards the right in Figure 1 by pull on a cord 38 conveniently of nylon; the pull could be exerted by carrying the cord over a pulley and suspending a weight from it, but in the illustrated example after passing over a pulley 39 the cord is wound on a drum 41 geared at 42 to a spindle 43 provided with a torsion spring 44. Other alternative means for urging the carriage could be used. Thus the spring and drum might be mounted on the carriage with the cord anchored to the end of the bar 34 or a rack and pinion might be used in this case instead of cord. A chain might be used also instead of a cord.

At the commencement of operations the rods 29 and the rod 31 are manually raised to the position corresponding with Figure 2. In this position the rod is held up by a latch 45 at the lower end of a substantially vertical arm 46 of a bell crank lever pivoted at 47, the other arm 48 extending in the direction in which the carriage is urged and terminating in a ramp 49 and an up-turned lug 51. As shown the latch 45 engages the edge of the yoke 52 by which the roller 21 (or 23) is mounted on the lower end of the rod 29 (or 31) and it has a bevelled lead so that when the rod is raised the latch automatically catches. The biasing force on the lever to cause the latch to catch is preferably provided by gravity and as shown to provide this the lever has a short arm 53 carrying a counter-weight 54. When the rods are so latched the rollers 21 are sufficiently above the rollers 19 to give free passage to a crossbar 55 on the carriage 37 to which the leading end of the web 28 is attached.

In the example shown the pivot 47 is on the opposite side of the rod 29 to the ramp 49 and lug 51 and the arm

48 therefore has a hole which gives ample clearance to the rod 29.

A projection 56 on the carriage extends above the lever arm 48 but clear of the rod 29. After the rods 29 and 31 have been latched in their raised positions, the roller 22 is lifted through its rod 32 against the spring 33 so that the web 28 can be introduced between the roller 22 and the first roller 19 without the first roller 19 feeding the web though it is a driven roller, and then attached to the crossbar 55 while the carriage is held back against the pull of the cord 38. The carriage is now released and the roller 22 allowed to return when the web will be fed between the rollers 22, 19 and the carriage under the pull of the cord will move forward (i. e. to the right in Figure 1) at the rate at which the web is fed in until it reaches the first checking position.

Up to the position shown in Figure 2 removal of the carriage is unimpeded but at this point the projection 56 rides on to the ramp 49 thus rocking the lever 46, 48 sufficiently to release the latch 45 and practically simultaneously checks the carriage by engagement with the lug 51. The release of the latch allows the rod 29 and roller 21 to fall until the roller after a short movement rests on the web 28, whereupon the rod and roller will descend at a rate governed by the rate of feed of the web. Figure 3 shows the position of the parts after the roller has descended a short distance.

When the roller 21 reaches its intended lowest position a projection on the rod 29 conveniently in a form of a collar 57 which can be adjusted in position for example by the aid of a grub screw 58 rocks the lever 46, 48 still further, conveniently through a push rod 59. This moves the lug 51 clear of the projection 56 while the rod 29 is also checked by the collar 57 resting on a boss 61 on the frame member 17*a*. The carriage is now free to continue moving under the pull of the cord 38 at a rate equal to the rate of feed of the web 28 until it reaches the next checking position when the whole cycle described is repeated.

The last roller to be released is the roller 23 but the carriage is checked clear by any convenient means for example a stop in the path of the projection 56 or even by the abutment of the carriage against the pulley 39. When the carriage reaches this point the operator releases the web from the crossbar 55 and the web is fed out between the rollers 23, 19.

The illustrated example shows a simple form of lock to hold each rod 29 (or 31) in its lowest position. This is a simple lever 62 pivoted on the boss 61. The collar 57 simply rides past the end 63 of the lever when, as shown in Figure 4, the relative position of the collar 57 and lever end 63 is such that the collar cannot be lifted again by movement of the rod 29. To release the lock the lever must be rocked further in the clockwise direction in Figure 4 by the operator sufficient clearance being left for the end 63 for this purpose. The other arm 64 of the lever serves as a counter-weight so that again the necessary biasing force is provided by gravity. The lever 62 is located to provide ample play to allow the rod and collar to move under variations in stretch of the web and similar inferences as it passes over the respective roller 21.

It will be observed that the operating force for lowering the rollers 21, for the latch lever 46, 48 and the locking lever 62 is provided by gravity and that none of the mechanism depends on the maintenance of close clearances thus no difficulties will be experienced if in the course of time a certain amount of corrosion occurs. Further with any of the means above described for urging the carriage merely pulling the carriage to the starting end causes the necessary energy to be stored. Similarly, mere raising of the rods 29, 31 and rollers 21, 23 stores the energy necessary for causing them to descend again.

Alternatively to shaping the end 63 of the lever 62 so that the locking effect is attained by a wedging action, the locking effect may be attained by shaping the other arm 64 of the lever so that it is so close to the longitudinal 17*a* that the lever cannot rock counter-clockwise in Figure 4 far enough to release the collar 57.

It will be seen that since the time of treatment is determined by the rate of in-feed of the web 28 between the rollers 22, 19, and since the web 28 is fed at this same rate into the first processing tank 11 and so on through each successive loop over the rollers 19, 21, the whole of the web, except for a very short portion extending from the crossbar 55 on the carriage down to the level of the liquid in the first processing tank 11 at the first stopping of the carriage, undergoes exactly the same treatment and accordingly only this short length is wasted.

It will also be clear that once the end of a length of web being treated has left the very first stage of treatment, the first bottom roller 21 can be raised and another web be secured to the crossbar 55 on the carriage, the succeeding rollers 21 being raised in turn after the end of the first web has passed out of the section in question and before the carriage reaches them. Thus, only very small intervals between successive webs are necessary, and this is useful where relatively short lengths of web are being processed.

I claim:

1. In apparatus for processing a web led up and down over nests of upper and lower guide rollers of which the lower rollers are suspended on rods whereby they can be lifted above the level of the upper rollers to leave an opening through which the web can be passed when threading up, the combination of a carriage to which the leading end of the web can be attached and which is guided to move substantially horizontally in a direction at right angles to the axes of the rollers, means for urging the carriage from the end of the apparatus at which the web enters towards the end at which it leaves, releasable means holding each rod with its roller in the raised position, means actuated by the arrival of the carriage in a position with the leading end of the web beyond a lower roller for releasing said rod holding means and for checking the carriage at this position, so that the rod and roller can then descend to carry the web into a downwardly extending loop, and means actuated by each rod when it reaches a predetermined position for releasing said checking means.

2. Apparatus as set forth in claim 1 wherein at least the upper roller at the entry end of the apparatus is positively driven thereby to feed the web.

3. Apparatus as set forth in claim 2 wherein a counter roller is retractably spring pressed towards said driven roller whereby to hold the web in contact with said driven roller.

4. Apparatus as set forth in claim 1 wherein the means for urging the carriage incorporates a flexible tension member and means located on the stationary part of the apparatus for applying tension to the flexible tension member.

5. Apparatus as set forth in claim 4 wherein said tension member is a cord which is wound upon a spring driven drum.

6. Apparatus as set forth in claim 1 wherein said holding means comprises a bell crank lever having one substantially vertical arm extending downwardly and one substantially horizontal arm extending in the direction of movement of the carriage, a latch on the lower end of said vertical arm located to engage a surface on the rod and roller assembly in the raised position, a ramp on said horizontal arm, and a projection on said carriage located to engage said ramp thereby to rock the bell crank lever and disengage the latch.

7. Apparatus as set forth in claim 6 wherein said bell crank lever is biased towards the engaged position of the latch and the latch has a bevelled leading surface whereby it is pushed aside and then engages automatically when the rod is raised.

8. Apparatus as set forth in claim 7 wherein said bell crank lever is biased by gravity.

9. Apparatus as set forth in claim 6 wherein said horizontal arm terminates in a lug which engages said projection after it has rocked the lever thereby to check the carriage, and said means actuated by each rod when it reaches its predetermined position includes a projecting member on the rod by which said bell crank lever is rocked further far enough to disengage said lug from said projection.

10. Apparatus as set forth in claim 9 wherein said rods are guided in apertures in a longitudinal frame member above the carriage and said bell crank levers are below said longitudinal member, the apparatus also including a push rod located in said longitudinal member adjacent each said rod one end of said push rod being engaged by said projecting member and the other acting upon the horizontal arm of said bell crank lever.

11. Apparatus as set forth in claim 10 also incorporating for each said rod a locking lever pivoted to said longitudinal frame member in such a position that said projection can move past it but cannot be returned by a movement of said rod so that said rod is thereby locked in its predetermined position and can only be released by manual movement of said rocking lever.

12. Apparatus as set forth in claim 1 also including means for locking each said rod when it reaches its predetermined position.

13. Apparatus as set forth in claim 1 also including means for driving a final upper guide roller at the end at which the web leaves, a counter roller for holding the web pressed against said final roller, the counter roller being carried by a rod provided with releasable means for holding it in the raised position and means actuated by the arrival of the carriage in a position with the leading end of the web between said counter roller and said final roller for releasing the rod holding means.

No references cited.