Aug. 2, 1960 H. W. FAEBER 2,947,235

PHOTOGRAPHIC DEVELOPING APPARATUS

Filed June 27, 1957 4 Sheets-Sheet 1

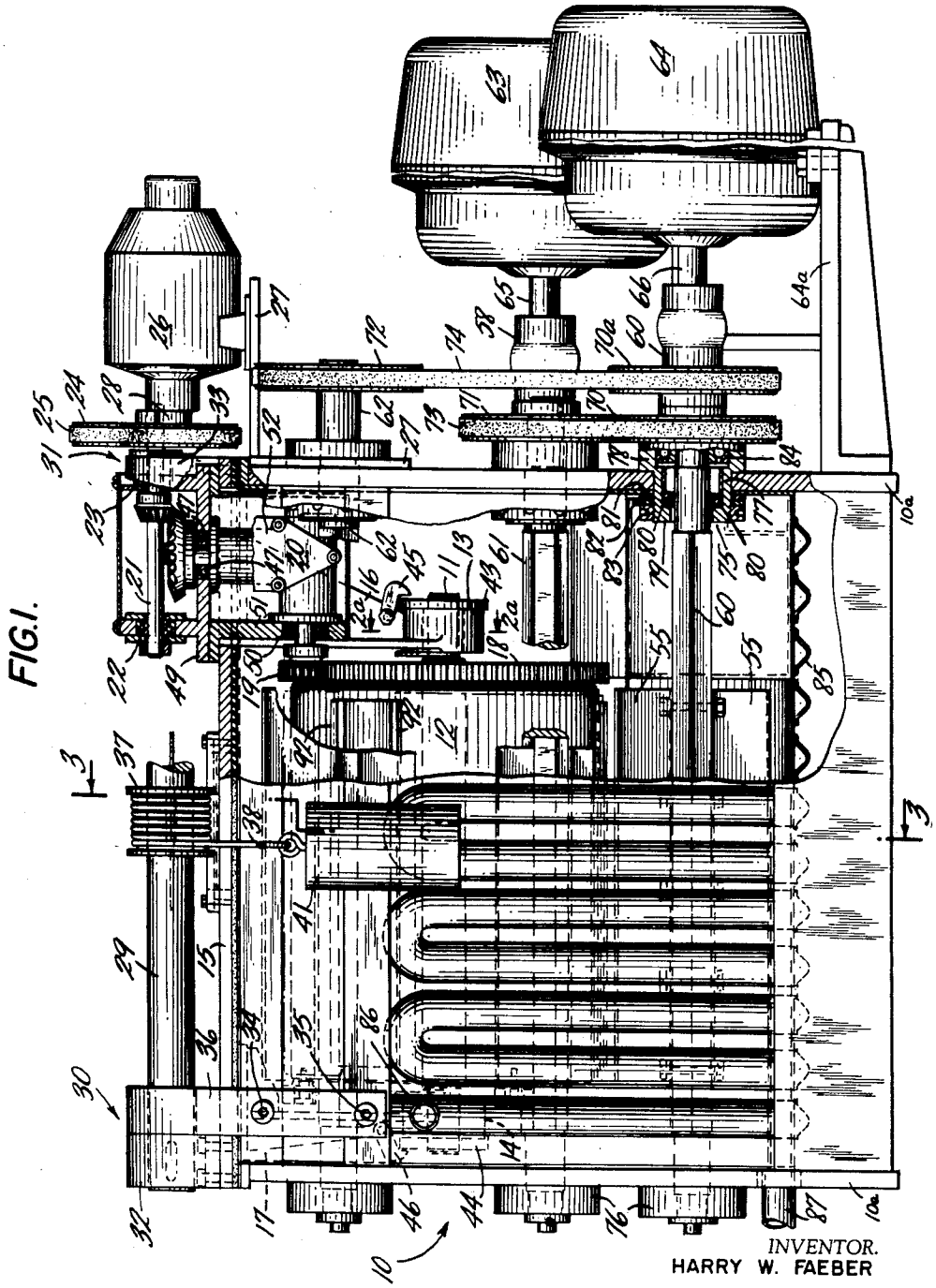


FIG. 1.

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PHOTOGRAPHIC DEVELOPING APPARATUS

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FIG. 2.

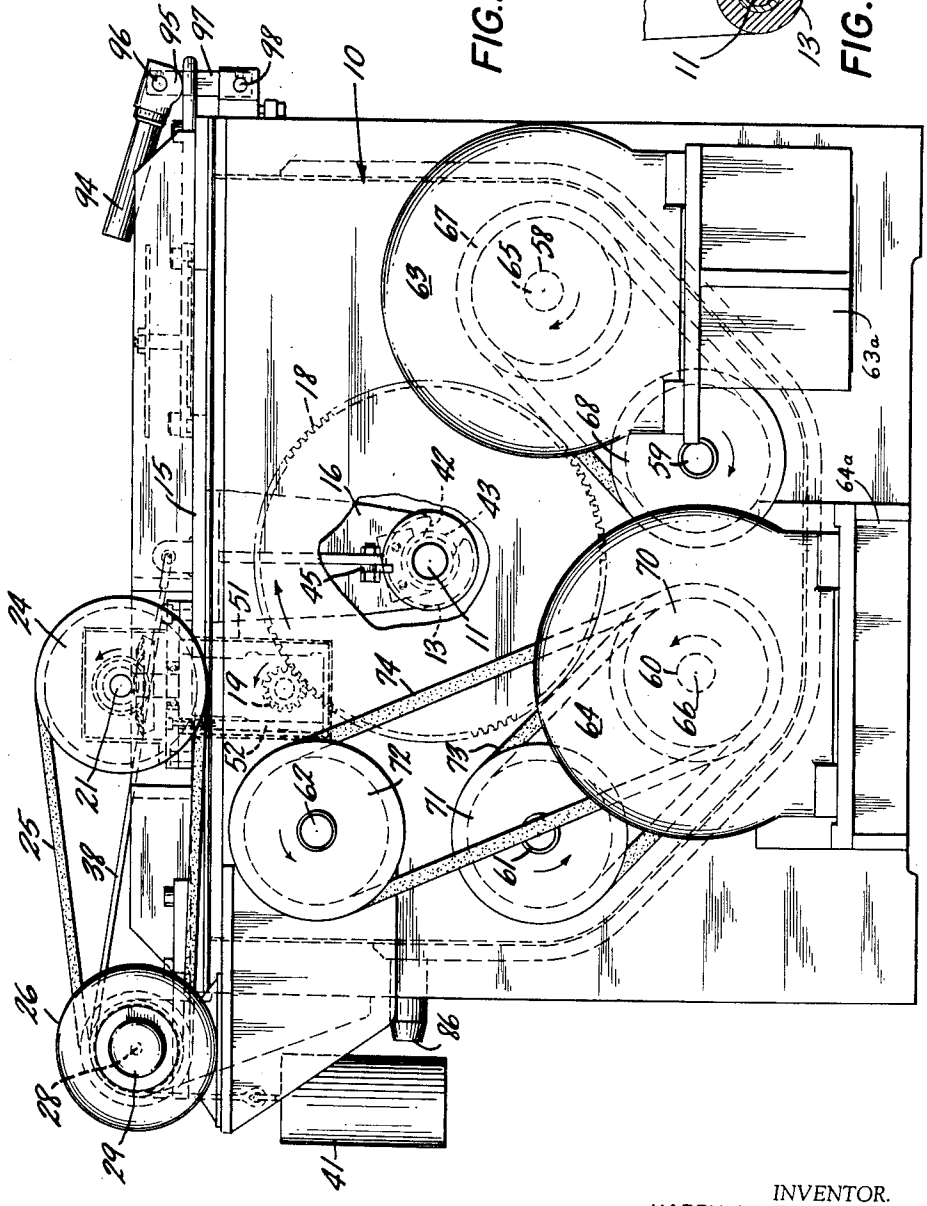
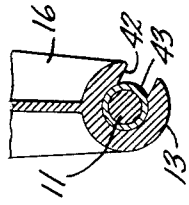


FIG. 2A.



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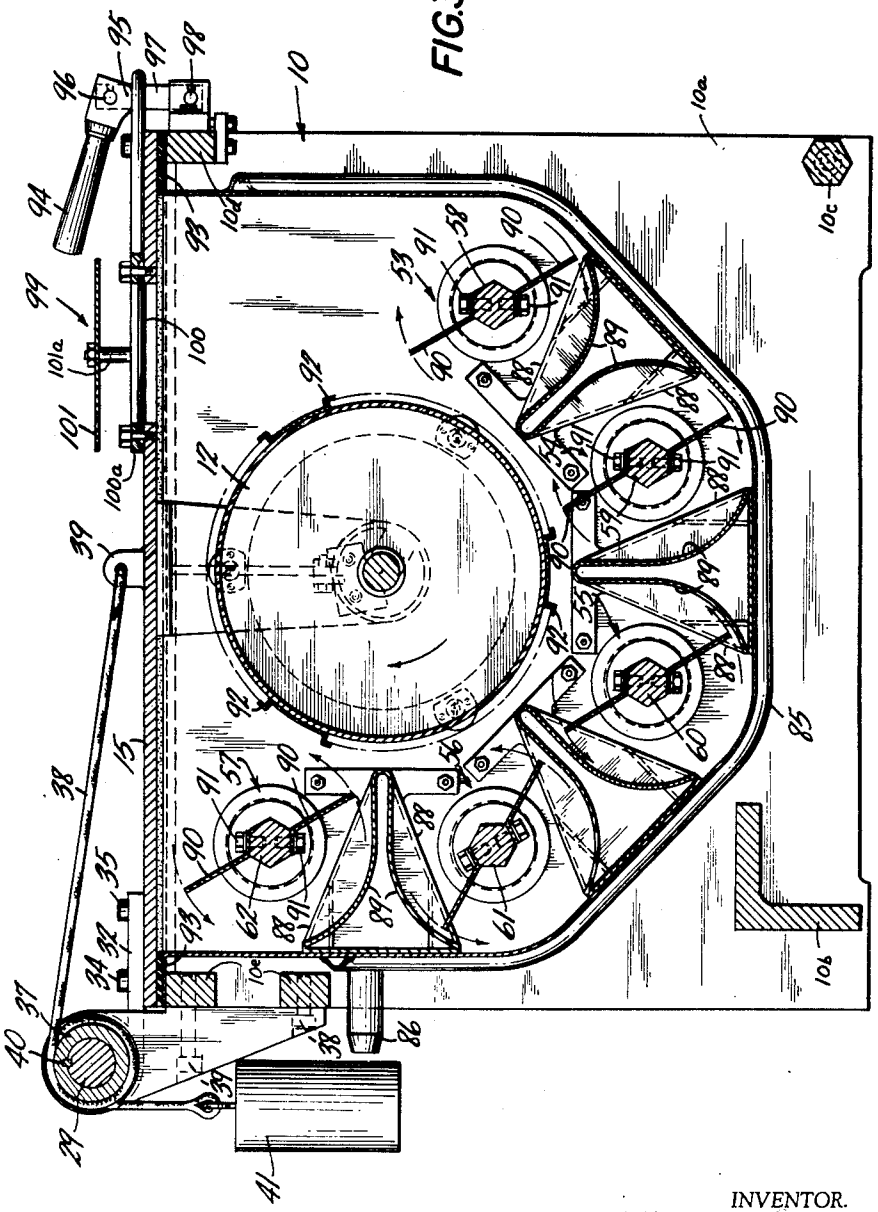
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PHOTOGRAPHIC DEVELOPING APPARATUS

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FIG. 3.



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PHOTOGRAPHIC DEVELOPING APPARATUS

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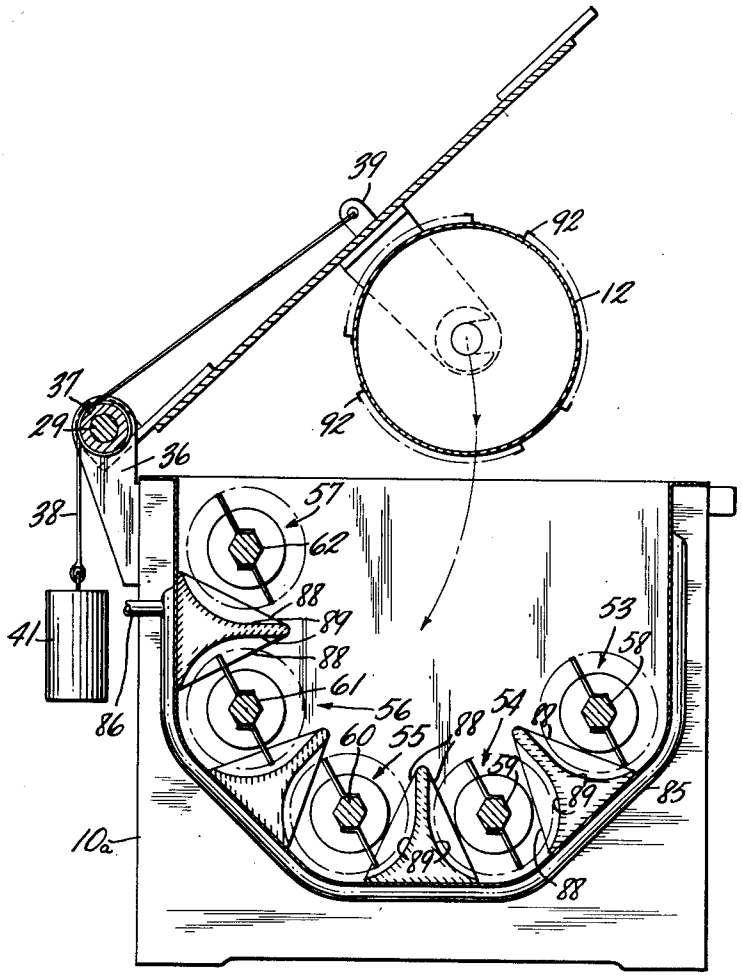


FIG.4.

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2,947,235

PHOTOGRAPHIC DEVELOPING APPARATUS

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Filed June 27, 1957, Ser. No. 668,436

10 Claims. (Cl. 95—93)

This invention relates to new and useful improvements in apparatus for processing exposed photographic materials and is directed particularly to the provision of apparatus for treating photographic materials with solutions.

The principal objects of the invention include the provision of apparatus for treating a plurality of sheets or plates of photographic material with solutions.

A primary object of the invention is to provide an apparatus of the above-mentioned character adapted to process photographs, films, and plates in a quicker and more economical manner than has heretofore been accomplished.

It is also an object of the invention to provide a photograph developer of the above-mentioned character with comparatively few parts to become out-of-order, requiring a minimum amount of attention, and capable of processing with no destruction to the photographs.

Generally, these and other objects of the invention are obtained by providing a tank to house the developing bath or solution. Positioned within the tank, either on the lid as shown in the drawings or otherwise, is a rotatable drum on which is placed the exposed photosensitive surfaces to be developed. A plurality of agitator paddles are nested within a baffle arrangement to splash the developing solution over the drum as the drum is rotated. The baffle arrangement keeps the fluid within the influence of the agitator paddles and, also, takes up much of the space within the tank. Thus, the quantity of developing solution required for the present invention is much less than devices heretofore known. Also, a much more thorough developing action is obtained in a shorter time.

All of the above objects are accomplished by means of such structure and relative arrangements of parts thereof as will fully appear by a perusal of the description below and by various specific features which will be hereinafter set forth. To the above cited and other ends and with the foregoing and various other novel features and advantages and other objects of the invention as will become more readily apparent as the description proceeds, the invention consists in certain novel features of construction and in the combination and arrangement of parts as will be hereinafter more particularly pointed out in the claims hereunto annexed and more fully described and referred to in connection with the accompanying drawings wherein:

Figure 1 is a rear elevation view partially in section showing the structural arrangement of parts for a preferred embodiment of the invention;

Figure 2 is an end view in elevation of the embodiment shown in Figure 1;

Figure 2A is a view taken along the line *2a—2a* in Figure 1;

Figure 3 is a sectional view in elevation taken along the line 3—3 in Figure 1; and

Figure 4 is a diagrammatic view of Figure 3 with the lid in an open position and showing the preferred relative location of the agitator paddles and the baffle arrangement.

Referring now to one embodiment of the invention as shown in Figure 1 of the drawings, a tank indicated generally by the numeral **10** is formed of a suitable material which is structurally rigid by either pressing or forging the tank **10** in an integral piece, or by assembling two end plates, a back plate, a bottom plate, and a front plate by, for example, welding. It is not critical how the tank **10** is formed, it only being essential that it is leak proof for the particular developing bath or solution to be contained therein.

The tank **10** is shown in partial section in Figure 1. A shaft **11** located axially through a drum **12** is supported at each end by suitable bearings **13** and **14** which, in turn, are supported from the lid **15** by downwardly depending support members **16** and **17**. Also mounted on the shaft **11** and fixed thereto is a gear **18** of substantially the same diameter as the drum **12** for causing rotation of the drum **12** and shaft **11** within the support bearings **13** and **14**.

The gear **18** is meshed with an output gear **19** of a bevel gear unit **20** which is connected to a power shaft **21** supported in bearings **22** and **23** on the upper surface of the lid **15**. A drive pulley **24** is attached to one end of the power shaft **21** to which rotation is caused by a belt **25** connecting the drive pulley **24** to the motor **26**.

The motor **26** is supported by a brace **27** attached by any suitable means to the outside surface of one end of the tank **10** in a rearward position such that the axis of the motor shaft **28** is in alignment with the axis of the hinge shaft **29** of the lid **15**. Such a position permits the belt drive **25** between the motor shaft **28** and the pulley **24** on the gear shaft **21** to remain taut as the lid **15** is raised and lowered.

Two spaced apart hinges **30** and **31** pivotally support the lid **15** at the rear of the tank **10**. One portion **32** and **33** of each hinge **30** and **31**, respectively, is fixed to the lid **15** by suitable means such as, for example, bolts **34** and **35** shown on the hinge portion **32** (Fig. 3). The other portion **36** of the hinge **30** is attached to the rear surface of the tank **10**, for example, also by suitable bolts **38** and **39** (Figs. 1 and 3). The portion of hinge **31** corresponding to the other portion **36** of the hinge **30** is not shown due to the cut-away section in Figure 1. However, the hinges **30** and **31** are structurally identical and, therefore, the omission of the details of the hinge **31** to permit the cut-away view in Figure 1 is deemed an exigency.

The axis of each hinge **30** and **31** is formed by a shaft **29** extending therebetween. The shaft **29** is fixedly attached to that portion of each hinge which is mounted on the lid **15** such that the shaft **29** turns as the lid **15** is raised or lowered. Interposed between the two hinges **30** and **31** on the shaft **29** is a pulley **37** which is fixedly attached to the shaft **29** by a key **40** (Fig. 3). A flexible cable **38** attached to an eyelet **39** (Fig. 3) on the forward, upper surface of the lid **15** extends rearwardly and is wound about the pulley **37** on the hinge shaft **29** to support a counterweight **41** at the rear of the tank **10** (Figs. 2 and 3). The counterweight **41** offsets the dead weight of the lid **15** permitting the operator to raise the lid more easily.

To permit the drum **12** to be removable, each bearing **13** and **14** is provided with a slot **42** (Fig. 2) so that the drum shaft **11** may be withdrawn and replaced periodically, as desired. The shaft **11** is held in position within the bearings **13** and **14** during operation by flanged bushings **43** (Fig. 2) and **44** (Fig. 1) which are placed over the ends of the shaft **11** and held in place by pivotal hooks **45** and **46** on the support brackets. To remove the cylinder **12**, hooks **45** and **46** are lifted, and the

flanged bushings 43 and 44 are slid off the shaft 11 endwise. Then the cylinder 12 is removed by lifting the shaft 11 from the bearings 13 and 14 through the radial slots 42 (Fig. 2A).

The bevel gear unit 20 (Fig. 1) coupling the power shaft 21 with the output gear 19 is supported within the tank 10 by a mounting plate 52 which depends downwardly from the plate 49. A casing 51 is supported by the lid 15 to enclose the gear unit 20 and to contain grease under pressure. By maintaining this grease under a positive pressure, the developing fluid in the tank 10 during operation will be kept out of the inside of the casing 51. The shaft of the output gear 19 is journaled in a suitable bearing 50 in one wall of the casing 51, and the vertical shaft of the gear unit 20 is journaled in a suitable bearing 47 in the plate 49.

Also positioned within the tank 10 are two agitators or paddles 53 and 54 located in the forward part of the tank and three agitators or paddles 55, 56 and 57 located toward the rear of the tank. Separate shafts 58, 59, 60, 61 and 62 are provided for each agitator 53, 54, 55, 56 and 57, respectively, in order that these agitator shafts may be nested within a baffle arrangement to be described presently.

Power is supplied to these agitator shafts by two separate motors 63 and 64 supported by brackets 63*a* and 64*a*, respectively. As shown in Figure 2, the three agitator shafts 60, 61, and 62 positioned toward the rear of the tank 10 are rotated by one motor 64, and the two agitator shafts 58 and 59 positioned toward the forward part of the tank 10 are rotated by the other motor 63. Motion is transmitted from the motor shaft 65 directly to the agitator shaft 58 and from a pulley 67 (Fig. 2) on the agitator shaft 58 to a pulley 68 on the agitator shaft 59 by a flexible belt 69. The motor 64 transmits motion directly to the agitator shaft 60 and from the pulleys 70 and 70*a* on the agitator shaft 60 to pulleys 71 and 72 on the agitator shafts 61 and 62 by flexible belts 73 and 74, respectively. Separate motors 63 and 64 are used because the three agitators 55, 56 and 57 toward the rear of the tank 10 are rotated in a counterclockwise direction whereas the two agitators 53 and 54 in the forward part of the tank 10 are rotated in a clockwise direction (Fig. 3). Of course, all of the agitators could be rotated from a single motor by appropriate connections, if desired.

As shown particularly in Figure 3, the paddle blades 90 may be independently formed by an angle which is secured to the agitator shaft by threaded bolt means 91. Of course, each paddle blade 90 could be formed integrally with each shaft, if desired.

The baffle arrangement as shown in greater detail in Figures 3 and 4 is a type of partition which substantially occupies the vacant space between the agitator paddles. Since the drum 12, as shown in Figure 1, does not extend the full length of the tank 10 to allow room within the tank for the support bearing 13 and the bevel gear unit 20, the space at that end of the tank is more completely filled by the baffle being substantially triangular in shape, as referred to generally in Figure 3 by the numeral 88. That portion of each baffle adjacent each paddle blade is indented into a concave position to allow close fitting with the blades. These indented surfaces are indicated generally by the numeral 89 in Figures 3 and 4.

Each agitator shaft is supported at one end by a suitable bearing (Fig. 1), a typical example of which is shown by the bearing 75 supporting the shaft 60, and at the opposite end by another bearing 76. These bearings not only supply the necessary support for the agitator shafts but also provide seals to prevent fluid leakage. Since all of these bearings are identical, reference will be made only to the bearing 75.

Referring now in greater detail to the agitator shaft bearing 75 (Fig. 1), each bearing is made of a substantially S-shaped body portion 77, one end 78 of which bears against the outer surface of the tank wall whereas the other end 79 of the body portion 77 is bored out to clear the agitator shaft on the inside of the tank 10. A seal is provided between the body portion 77 of the bearing and the shaft 60 by U-shaped packing 80. The inside of the bearing body portion 77 is sealed by a plastic washer 81 placed over the body portion 77 and pressed against the inside end wall of tank 10 by a plain metal washer 82 and a threaded washer 83, which arrangement also clamps the tank 10 and the sideframe 10*a*. Side frames 10*a* are connected by tie bars 10*b*—10*e*. The portion of the bearing housing outside of the tank 10 contains the ball bearing 84 through which the agitator shaft 60 is supported.

The drum 12 (Fig. 3) is provided with three angle sections 92 such that grooves are formed into which the material to be developed is mounted. With this material, which may be exposed photographic printing plates or the like, mounted on the drum 12, the lid 15 is closed against suitable sealing material 93 such as, for example, plastic or sponge rubber, and clamped by a handle 94. Additional leverage to tighten the lid 15 is obtained by the raised portion 95 on the handle 94 as the handle 94 is pivoted rearwardly about the pin 96. The handle 94 and the linkage 97 are pivoted in the first instance about the pin 98 to first position the handle 94 above the lid 15. Then, as the handle 94 is further pivoted about the pin 96, the raised portion 95 is brought to bear against the lid 15 to lock it tightly in place.

Disposed about the outside surface of the tank 10 and formed integrally therewith is a cooling jacket 85 for the circulation of a cooling fluid. The cooling fluid is injected into the jacket 85 at an opening 86 in the rear of the tank 10 and the output 87 for the cooling fluid is on the side of the tank 10 (Fig. 1). Heat developed by the various moving parts connected with the tank 10 and by the agitated developing solution is thereby kept to a minimum.

A safety feature is incorporated in the apparatus as indicated generally by the numeral 99. This feature provides a release for excessive pressure which might develop within the tank 10 due to, for example, an explosion of the chemicals used for the developing bath. The safety feature 99, as shown in Figure 3, is a disc of glass 100, or the like, held by flange 100*a* with a metal disc 101, supported by studs 101*a*, positioned above the glass as a deflector. The studs 101*a* are mounted on the flange 100*a*. Of course, other pressure release valves may be used and may be placed in other locations about the tank 10, if desired.

In operation, the tank 10 is supplied with a quantity of an appropriate chemical solution for the particular developing to be accomplished. With the lid 15 in a raised position, the plates to be developed are mounted on the rotatable drum 12 by sliding them within the angle grooves 92. For the particular embodiment of the invention shown in the drawings, three plates may be mounted on the drum 12 at one time.

Then the lid 15 is closed and clamped tightly by the handle 94. As the drum holding the plates to be developed is turned by the motor 26, the motors 63 and 64 revolve the series of agitators 53 through 57 to splash the developing solution about the drum 12. Due to the closeness of the agitator paddles 90 to the baffle surfaces 89, a much smaller quantity of developing solution is required than that used in developing apparatus heretofore known. Also, a much more thorough developing action is obtained as will be obvious to one skilled in this art from the present detailed description.

The invention may be embodied in other specific forms without departing from the essential characteristics thereof. Hence, the present embodiments are therefore to be considered in all respects merely illustrative and not as being restrictive, the scope of the invention being in-

dicated by the appended claims rather than by the foregoing description, and all modifications and variations as fall within the meaning and purview and the range of equivalency of the appended claims are therefore intended to be embodied therein.

I claim:

1. A photographic processing apparatus comprising a tank for enclosing photographic processing fluid, means within the tank to support material to be processed, a plurality of agitators supported within the tank, and a plurality of baffles within the tank to substantially fill the space between adjacent agitators and to maintain processing fluid adjacent the plurality of agitators.

2. A photographic processing apparatus comprising a tank for enclosing photographic processing fluid, a removable drum within the tank to support material to be processed, a first plurality of paddles within the tank to agitate the processing fluid by rotating in one direction, a second plurality of paddles within the tank to agitate the fluid by rotating in the opposite direction, and a baffle within the tank in proximity to the first and second pluralities of paddles for maintaining processing fluid adjacent the agitator.

3. A photographic processing apparatus comprising a tank for enclosing photographic processing fluid, a drum within the tank to support material to be processed, a plurality of paddles within the tank to agitate the processing fluid, a baffle disposed between adjacent paddles to substantially fill the space between adjacent paddles and to maintain the processing fluid in proximity to the paddles, a power means connected to rotate the drum, and separate power means to rotate the paddles.

4. A photographic processing apparatus comprising a tank for enclosing photographic processing fluid, a rotatable drum within the tank, hook means on the rotatable drum to mount material to be processed, a first plurality of agitators within the tank to establish motion in the fluid, a second plurality of agitators within the tank and spaced apart from the first plurality of agitators to establish additional motion in the fluid, a first power means connected to the rotatable drum to induce rotation thereof, a second power means connected to the first plurality of agitators to rotate the agitators in one direction, a third power means connected to the second plurality of agitators to rotate the agitators in the opposite direction, and a plurality of baffles in proximity to the first and second agitators for maintaining processing fluid adjacent the first and second pluralities of agitators.

5. A photographic processing apparatus comprising a tank for enclosing photographic processing fluid, two bearings mounted within the tank in spaced apart relation, a rotatable drum supported between the bearings within the tank, means on the rotatable drum to mount material to be processed, a first plurality of agitators within the tank to establish motion in the fluid, a second plurality of agitators within the tank and spaced apart from the first plurality of agitators to establish additional motion in the fluid, a first power means connected to the rotatable drum to induce rotation thereof, a second power means, means interconnecting the first plurality of agitators to be driven by the second power means, a third power means, means interconnecting the second plurality of agitators so that the third power means rotates these agitators in the opposite direction, and a plurality of baffles in proximity to the first and second agitators for maintaining processing fluid adjacent the first and second pluralities of agitators.

6. A photographic processing apparatus comprising a tank for enclosing photographic processing fluid, a pressure-tight lid for sealing the tank, spaced apart arms depending from the lid to support, respectively, bearing means, a rotatable drum supported by the bearing means within the tank, means on the rotatable drum to mount material to be processed, a first plurality of agitators within the tank to establish motion in the fluid, a second plurality of agitators within the tank to establish additional motion in the fluid, a first power means connected to the rotatable drum to induce rotation thereof, a second power means connected to the first plurality of agitators to rotate the agitators in one direction, a third power means connected to the second plurality of agitators to rotate these agitators in the opposite direction, and a plurality of baffles in proximity to the first and second agitators for maintaining processing fluid adjacent the first and second pluralities of agitators.

7. A photographic processing apparatus comprising a tank for enclosing photographic processing fluid, a rotatable drum within the tank, a first power means mounted externally of the tank, gear means connecting the rotatable drum within the tank to the first power means, hook means on the rotatable drum to mount material to be processed, a first plurality of agitators within the tank to establish motion in the fluid, a second plurality of agitators within the tank and spaced apart from the first plurality of agitators to establish additional motion in the fluid, a first power means connected to the rotatable drum to induce rotation thereof, a second power means connected to the first plurality of agitators to rotate the agitators in one direction, a third power means connected to the second plurality of agitators to rotate the agitators in the opposite direction, and a plurality of baffles in proximity to the first and second agitators for maintaining processing fluid adjacent the first and second pluralities of agitators.

8. A photographic processing apparatus comprising a tank for enclosing photographic processing fluid, a pressure-tight lid rotatable about an axis to seal the tank, a rotatable drum within the tank, a first power means having an axis of rotation substantially in alignment with the axis of the pressure-tight lid, a pulley mounted externally of the tank on the lid, gear means connecting the rotatable drum within the tank to the pulley on the lid, belt means connecting the pulley with the first power means so that the belt means is maintained operative with the lid in any position, a first plurality of agitators within the tank to establish motion in the fluid, a second plurality of agitators within the tank and spaced apart from the first plurality of agitators to establish additional motion in the fluid, a first power means connected to the rotatable drum to induce rotation thereof, a second power means connected to the first plurality of agitators to rotate the agitators in one direction, a third power means connected to the second plurality of agitators to rotate the agitators in the opposite direction, and a plurality of baffles in proximity to the first and second agitators for maintaining processing fluid adjacent the first and second pluralities of agitators.

9. A photographic processing apparatus comprising a tank for enclosing photographic processing fluid, a rotatable drum within the tank, hook means on the rotatable drum to mount material to be processed, a first plurality of agitators within the tank to establish motion in the fluid, a second plurality of agitators within the tank and spaced apart from the first plurality of agitators to establish additional motion in the fluid, a first power means connected to the rotatable drum to induce rotation thereof, a second power means connected to the first plurality of agitators to rotate the agitators in one direction, a third power means connected to the second plurality of agitators to rotate the agitators in the opposite direction, a plurality of baffles disposed between adjacent agitators and having surfaces which conform substantially with the path of rotation of the agitators, whereby the processing fluid is maintained adjacent the first and second pluralities of agitators.

10. A photographic processing apparatus comprising a tank for enclosing photographic processing fluid, a rotatable drum within the tank, hook means on the rotatable drum to mount material to be processed, a first plurality

of agitators within the tank to establish motion in the fluid, a second plurality of agitators within the tank and spaced apart from the first plurality of agitators to establish additional motion in the fluid, a first power means connected to the rotatable drum to induce rotation thereof, a second power means connected to the first plurality of agitators to rotate the agitators in one direction, a third power means connected to the second plurality of agitators to rotate the agitators in the opposite direction, the agitators in the first and second pluralities being disposed in an arc about the surface of the rotatable drum, and a baffle disposed between adjacent agitators

and having surfaces conforming substantially to the path of rotation of the agitators so that the processing fluid is maintained adjacent the agitators.

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