

PATENT SPECIFICATION (11)

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- (21) Application No. 7335/74 (22) Filed 18 Feb. 1974 (19)
- (31) Convention Application No. 2 307 986
- (32) Filed 17 Feb. 1973 in
- (33) Fed. Rep. of Germany (DT)
- (44) Complete Specification published 2 March 1977
- (51) INT. CL.³ G03D 3/06
- (52) Index at acceptance
G2X P3



(54) IMPROVEMENTS IN AND RELATING TO APPARATUS FOR PROCESSING PHOTOGRAPHIC MATERIAL

(71) We, AGFA-GEVAERT AKTIEN-
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under German Law, of Leverkusen, Ger-
many, do hereby declare the invention, for
which we pray that a patent may be granted
to us, and the method by which it is to be
performed, to be particularly described in
and by the following statement:—

The invention relates to apparatus for pro-
cessing photographic material.

Processing apparatus has previously been
proposed having a bath tank with a topping-
up device and an overflow to maintain a par-
ticular level of liquid, and a regenerating
device for the addition of processing liquid
corresponding to the quantity or area of
photographic material processed or to be
processed. In such apparatus the topping-
up device ensures that the liquid does not
fall below a prescribed level. The possibility
of this preselected level being exceeded is
excluded by means of the overflow, so that
the required level is regularly maintained
with great accuracy. The regenerating device
is generally controlled by a scanning device
in the path of the photographic material, so
that liquids can be added accordingly by
means of a dosing pump, for example. Dos-
ing pumps of this type are very costly, how-
ever. Other regenerating devices are re-
stricted simply to replacing by means of the
topping-up device the liquid lost by being
carried out of the bath on the material. The
disadvantage of this method, however, is that
the quantity of liquid to be added per sur-
face area depends on the amount of liquid
carried away by the photographic material.
Since the topping-up concentrates cannot be
concentrated as much as required, the adjust-
ability of the addition of regenerating fluid in
this manner is restricted.

The invention provides apparatus for pro-
cessing photographic material which com-
prises a tank for processing liquid through
which, in operation, photographic material
is passed, and at least a portion of a circula-
tion path for processing liquid within the
apparatus passing through the tank, means
for sensing the photographic material which

passes through the tank, means, respective
to a signal from the sensing means, or ex-
tracting liquid from the circulation path,
and means for maintaining liquid in the tank
at a predetermined level, which level main-
taining means includes means for supplying
fresh, previously uncirculated processing
liquid to the circulation path to replace ex-
tracted liquid.

With the arrangement of the invention it
is possible for any required dosage of liquid
per unit area of photographic material to be
fed in. The removal of used liquid from
circulation within the apparatus, including
the tank, by extraction means, for example,
a pump, which can be operated intermit-
tently, is relatively easy to carry out in a
manner that is controlled by the photo-
graphic material passing through. The re-
quired amount of regenerating liquid can
then be added to the tank, for example, by
means of a topping-up device, to maintain
the liquid in the tank at the predetermined
level.

Advantageously, the means for extracting
liquid is arranged, in response to the signal
from the sensing means, to extract from the
circulation path within the apparatus a
volume of liquid dependent upon the
quantity, or area, of photographic material
processed or to be processed.

The means for extracting liquid may be
arranged to operate after the photographic
material has passed through the tank. Al-
ternatively, or in addition, the means for
extracting liquid may be arranged to operate
intermittently during the passage of photo-
graphic material through the tank.

Apparatus for processing photographic
material constructed in accordance with the
invention will now be described, by way of
example, with reference to the accompany-
ing drawings, in which:

Figure 1 shows a plan view of a portion
of the apparatus;

Figure 2 shows a longitudinal section
through the arrangement of Figure 1 taken
along the line II—II in Figure 1;

Figure 3 shows a wiring diagram for con-

trolling the apparatus of Figures 1 and 2; and

Figure 4 shows a switching-on diagram, given by the voltage at a store capacitor in the circuit of Figure 3.

Referring to Figs. 1 and 2 of the accompanying drawings, in a machine frame 1 is a trough-shaped tank 1a which forms a processing chamber. Pairs of rollers are arranged in the tank for the passage of photographic material, which is to be developed, through the tank, but only one roller 2 of each pair is visible. The rollers 2 and their drive may be constructed in a known manner. Arranged in the tank 1a is a guide member 3 which allows a stream of liquid emerging from an outlet pipe 4 of a radial pump 5 to circulate in the direction of the longitudinal axis of the apparatus on one of the tank walls until the stream of liquid is deflected at the end of the tank and returns to the intake side of the radial pump. As can be seen from Figure 2, the radial pump 5 has a vertical spindle 5a. The rotor of the pump 5 has substantially radial blades and is covered over by means of a housing section 1b. The spindle 5 is guided at a certain height above the housing section 1b in a bearing 6 and carries at its upper end a bevel gear 7 which engages with a bevel gear 8 driven by a motor.

The motor to drive the pump is an alternating current motor and contains two windings which may have different winding numbers. The windings can be connected separately to a current source so that, depending on the type of connection, the motor delivers a greater or lesser output, and the pump 5, with corresponding increase or decrease in pressure resistance, operates at a greater or lesser rate.

In an alternative winding arrangement, one winding is connected to the current source when the pump is operating at a lower rate, and both windings are connected when the pump is operating at a higher pumping rate.

The housing 1b is in the form of a spiral housing, in which the outlet pipe 4 adjoins the pump rotor 5 tangentially in a certain area. Just before the opening of the outlet pipe 4 into the processing tank 1a a narrowing of the cross-section is provided which is adjustable by means of a screw 9 and with a corresponding pumping rate leads to back pressure in the space between the pump 5 and the adjusting screw 9. The back pressure created by a given pumping rate is therefore adjustable by means of the screw 9. A branching section which becomes a riser 10 is also provided in this region, upstream of the adjustable screw 9. The riser 10 rises above the top of the tank 1a and opens into an open drainage channel 11 which

leads to a collecting container for used processing liquid.

Inside the apparatus housing, within an ante-chamber 1c to the tank 1a but at the greatest possible distance from the pump 5, which is also at least partially located within the ante-chamber 1c there is a topping-up device 13 which consists in a known manner of a bottle with the opening pointing downwards and with a spring-loaded valve. The topping-bottle 13 is fitted onto spoke-like support surfaces 13a, b, c, d, being aligned thereon by means of the inner rim of a bore-hole 12, and a pin 14 fixedly arranged in the housing, so that it is vertical in the centre of the bore-hole and pushes the valve on the bottle upwards so that air can flow into the bottle, and liquid thereby emerges from the bottle, when the level of the liquid in the ante-chamber 1c has dropped to below the level of the support surfaces 13a, b, c, d. Such a drop in liquid level creates an air gap between the surface of the processing liquid in the antechamber 1c and the valve at the bottle opening. The surfaces 13a to d are on a level which corresponds to the level of the processing fluid in the antechamber 1c when the pump 5 is operating in its circulating phase.

The antechamber 1c containing the topping-up device 13 and the pump 5, is separated from the tank 1a by means of an overflow edge 15. This division of the liquid chambers into antechamber and tank with a pump conveying liquid from the antechamber into the tank, as described in British Patent Specification No. 1,436,632 (Application No. 19016/73), has the result that the level in the tank is kept very constant with regard to time, with simultaneous circulation of all the liquid and with very economical and accurately measured addition of liquid.

Figure 3 shows a circuit for controlling the motor for the pump 5. Not shown in Figures 1 and 2 is a scanning or sensing switch, the sensor of which is actuated as soon as there is photographic material in the apparatus. This switch is indicated by 16 in Figure 3. It is in the form of a changeover switch, and, in the rest position shown, short-circuits a store capacitor 17 by way of a variable resistor 18 and a fixed resistor 19, and also by way of a changeover contact 20a of a relay 20. In its operating position the switch 16 connects the capacitor 17 to a direct current source 21 which by way of a Zener diode 22, a transistor 23 and resistors 24 and 25 is constructed as a constant current source.

One connection of the capacitor 17 is connected to the base of a first transistor 26, which with a second transistor 27 and the corresponding resistors forms a trigger or a tripping stage. A transistor 28 operating

as an end amplifier lies in the current circuit of a relay 29 which is bridged by means of a spark-quenching diode 30.

In addition, the terminal of the capacitor 17 has connected to it an input transistor 31 which with further transistors 32 and 33 forms a second tripping stage which by way of transistors 34 and 35 controls the relay 20 for the purpose of increasing the pumping rate. However, two operating contacts 20b of the relay 20 and 29a of the relay 29 are series-connected in parallel with the end stage transistor 35. In addition, the relay 29 controls an operating contact 29b in the circuit of the pump motor 36 for a second winding which increases the pumping rate.

The regenerating apparatus according to Figures 1 and 2 co-operates with the left-hand portion of the circuit according to Figure 3 for the control of the relay 29 as follows:

The switch 16 is in the rest state, in which it is shown in Figure 3, when it does not detect the presence of photographic material in the tank 1a, and with the switch in the rest state, the pump motor 36 only runs at a revolution speed which corresponds to the current consumption of one winding. With this output liquid is drawn from the upper region of the antechamber 1c, above the rotor of the pump 5, and is forced through the outlet pipe 4 into the processing tank 1a. The screw 9 is rotated upwards so far that the pressure rise at the foot of the riser 10 produced by the narrowing of the cross-section remains so small that the liquid level does not reach the discharge channel 11 while the pump motor 36 is operating at the lower rate. In this stage, therefore, the liquid circulates within the tank 1a, and a quantity of liquid corresponding to that emerging from the pipe 4 passes over the overflow 15 into the ante-chamber 1c and thence back into the pump 5. Topping-up from the supply bottle takes place only when the liquid level in the ante-chamber 1c sinks below the level of the support surfaces 13a, b, c, d, due, for example, to evaporation, so that air can pass into the supply bottle from below.

In this rest position the capacitor 17 is completely discharged by way of the resistors 18 and 19. If photographic material which is to be processed is now introduced between the transport rollers 2 and moved through the tank, for a period of time corresponding to the run-through speed and length of the photographic material the changeover switch 16 is brought into the position in which it connects the collector of the transistor 23 to the capacitor 17. Due to the constant current characteristic of this source, the capacitor undergoes linear charging which without taking into account the second tripping stage for the relay 20 persists until the photographic material passing

through comes to an end and liberates the switch 16.

Since the photographic material passes through the apparatus and therefore also past the sensor of the switch 16 at a specific rate, the duration of time for which the switch 16 is held in its operating position is proportional to the length of the photographic material. And hence for sheets of known width, the time during which the switch 16 is in its operating position is also proportional to the surface area of the photographic material passing through the tank. The time over which the capacitor 17 is charged, and therefore the quantity of charge accumulated on it, is hence also directly proportional to this quantity of photographic material. When the switch 16 is liberated, it returns to the position shown, so that on the one hand the relay 29 is excited by means of the tripping stage 26 and 27 and on the other hand the capacitor 17 is discharged by way of the resistors 18 and 19 at a speed which can be considerably greater in relation to the charging speed. (The rate of discharge of the capacitor 17 can be adjusted by means of the variable resistor 18.) This leads to shortening of the pumping time at the high pumping rate with respect to the remaining run-through time for the photographic material, which is of particular advantage, particularly in cases where only very small quantities of fresh processing fluid are required per unit area of the material to be developed, since a run-through quantity can still be achieved while using a topping-up bottle 12 having a relatively large cross-section, which reduces the risk of blockages in the neck of the bottle. The rate at which the liquid is pumped out of or extracted from the tank 1a is, of course, adjustable by means of the screw 9, the position of which determines the back pressure in the outlet pipe 4.

If the cross-sectional area of the neck of the topping-up bottle is reduced, so that the rate of flow from the bottle during a topping-up operation is also reduced, then difficulties can arise owing to the risk of deposits forming in the neck, which could significantly alter its cross-sectional area and hence alter the rate of flow of liquid out of the bottle to an extent which is not easily calculable. Hence, when the volume of regenerating liquid required from the topping-up bottle is low, for a particular processing operation, the rate of flow of liquid from the bottle is not reduced by decreasing the cross-sectional area of the bottle neck, which could lead to the difficulties described above, but rather the time during which the extraction means operates (which corresponds substantially to the time during which liquid flows from the topping-up bottle) is reduced. These considerations are also applicable if

the quantity of liquid to be removed by a pump per unit time cannot be set at an optionally low value with the necessary precision.

5 The result of the attraction of the relay 29 is that the pump motor 36 is brought by way of the contact 29b to the high output as long as the voltage at the capacitor 17 has not dropped to a value which allows the tripping stage 26 and 27 to trip back. When this part circuit is effective, therefore, a voltage is formed in the capacitor 17 as a measure of the quantity of liquid to be added, which will be fed in all at one after the end of the run-through. Whilst the motor 36 is running at the high output, owing to damming up at the screw 9 the liquid level in the riser 10 rises so far that a quantity of liquid which can be determined in advance flows through the channel 11 and is discharged. The topping-up device on the surfaces 13a, b, c, d, then in turn tops up the liquid in the antechamber 1c until the same liquid level is reached there as in the tank 1a.

25 The disadvantage of this embodiment is that the high pumping rate time is relatively long. Due to the long inflow time for regenerating liquid during the high pumping rate period, fresh regenerating liquid can pass into the intake aperture of the pump and thus reach the discharge immediately by way of the riser 10.

This undesirable effect can be countered on the one hand by making the distance between the inflow of the topping-up device and the intake aperture of the pump as great as possible. However, this is not always sufficient to prevent fresh regenerating liquid from being drawn out during the high pumping rate period. The right-hand section of the circuit according to Figure 3 leads to pulse-like switching-on of the high motor output corresponding to the illustration in Figure 4. Proceeding from the fully discharged capacitor on the zero line of the voltage line on the time axis, the switch 16 is brought into the upright position again when photographic materials enters. The charging of the capacitor 17 then begins. 50 The capacitor potential is applied immediately to the input of the second tripping stage 31 and 32, the response threshold of which is however higher than that of the first tripping stage. This tripping stage therefore only excites the relay 20 after charging to a voltage U_1 in Figure 4. The attraction of the relay 20 leads to the switching of the contact 20a, which leads to the tripping of the first tripping stage and thus to the attraction of the first relay 29. In addition, the self-holding contact 20b is closed. The attraction of the relay 29 leads by way of the contact 29b to the switch-over to the higher motor output and to the switching-on of the self-holding contact 29a, so that the relay

20 remains energised independently of the potential at the capacitor 17. The switching of the switch 20a also leads to the result that the capacitor 17 is discharged. This is the steep downward phase of the voltage curve shown in Figure 4. The discharge curve is approximated by a straight line, which is admissible without disturbing inaccuracies in the voltage range in question.

The response threshold voltage U_1 may be adjustable, by means not shown in the circuit of Figure 3. The time taken for the capacitor 17 to discharge from the potential U_1 to the potential U_2 is arranged to be less than the average time taken by fluid to flow from the opening of the topping-up device 13 to the intake aperture of the pump 5, so that no or very little fresh regenerating liquid is extracted from the apparatus before it has circulated within the tank 1a, since the high pumping rate is simultaneous with the capacitor discharge.

The discharge operation with simultaneous high pumping rate continues until the capacitor potential has fallen below the response threshold U_2 for the first tripping stage. The result of this is that the relay 29 becomes currentless. The switch 29a is thus opened, whereupon the relay 20 drops out and the contact 20a returns to the position shown. The re-charging of the capacitor 17 then begins, whilst the dropping-out of the contact 29b leads to the reduction of the motor output. This cycle of charging of the capacitor and discharging with simultaneous higher pumping rate continues until the switch 16 returns to the position shown when the layer support comes to an end. It may then happen that the trigger voltage U_1 of the second tripping stage is no longer reached. However, with the return of the switch 16 to the position shown the first tripping stage is now again connected to the capacitor, and this leads to the attraction of the relay 29 insofar as the capacitor potential is still above its trigger voltage. The relay 20 is then no longer attracted but for the duration of discharging until the trigger voltage is reached current is also supplied by way of the switch 29b to the pump with its second winding.

Instead of one pump with two output stages, two separate pumps may also be used, one as circulating pump and the other as removal pump, in which case the removal pump would have to be connected to the contact 29b in Figure 3.

Circuits other than those shown are also feasible for the control of the regeneration device mentioned, for example, integrated switching circuits with two tripping stages influencing one another reciprocally. The motor provided may also be a direct current motor which is connected to a higher voltage to obtain the higher output. The scan-

ning means may be arranged at either the entrance or the exit to the tank 1a.

The apparatus may be used for processing different types of photographic material, such as films on transparent supports coated on one or both sides and emulsions on paper supports. The material may be in either strip or sheet form but the apparatus is especially useful in processing layer supports in sheet form.

WHAT WE CLAIM IS:—

1. Apparatus for processing photographic material, which apparatus comprises a tank for processing liquid through which, in operation, photographic material is passed, and at least a portion of a circulation path for processing liquid within the apparatus passing through the tank, means for sensing the photographic material which passes through the tank, means, responsive to a signal from the sensing means, for extracting liquid from the circulation path, and means for maintaining liquid in the tank at a predetermined level, which level maintaining means includes means for supplying fresh, previously uncirculated processing liquid to the circulation path to replace extracted liquid.

2. Apparatus as claimed in claim 1, wherein the means for extracting liquid is arranged, in response to the signal from the sensing means, to extract from the circulation path within the apparatus a volume of liquid dependent upon the quantity, or area, of photographic material processed or to be processed.

3. Apparatus as claimed in claim 1 or claim 2, wherein the means for extracting liquid is arranged to operate after the photographic material has passed through the tank.

4. Apparatus as claimed in claim 1 or claim 2, wherein the means for extracting liquid is arranged to operate intermittently during the passage of photographic material through the tank.

5. Apparatus as claimed in any one of claims 1 to 4, wherein the means for extracting liquid from the circulation path within the apparatus comprises a pump.

6. Apparatus as claimed in claim 5, wherein the pump is operable at two different rates and at the lower rate it is arranged to circulate liquid around the circulation path and at the higher rate it is arranged simultaneously to extract liquid from the circulation path.

7. Apparatus as claimed in claim 6, wherein there is provided a motor for driving the pump having two windings and the arrangement is such that when one of the windings is connected to a voltage supply the pump is operated at its lower rate and when the other or both of the windings are

connected to a voltage supply the pump is operated at its higher rate.

8. Apparatus as claimed in any one of claims 1 to 7, wherein there is provided adjustment means for adjusting the rate at which the extraction means extracts liquid from the circulation path.

9. Apparatus as claimed in any one of claims 5 to 6, or in claim 8 when dependant on claim 5, wherein the pump comprises an outlet conduit having an opening through which the conduit is in communication with the tank so that liquid can be released into the tank, and also comprises a further opening, upstream of the first-mentioned opening, through which liquid can be extracted from the circulation path, and wherein there is provided adjustment means for adjusting the rate at which the extraction means extracts liquid through the further opening which comprises means for varying the cross-section of the outlet conduit downstream of the further opening and upstream of the first-mentioned opening to vary the proportion of the liquid extracted per unit time.

10. Apparatus as claimed in claim 9, wherein there is provided a liquid extraction conduit comprising a riser pipe, the outlet conduit being in communication with the liquid extraction conduit through the said further opening at the bottom of the said riser pipe, and the arrangement being such that liquid is discharged when it reaches the top of the riser pipe.

11. Apparatus as claimed in any one of claims 1 to 10, wherein the means for maintaining liquid in the tank at a predetermined level further comprises an overflow at said predetermined level.

12. Apparatus as claimed in any one of claims 1 to 11, wherein the means for supplying fresh processing liquid to the circulation path is arranged to add the liquid at a position remote from the region from which the extraction means is arranged to extract liquid from the circulation path.

13. Apparatus as claimed in any one of claims 1 to 12, wherein the scanning means is arranged to ascertain the time taken for photographic material to pass through the tank and wherein there is provided a storing device which is arranged to store information corresponding to the said pass-through time of the photographic material, as ascertained by the sensing means, the storing device being further arranged to actuate the extraction means so that the extraction means operates over a time which is less than and linearly proportional to the said pass-through time.

14. Apparatus as claimed in claim 13, when dependent on claim 11 or claim 12, wherein the storing device is arranged to actuate the extraction means cyclically in a pulse-like manner for periods of time that



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ning means may be arranged at either the entrance or the exit to the tank 1a.

The apparatus may be used for processing different types of photographic material, such as films on transparent supports coated on one or both sides and emulsions on paper supports. The material may be in either strip or sheet form but the apparatus is especially useful in processing layer supports in sheet form.

WHAT WE CLAIM IS:—

1. Apparatus for processing photographic material, which apparatus comprises a tank for processing liquid through which, in operation, photographic material is passed, and at least a portion of a circulation path for processing liquid within the apparatus passing through the tank, means for sensing the photographic material which passes through the tank, means, responsive to a signal from the sensing means, for extracting liquid from the circulation path, and means for maintaining liquid in the tank at a predetermined level, which level maintaining means includes means for supplying fresh, previously uncirculated processing liquid to the circulation path to replace extracted liquid.

2. Apparatus as claimed in claim 1, wherein the means for extracting liquid is arranged, in response to the signal from the sensing means, to extract from the circulation path within the apparatus a volume of liquid dependent upon the quantity, or area, of photographic material processed or to be processed.

3. Apparatus as claimed in claim 1 or claim 2, wherein the means for extracting liquid is arranged to operate after the photographic material has passed through the tank.

4. Apparatus as claimed in claim 1 or claim 2, wherein the means for extracting liquid is arranged to operate intermittently during the passage of photographic material through the tank.

5. Apparatus as claimed in any one of claims 1 to 4, wherein the means for extracting liquid from the circulation path within the apparatus comprises a pump.

6. Apparatus as claimed in claim 5, wherein the pump is operable at two different rates and at the lower rate it is arranged to circulate liquid around the circulation path and at the higher rate it is arranged simultaneously to extract liquid from the circulation path.

7. Apparatus as claimed in claim 6, wherein there is provided a motor for driving the pump having two windings and the arrangement is such that when one of the windings is connected to a voltage supply the pump is operated at its lower rate and when the other or both of the windings are

connected to a voltage supply the pump is operated at its higher rate.

8. Apparatus as claimed in any one of claims 1 to 7, wherein there is provided adjustment means for adjusting the rate at which the extraction means extracts liquid from the circulation path.

9. Apparatus as claimed in any one of claims 5 to 6, or in claim 8 when dependant on claim 5, wherein the pump comprises an outlet conduit having an opening through which the conduit is in communication with the tank so that liquid can be released into the tank, and also comprises a further opening, upstream of the first-mentioned opening, through which liquid can be extracted from the circulation path, and wherein there is provided adjustment means for adjusting the rate at which the extraction means extracts liquid through the further opening which comprises means for varying the cross-section of the outlet conduit downstream of the further opening and upstream of the first-mentioned opening to vary the proportion of the liquid extracted per unit time.

10. Apparatus as claimed in claim 9, wherein there is provided a liquid extraction conduit comprising a riser pipe, the outlet conduit being in communication with the liquid extraction conduit through the said further opening at the bottom of the said riser pipe, and the arrangement being such that liquid is discharged when it reaches the top of the riser pipe.

11. Apparatus as claimed in any one of claims 1 to 10, wherein the means for maintaining liquid in the tank at a predetermined level further comprises an overflow at said predetermined level.

12. Apparatus as claimed in any one of claims 1 to 11, wherein the means for supplying fresh processing liquid to the circulation path is arranged to add the liquid at a position remote from the region from which the extraction means is arranged to extract liquid from the circulation path.

13. Apparatus as claimed in any one of claims 1 to 12, wherein the scanning means is arranged to ascertain the time taken for photographic material to pass through the tank and wherein there is provided a storing device which is arranged to store information corresponding to the said pass-through time of the photographic material, as ascertained by the sensing means, the storing device being further arranged to actuate the extraction means so that the extraction means operates over a time which is less than and linearly proportional to the said pass-through time.

14. Apparatus as claimed in claim 13, when dependent on claim 11 or claim 12, wherein the storing device is arranged to actuate the extraction means cyclically in a pulse-like manner for periods of time that



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are each shorter than the average or mean time taken for processing liquid to flow from the means for adding processing liquid to the region from which the extraction means is arranged to extract liquid from the circulation path.

15. Apparatus as claimed in claim 13 or claim 14, wherein the storing device comprises a capacitor charging of which is initiated when the sensing means initially ascertains the presence of photographic material passing through the tank, there being provided a first trigger controlled by the capacitor and so arranged that, when the potential across the capacitor exceeds a predetermined first threshold value, subsequent discharging of the capacitor causes the trigger to become actuated until the potential of the capacitor falls below the said first threshold value, and the extraction means being arranged to operate for the duration of the actuation of the first trigger.

16. Apparatus as claimed in claim 15, wherein there is provided a second trigger controlled by the capacitor and arranged

to interrupt the charging of the capacitor when the potential of the capacitor reaches a second threshold value, higher than the first, and to cause the capacitor to be discharged until it reaches the first threshold value whereupon charging of the capacitor is continued.

17. Apparatus as claimed in claim 16, wherein there is provided a variable discharge resistor so that the time taken for the capacitor to be discharged from the second threshold value to the first threshold value can be adjusted.

18. Apparatus as claimed in claim 16 or claim 17, wherein there is provided means for adjusting the second threshold value.

19. Apparatus substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1977.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.