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EP 0 127 497 B1

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Description

This invention relates to automatic dispensers, in particular for dispensing liquid detergents, soaps and germicides. A need has long existed for a dispenser that would release a measured quantity of soap or other material without the need for the user to depress a button, move a handle or the like. The handling of such actuators of conventional dispensers by a number of users spreads disease causing micro-organisms and creates an unsightly appearance around the dispenser actuator. Thus, a dispenser that would release a predetermined quantity of liquid soap or the like in response to the presence of a hand or other receiving object placed under the dispenser outlet would eliminate the aforementioned disadvantages of conventional dispensers.

In the state of the art, for example as illustrated by FR-A-1 410 288 and FR-A-2 016 862, various solutions to this problem have been proposed.

Therefore it is an object of this invention to release soap, detergent, or other liquid or semi-solid materials (hereinafter termed fluid) in response to the mere placement of a hand or other receiving object within the proximity of the dispenser outlet.

It is a further object of this invention that a predetermined quantity of fluid (hereinafter termed a portion) be released from the dispenser upon each instance of use.

Further, it is an object of this invention that the dispenser be adapted to the use of a disposable fluid container which can be placed within the dispenser, and that such a disposable container be integrally connected to disposable valve means and outlet means. In this manner, the entire wetted pathway from the container through the outlet means may be discarded after the emptying of the container, thereby minimizing the opportunities for a build-up of micro-organisms.

It is a further object of this invention that the dispenser contain a proximity detector means of an electrical nature, and that said proximity detector means consumes a minimum of electric power, thereby allowing the use of disposable or rechargeable batteries.

The present invention is concerned with an automatic fluid dispenser, in particular for dispensing liquid detergents, soaps and germicides, of the type comprising:

- a flexible container for fluid integrally connected to valve means and outlet means,
- a pressure plate which is connected to a spring-driven lever for imparting a squeezing force to said flexible container, and
- proximity detector means connected to means for opening and closing said valve means, characterized in that said spring-driven lever comprises:

(a) an external spring whose axis is near the central pivot point of a first order lever when the liquid container is full, the said spring axis mov-

ing away from the said central pivot point of the lever as the container is emptied;

(b) a first order lever whose extremities comprise the attachment point of said spring and the attachment point of an axle attached to the pressure plate, respectively, and

(c) sufficient length of said spring so that the torque increase caused by the increasing distance of the spring center line from the central pivot point as the container empties is more than the torque decrease caused by the lessening extension of the spring caused by movement of the lever as the container empties.

Figure 1 is an overall view of the embodiment of the dispenser.

Figure 2 is a view from beneath the dispenser.

Figure 3 is a side view of the dispenser showing a sectional view of internal components.

Figure 4 is a perspective view showing the pressure plate lowered in its position on the container bag.

Figure 5 is a perspective view showing the container pressure plate raised.

Figure 6 is a block diagram of the electronic circuits of the dispenser.

The instant invention is directed to a fluid dispenser comprising:

- (a) a flexible container for a fluid, integrally connected to valve means and outlet means;
- (b) means for imparting a squeezing force to said flexible container;
- (c) and proximity detector means connected to means for opening and closing said valve means.

This invention is particularly directed to a fluid dispenser which contains an electric power source, an electronic proximity detector, a means for holding and supporting a flexible, disposable bag container, an actuator which opens and closes a disposable valve which is part of the container assembly, and a pressurizing means which applies a force to the top of the bag, moving fluid from the bag through the valve when the valve is open.

In a preferred embodiment of this invention, the power source for the dispenser is a dry-cell battery, allowing location of the dispenser anywhere. The proximity detector employs very short pulses of infra-red radiation which are directed downward in a beam aimed toward the area under the dispenser outlet, and in association with a detector of infra-red radiation which is designed to pick up reflected light from a hand or other receiving object placed below the outlet. When the detector picks up a light signal (it is energized continuously in order to be in constant readiness), it is converted to a timed pulse which is transmitted to the actuator, opening the valve. A predetermined interval later, another timed pulse is sent to the actuator, closing the valve. The fluid container is a flexible bag which lies in a horizontal position on a shelf above the detector. The valve means and outlet means are also disposable and are attached to the bag, hanging below it. In order to provide a substantially constant flow rate from the container, a spring-

driven pressure plate presses gently on top of the bag and is arranged to press with gradually increasing force as the bag empties, compensating for the naturally slowing flow of the unassisted bag under this condition. This combination of constant flow rate and predetermined open time for the valve yields portions of uniform size.

Referring now to the drawings, Figures 1 and 2 show two views of the dispenser, and in both of them the front side of the dispenser is on the left, and a wall mount is on the right. The dispenser may be mounted to a wall by means of bracket 3. Fluid is dispensed from outlet 4 which protrudes through dispenser bottom 1 at orifice 5. The proximity detector means uses two infra-red devices: emitter means 6 and detector means 7. Both of these are aimed optically downward in the same direction so that any object near the dispenser and illuminated by the beam from 5 will reflect a portion of this illumination back to detector 7.

Figure 3 shows a sectional view of the side of the dispenser. Any flexible material may be employed to create a flexible container. The flexible container is supported by shelf 13. Preferred materials for the container include rubber and heat-sealed plastic sheet material. Flexible outlet tube 4 is sealed to the flexible container and leads to the bottom area of the dispenser as shown. A simple and preferred valve and actuator mechanism consists of a pinching means coupled to a special solenoid actuator. In Figure 3 the pinch assembly is comprised of fixed pinch jaw 17 and movable pinch jaw 16. One suitable solenoid mechanism 15 is shown in Figure 3, and is based on the Model S89R bistable impulse relay manufactured by the Potter and Brumfield Division of AMF Corporation. In this mechanism, each pull stroke of the solenoid plunger causes pin 27 to travel toward the heel-end 28 of the solenoid. In the position shown in Figure 3 the pin thus moves within the upper leg of the vee-slot in cam 29. When the pin reaches the end of the slot (the position shown in Figure 3) the cam 29 is rotated clockwise, causing the pinch valve to close through the action of link 32 and movable jaw 16. When the solenoid is de-energized, an internal spring (not shown) moves pin 27 back to a position at the apex of the vee slot in cam 29. The next time the solenoid is energized pin 27 traverses the lower leg of the vee slot, at the end of which cam 29 is caused to rotate counterclockwise, opening the pinch valve. Thus, successive electrical actuations of the solenoid alternately open and close the pinch valve. This is important, because any required quantity of fluid may be dispensed by only two very short impulses — one to open the valve and the other to close it. Using a Potter and Brumfield-type device, an electrical impulse lasting only 0.1 second is needed for each transfer of the cam from one position to the other. Since a typical fluid-dispense event may require as much time as several seconds, the use of an impulse solenoid of this

nature saves a great deal of electrical energy from its battery.

The electronic circuit 18 of Figure 2, powered by battery 14, converts the signal picked up by detector 7 to a short — e.g. 0.1 second — opening pulse. A pre-set interval later, the circuit sends an identical pulse to the solenoid, closing the valve. This pre-set interval is the primary control within the dispenser for the amount of fluid dispensed. It is also an exact control, provided that the flow rate through the valve is constant. If the bag container is simply resting on shelf 13, with only gravity providing pressure on the fluid or its container, the flow rate will decrease from its maximum value when the container is full, to zero when the container is empty. Thus it is necessary to provide an additional means for gradually increasing pressure on the bag container as the container is gradually emptied during the any successive withdrawals of fluid from the dispenser. In this way the naturally decreasing hydrostatic pressure caused by the height of the fluid level in the bag can be compensated by the aforementioned increase in pressure applied to the bag.

Figures 4 and 5 show the general arrangement of the dispenser parts. In particular, Figure 4 shows that the flexible bag 19 lies under a pressure plate 11 which is attached in a pivoting manner to axle 26. This axle, in turn, is solidly attached to a straight lever 30 and a triangular lever 20. These two levers are attached together by a shaft 31 which is free to rotate in holes or bearings which are an integral part of the dispenser framework (not shown). Extension spring 24 is attached to the dispenser framework at 25 and to the triangular lever at 22. In the position shown in Figure 4 the spring is attempting to cause counterclockwise rotation of the triangular lever, and hence a downward motion on the pressure plate. Referring still to Figure 4, if one were to raise the pressure plate until the centerline of spring 24 passed directly over the centerline of shaft 21, then the spring would exert no torque on the triangular lever and there would be no force exerted downward on the pressure plate. Thus it can be seen that, as the pressure plate moves downward from a "dead-center" position, the centerline of the spring moves away from its position directly over the centerline of shaft 21 and this causes a progressively increasing torque to be applied to the triangular lever. The foregoing statement is strictly true only when the spring is long enough to provide a decrease in force along its own axis, as the triangular lever moves counterclockwise, which is less than the increasing torque effect caused by the increase in distance of the spring centerline from the centerline of shaft 21. In practice this is a very simple condition to meet, since the total travel of the pressure plate is small and the effect of shortening the spring as the fluid leaves the container is very much less than the effect of increasing the moment-arm in the mechanism, or the distance from the spring centerline to the centerline of

shaft 21. As an essential feature of the present invention, it is only necessary to provide a means for increasing pressure-plate force which is substantially equal to the decreasing effect of progressively-decreasing hydrostatic pressure occurring as the container is emptied.

Figure 3 reveals that the dispensed fluid touches only the disposable flexible container 19 and the flexible outlet tube 4. Thus there is no clean-up needed when an empty container is replaced by a full one, the entire fluid flow path being replaced and renewed when the container, assembly is replaced. In order to permit easy replacement of the container fixed pinch jaw 17 may be adapted to be swung out of the way during container and outlet tube replacement. It is clear that alternative valve mechanisms may be used, as long as they are disposable and adapted to operate in association with solenoid 15. A poppet or movable-flap type of valve, for example, may be used. Also, a rotary valve may be employed, deriving its actuation from the angular motion of the cam 29. As an alternative valve mechanism, the resilient tube 4 may be bent to provide a kink seal. The minimum angle to provide a kink seal is defined for each resilient material and can be accomplished by any mechanism that bends the tube to the required angle.

Use of the pressure plate 11, also gives rise to a simple indicator for the quantity of fluid in the container. This is done, for example, by mounting a graduated dial (not shown) on shaft 31. The angular position of the dial is a direct indication of the amount of fluid in the bag. Alternatively, a switch or other electrical transducer may be mounted in cooperation with the levers 20 or 30 so that upon approaching a nearly empty condition of the container the position of the lever is sensed by the switch, lighting a lamp or the like.

A major objective of the present invention is to reduce the electrical energy required for continuous dispenser use. Two major components of electrical consumption are present; (1) the valve solenoid and (2) the light emitter portion of the proximity detector. Valve solenoid power consumption has been lowered appreciably by the use of a bistable device, as explained above. To reduce energy consumption of the other component, this invention employs a far lower pulse frequency and pulse duty cycle than are used in other proximity detectors used for general industrial purposes. Preferred values are near 5—20 pulses per second and a duty cycle of near 0.007. Also, the lowest effective emitter current is used. Figure 6 shows the block diagram of the electronic circuits of the dispenser. Reflected radiation is received by the phototransistor, whose signal is amplified and then separated from ambient light in a level clipper. The resulting signal is fed to the 0.1 second pulse generator which causes the solenoid to stroke and open the valve. An auxiliary switch on the solenoid causes, through feedback path A, a variable timer to generate a "valve-open" interval, at the end of

which a signal is sent to the same 0.1 second pulse generator, stroking the solenoid again and closing the valve. An additional circuit path B stops the interval timer if the hand is removed prematurely from below the dispenser and immediately causes a solenoid pulse which closes the valve before the normal open interval has transpired.

An additional means for lowering consumption of electrical energy may be employed as an addition to the preferred embodiment of this invention. This is an additional circuit, not shown in the Figures, which senses the presence or absence of general room illumination in the location of the dispenser. In operation, a simple power-transistor gate, actuated by a cadmium-sulfide photoresistor located on or near the exterior of the dispenser, shuts down the dispenser electronics until such times as the room lights are turned on again. In, for example, an industrial situation wherein only a single-shift schedule is being worked, the battery life in the dispenser would be approximately tripled over that obtained without this feature.

Claims

1. An automatic fluid dispenser, in particular for dispensing liquid detergents, soaps and germicides, of the type comprising:

— a flexible container for fluid integrally connected to valve means and outlet means,

— a pressure plate which is connected to a spring-driven lever for imparting a squeezing force to said flexible container, and

— proximity detector means connected to means for opening and closing said valve means, characterized in that said spring-driven lever comprises:

(a) an extension spring (24) whose axis is near the central pivot point (21) of a first order lever (20) when the liquid container (19) is full, the said spring axis moving away from the said central pivot point of the lever as the container is emptied;

(b) a first order lever (20) whose extremities comprise the attachment point (22) of said spring (24) and the attachment point (23) of an axle (26) attached to the pressure plate (11), respectively, and

(c) sufficient length of said spring (24) so that the torque increase caused by the increasing distance of the spring center line from the central pivot point (21) as the container empties is more than the torque decrease caused by the lessening extension of the spring (24) caused by movement of the lever (20) as the container empties.

2. The fluid dispenser according to claim 1, characterized in that said means for opening said valve means is an electromagnetic actuator.

3. The fluid dispenser according to claim 2, characterized in that the said actuator is powered by batteries (14).

4. The fluid dispenser according to claim 3, characterized in that the said actuator is con-

trolled by an electric circuit responsive to the presence of an object placed near the dispenser.

5. The fluid dispenser according to claim 4, characterized in that the said electric circuit employs emitter means (5) of visible or invisible light aimed below the dispenser and a detector means (7) of such light aimed in the same direction as said emitter means wherein the presence of an object near the dispenser and in the common paths of said emitter and detector means causes at least some of the light emitted by the emitter means to be reflected back toward the detector means, said detector means being of sufficient sensitivity to transmit a signal responsive to said near object.

6. The fluid dispenser according to claim 2, characterized in that the said actuator is a bistable device, characterized by utilizing a brief application of electrical current to position it in a first position, and an additional brief application of electrical current to position it in a second position, and further characterized in that a third brief application of electric current will return it to said first position.

Patentansprüche

1. Automatischer Fluidspender, insbesondere zur Ausgabe von flüssigen Reinigungsmitteln, Seifen und keimtötenden Mitteln der Bauform, die aufweist:

- einen flexiblen Behälter für das Fluid, der einheitig mit einer Ventileinrichtung und einer Auslaßeinrichtung verbunden ist,

- eine Preßplatte, die mit einem federangtriebenen Hebel verbunden ist, um eine Quetschkraft auf den flexiblen Behälter auszuüben, und

- eine Annäherungsdetektoreinrichtung, die mit der Einrichtung zum Öffnen und Schließen der Ventileinrichtung verbunden ist,

dadurch gekennzeichnet, daß der federangtriebene Hebel aufweist:

(a) eine Zugfeder (24), deren Achse in der Nähe des zentralen Drehpunktes (21) eines ersten Hebels (20) liegt, wenn der Flüssigkeitsbehälter (19) voll ist, wobei sich diese Federachse von dem zentralen Drehpunkt des Hebels beim Leeren des Behälters weg bewegt,

(b) einen ersten Hebel (20), dessen Enden jeweils den Befestigungspunkt (22) der Feder (24) und den Befestigungspunkt (23) einer Achse (26) aufweisen, die an der Preßplatte (11) angebracht ist, und

(c) eine ausreichende Länge der Feder (24) derart, daß die Drehkraftzunahme, die durch den größer werdenden Abstand der Federmittellinie von dem zentralen Drehpunkt (21) beim Entleeren des Behälters verursacht wird, größer als die Drehkraftabnahme ist, die durch die Verringerung der Ausdehnung der Feder (24) verursacht wird, wenn sich der Hebel (20) beim Entleeren des Behälters bewegt.

2. Fluidspender nach Anspruch 1, dadurch gekennzeichnet, daß die Einrichtung zum Öffnen der Ventileinrichtung eine elektromagnetische Betätigseinrichtung ist.

3. Fluidspender nach Anspruch 2, dadurch gekennzeichnet, daß die Betätigseinrichtung durch Batterien (14) mit Energie versorgt wird.

4. Fluidspender nach Anspruch 3, dadurch gekennzeichnet, daß die Betätigseinrichtung durch eine elektrische Schaltung gesteuert wird, die auf das Vorhandensein eines Gegenstandes in der Nähe des Spenders anspricht.

5. Fluidspender nach Anspruch 4, dadurch gekennzeichnet, daß die elektrische Schaltung eine Emittereinrichtung (5) für sichtbares oder unsichtbares Licht aufweist, das unterhalb des Spenders gerichtet wird, und eine Detektoreinrichtung (7) für dieses in dieselbe Richtung wie die Emittereinrichtung gerichtete Licht vorgesehen ist, wobei durch das Vorhandensein eines Gegenstandes in der Nähe des Spenders und auf den gemeinsamen Wegen der Emittereinrichtung und der Detektoreinrichtung bewirkt, daß wenigstens ein Teil des von der Emittereinrichtung ausgegebenen Lichtes zu der Detektoreinrichtung zurückreflektiert wird, und wobei die Detektoreinrichtung eine ausreichende Empfindlichkeit hat, daß ein auf die Annäherung des Gegenstands ansprechendes Signal übertragen wird.

6. Fluidspender nach Anspruch 2, dadurch gekennzeichnet, daß die Betätigseinrichtung eine bistabile Einrichtung ist, daß unter Ausnutzung eines kurzen Anlegens eines elektrischen Stromes diese in eine erste Stellung bringbar ist und durch ein zusätzliches kurzes Anlegen eines elektrischen Stromes in eine zweite Stellung bringbar ist, und daß ferner an einem dritten kurzen Anlegen eines elektrischen Stromes diese in ihre erste Stellung zurückkehrt.

Revendications

1. Distributeur automatique de fluide, en particulier pour distribuer des détergents, savons et germicides liquides, du type comportant:

- un conteneur souple pour fluide, connecté à un moyen formant robinet et à un moyen formant sortie, et d'une pièce avec ces moyens,

- une plaque de pression qui est connectée à un levier entraîné par un ressort pour communiquer une force d'écrasement au conteneur souple, et

- un moyen formant détecteur de proximité connecté à un moyen pour ouvrir et fermer ledit moyen formant robinet,

caractérisé en ce que ledit levier entraîné par un ressort comporte:

(a) un ressort de traction (24) dont l'axe est proche du point formant pivot axial (21) d'un levier (20) répondant à la première demande lorsque le conteneur de liquide (19) est plein, ledit axe de ressort s'écartant du point formant pivot axial du levier au fur et à mesure que le conteneur se vide;

(b) un levier répondant à la première demande (20), dont les extrémités sont respectivement le point de fixation (22) dudit ressort (24) et le point de fixation (23) d'une tringle (26) fixée à la plaque de pression (11), et

(c) une longueur suffisante dudit ressort (24), de façon que l'accroissement du couple causé par

l'accroissement de la distance entre l'axe du ressort et le point formant pivot axial (21), au fur et à mesure que le conteneur se vide, soit supérieur à la diminution du couple causé par la moindre traction du ressort (24) causée par le mouvement du levier (20) au fur et à mesure que le conteneur se vide.

2. Distributeur de fluide selon la revendication 1, caractérisé en ce que ledit moyen d'ouverture dudit moyen formant robinet est un actionneur électromagnétique.

3. Distributeur de fluide selon la revendication 2, caractérisé en ce que ledit actionneur est alimenté par des batteries (14).

4. Distributeur de fluide selon la revendication 3, caractérisé en ce que ledit actionneur est commandé par un circuit électrique sensible à la présence d'un objet placé près du distributeur.

5. Distributeur de fluide selon la revendication 4, caractérisé en ce que ledit circuit électrique utilise un moyen formant émetteur (5) de lumière visible ou invisible dirigée sous le distributeur,

ainsi qu'un moyen formant détecteur (7) de la même lumière dirigée dans la direction dudit moyen formant émetteur, étant précisé que la présence d'un objet près du distributeur et sur le chemin commun dudit moyen formant émetteur et dudit moyen formant détecteur fait qu'au moins une partie de la lumière émise par le moyen formant émetteur est réfléchie vers le moyen formant détecteur, ledit moyen formant détecteur ayant une sensibilité suffisante pour transmettre un signal correspondant audit objet proche.

6. Distributeur de fluide selon la revendication 2, caractérisé en ce que ledit actionneur est un dispositif bistable remarquable par le fait qu'il utilise une brève application de courant électrique pour se positionner dans une première position, et une brève application supplémentaire de courant électrique pour se positionner dans une seconde position, et remarquable en outre en ce qu'une troisième brève application de courant électrique le ramène à ladite première position.

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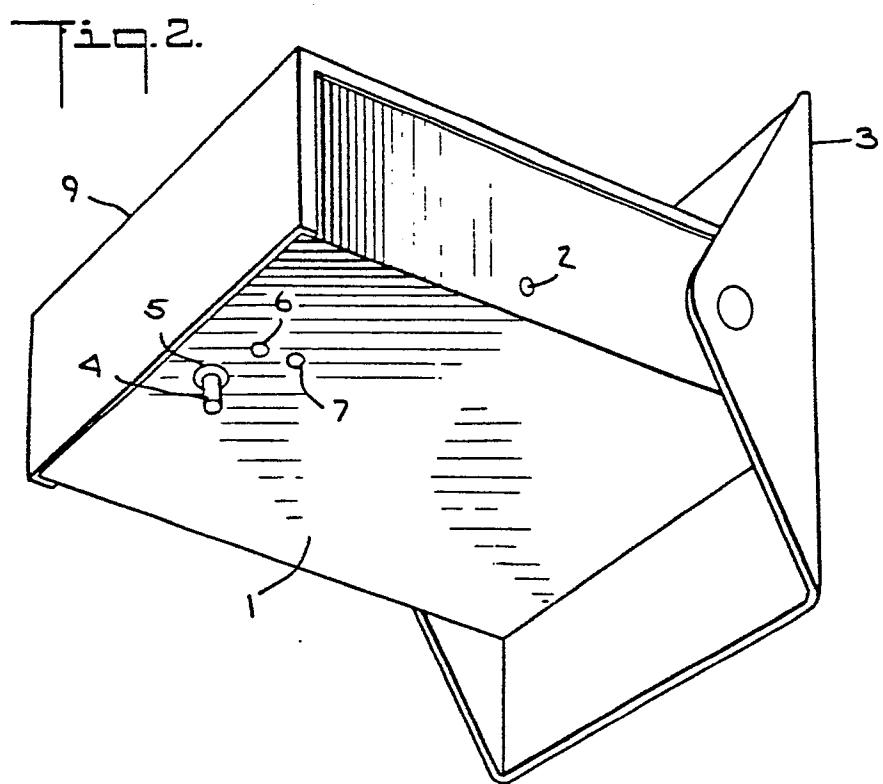
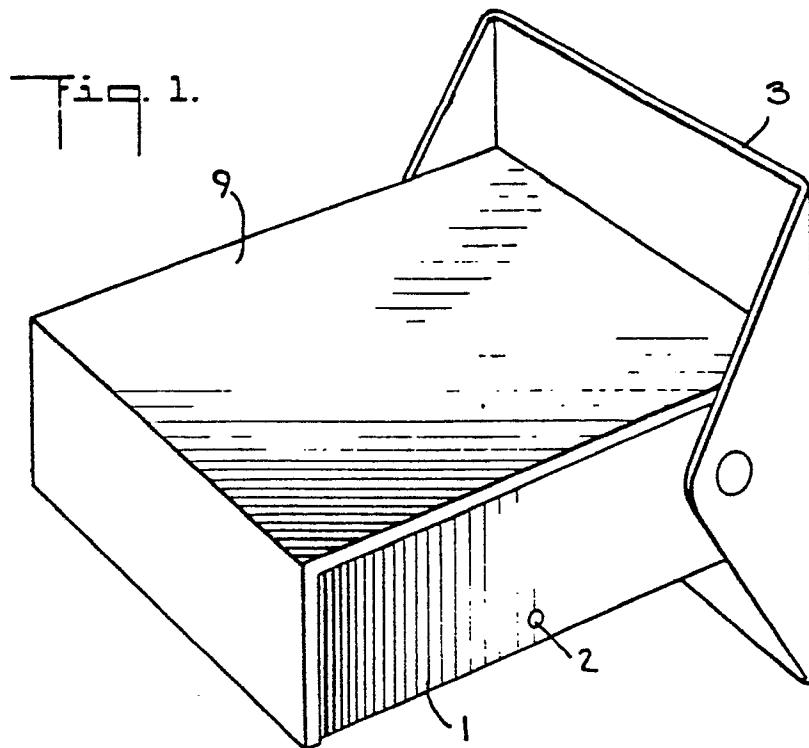
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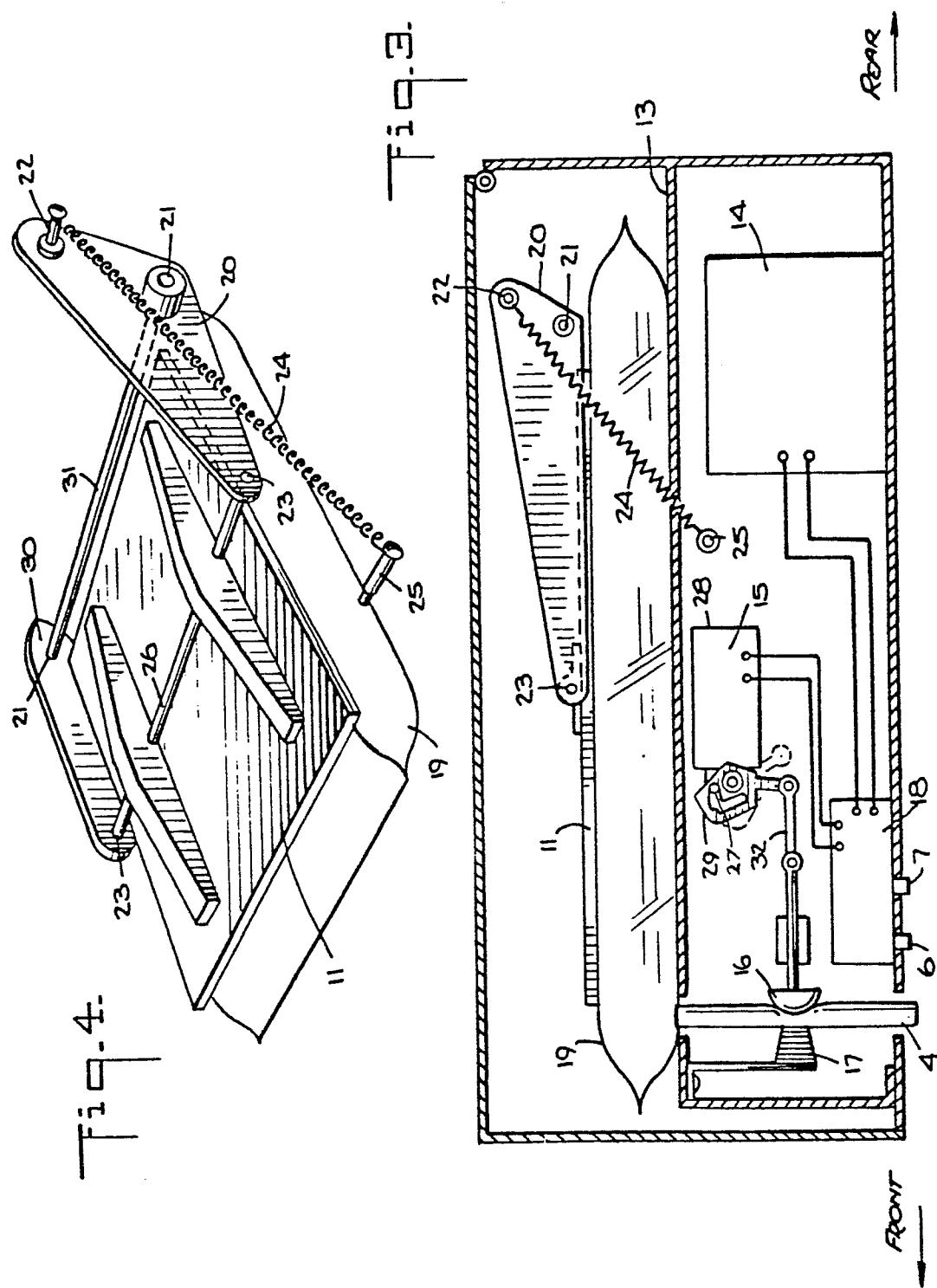
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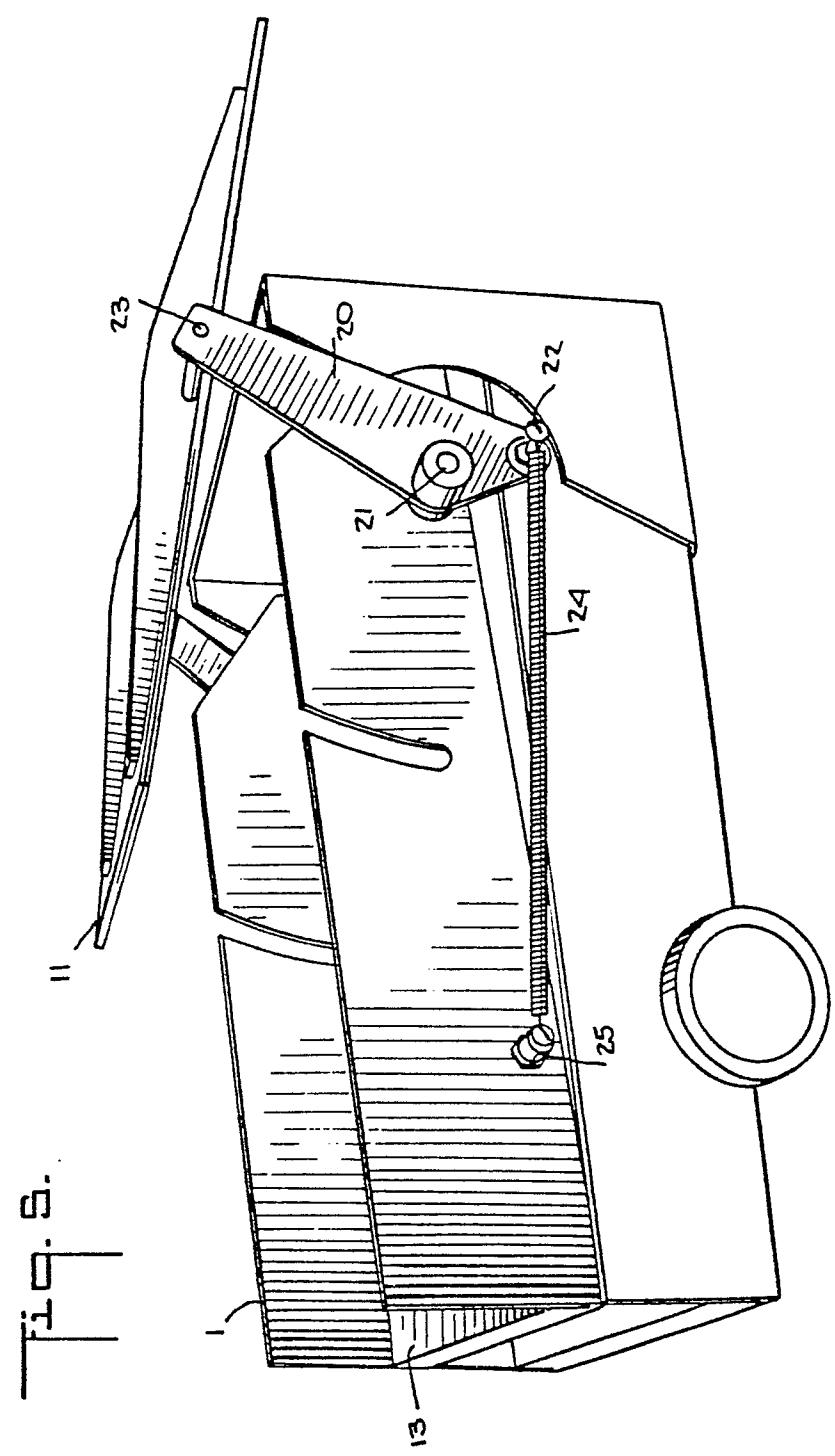
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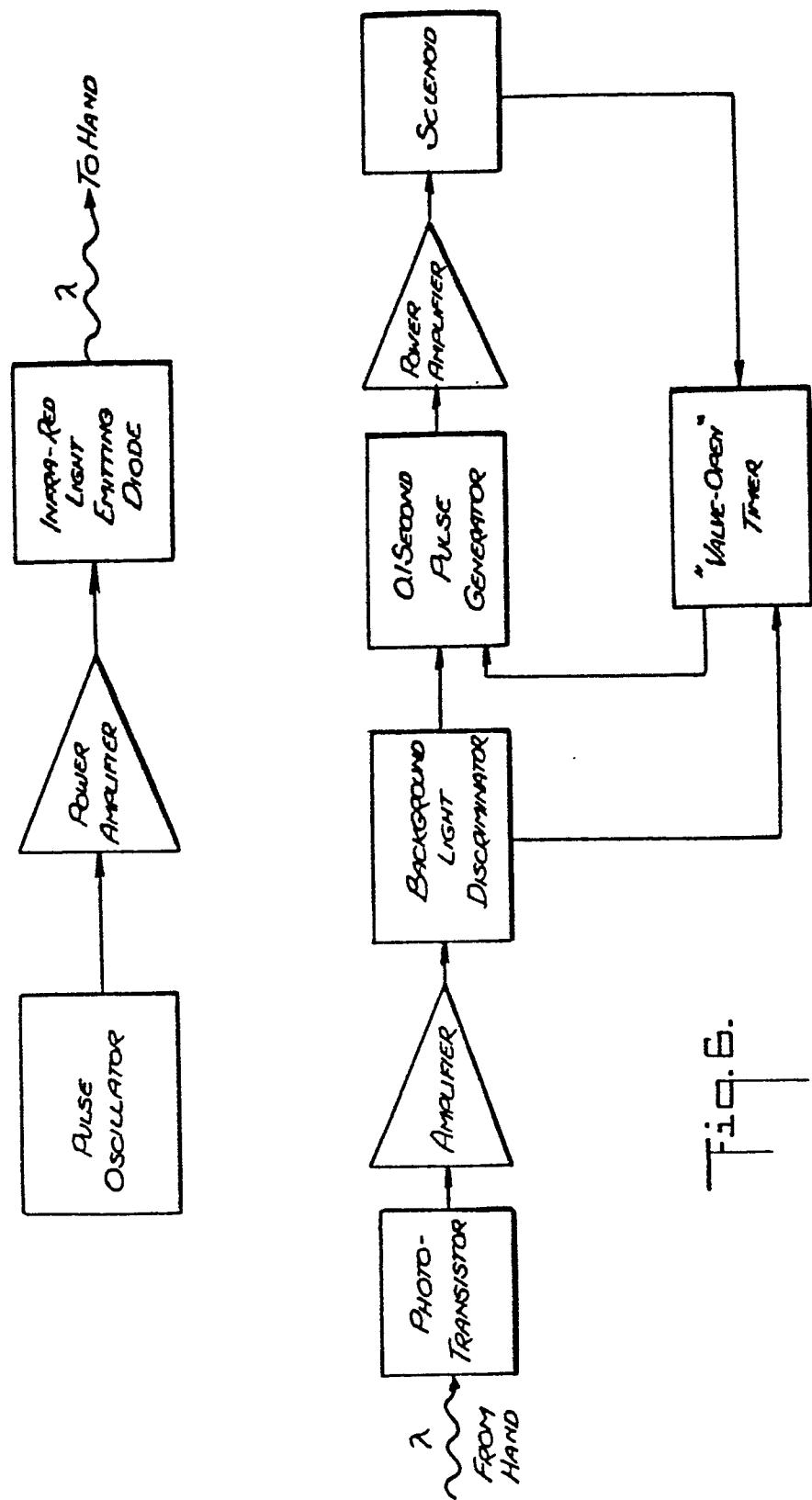


Fig. 8.