APPLICATION FOR A STANDARD PATENT OR A STANDARD PATENT OF ADDITION

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(c) hereby apply for the grant of a Standard Patent for an invention entitled "Swimming pool cleaning device" which is described in the accompanying complete specification.

(e) For a Convention application — details of basic application(s) —

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I/We request that the Patent may be granted as a Patent of Addition to Patent No. 85/8515 in the name of

My/Our address for service is ARTHUR S. CAVE & CO., Patent and Trade Mark Attorneys, 1 Alfred Street, Sydney, New South Wales, Australia 2000.

Dated this 4th day of November 1986

Andries Johannes STOLTZ
By His Patent Attorneys

ARTHUR S. CAVE & CO.

JAMES G. SIELY, F.I.P.A.A.
A swimming pool cleaning device comprising a head having an inlet opening adapted to be located adjacent a submerged surface to be cleaned, an outlet from the head connected to the inlet through a flow channel, a valve associated with the flow channel and biased to an open position, the valve being arranged to move to a closed position to at least substantially close the flow channel intermittently when water flows through the channel in use, and a variable volume chamber communicating with the flow channel downstream of the valve and biased to a distended condition for enhancing operation of the valve in use, the head and flow channel being co-erative to cause movement thereof across a submerged surface in consequence of the intermittent closure of the valve in use.
Complete Specification (ORIGINAL)

FOR OFFICE USE

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TO BE COMPLETED BY APPLICANT

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Complete Specification for the invention entitled:
"Swimming pool cleaning device"

The following statement is a full description of this invention, including the best method of performing it known to me:-
INTRODUCTION

THIS INVENTION relates to an automatic swimming pool cleaning device of the kind wherein means are provided for interrupting flow of water sucked through the device to thereby cause the device to move across a submerged surface to be cleaned.

BACKGROUND TO THE INVENTION

The above type of device is well known and is described in various patent specifications such as South African Patent No 71/1024 (Raubenheimer), United States Patent No 4023227 (Chauvier), and United States Patent No 4133068 (Hoffmann).
It is an object of this invention to provide a swimming pool cleaning device which operates efficiently and is less susceptible to operational malfunction caused by foreign matter becoming lodged within the device compared with many prior art devices.

**SUMMARY OF THE INVENTION**

According to the invention there is provided a swimming pool cleaning device comprising a head having an inlet opening adapted to be located adjacent a submerged surface to be cleaned, an outlet from the head connected to the inlet through a flow channel, a valve associated with the flow channel and biased to an open position, the valve being arranged to move to a closed position to at least substantially close the flow channel intermittently when water flows through the channel in use, and a variable volume chamber communicating with the flow channel downstream of the valve and biased to a distended condition for enhancing
operation of the valve in use, the head and flow channel being operative to cause movement thereof across a submerged surface in consequence of the intermittent closure of the valve, in use.

Further features of the invention provide for the valve to be either a spring loaded plunger valve or a pivotable flap valve arranged to co-operate with a valve seat formed in the flow channel; for the variable volume chamber to be located either in a branch off the flow channel or to form an enlarged zone of the channel in its length; and for the variable volume chamber to comprise a cup shaped diaphragm. As an alternative the variable volume chamber may comprise a spring loaded piston acting in a cylinder.

The invention also provides for the spring loading of the plunger or flap valve to be adjustable, and, for adjustable means to be associated with the variable volume chamber for urging it to a distended condition.
Preferably the head is of the type in which the inlet is located within a foot of the head, the foot being surrounded by a flexible disc and wherein the channel extends at an incline to the disc and thus at an incline to the submerged surface being cleaned.

These and further features of the invention will become more apparent from the following description of various embodiments thereof given below by way of examples with reference being made to the accompanying drawings:

**BRIEF DESCRIPTION OF THE DRAWINGS**

In the drawings:

Figure 1 is a cross-sectional side elevation of one form of swimming pool cleaning device according to the invention,
Figure 2 is a similar view through a second embodiment of the invention; and,

Figure 3 is a similar view through an alternative variable volume chamber for the embodiment of Figure 2.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring initially to Figure 1, a swimming pool cleaner is shown whereof a head 1, has an inlet opening 2, an outlet opening 3 and a flow channel 4 connecting the inlet with the outlet. A plunger type of valve, having a plunger 5 carrying a closure 6 and being slidable in a cylinder 7 therefor is arranged such that the closure can engage a valve seat 8 encircling the flow channel near the inlet end to close the flow channel through the head 1 intermittently as will be described below.

A tension spring 9 biases the plunger 5
away from the valve seat 8. One end of the
tension spring is mounted inside the plunger, which
is hollow, and the other end 10 is mounted to a
screw threaded plug 11 which screws into the back
of the cylinder 7. By screwing the plug into the
cylinder to a greater or lesser extent the tension
on the spring 9 can be adjusted.

The closure 6 is of a shape and
configuration which will ensure that when, in use,
water is drawn through the flow channel from the
inlet to the outlet the plunger will be drawn
towards the valve seat 8 against the action of the
tension spring in order to substantially close the
valve intermittently.

Such intermittent closure of the valve is
enhanced, as provided by the invention, by the
presence of a variable volume chamber 12, which, in
this embodiment of the invention, assumes the form
of a cup shaped elastomeric diaphragm 13 having its
periphery attached to a rigid plate 14 carried on a
connecting tube 15 communicating between the inside of the variable volume chamber and the channel 4. The diaphragm, being elastomeric, is automatically biased to a distended condition but the bias is enhanced by the presence of a compression spring 16.

A foot 17 is formed around the inlet 2, the foot 17 having a suction port 18 formed therein for allowing by-pass water to enter into the inlet 2. A flexible disc 19 is fitted around the foot 17 and, in use, the disc 19 and foot 17 will be located against a surface 20 to be cleaned.

The foot and disc are arranged such that, when they are in firm contact with the submerged surface, the axis of the flow channel is inclined to such surface at about 45° for reasons that will be quite apparent to those skilled in the art.

The outlet 3 is, for use, connected through a swivel coupling 21 to a flexible hose...
(not shown), the hose being connected to the suction side of a pump which will, in use, draw water through the head and the hose to a swimming pool filter.

In use, as water is drawn through the head the plunger 5 will be urged to move against the action of the tension spring so as to move the closure towards, and generally fully onto, the valve seat 7. As the closure 6 strikes the valve seat 8 the flow in the flow channel 4 is interrupted and pressure in the flow channel 4 is suddenly decreased. This decrease in pressure in the flow channel is conveyed through the connecting tube 15 to the interior of the variable volume chamber. This causes the diaphragm 13 to collapse against the action of the compression spring 16, thereby, at least to some extent, relieving the suction force inside the flow channel 4 and allowing the closure 6 and plunger 5 to move away from the valve seat 8 under the action of the tension spring 9.
The flow will thereafter recommence through the flow channel and the closure will once again be drawn against the valve seat 8 to thereby repeat the cycle. This cyclical opening and closing of the flow channel will cause the pool cleaning device to move across the surface 20 to be cleaned by the virtue of the inclined, and thus non-symmetrical axial direction in which the flow channel extends.

It will be appreciated that in order for the device to operate properly, and over a wide range of suction pressures, it is important that the arrangement of the various components be optimally selected. Thus, the dimension indicated in Figure 1 by the letter "x", which is the distance between the valve seat 8 and the inlet to the connecting tube 15 as well as the dimension indicated in Figure 1 by the letter "y", which is the length of the connecting tube 15, should be selected with a consideration of the flow and hydrostatic forces which arise in a device of this
nature operating in these conditions. Where the length of the connecting tube is appreciable it may, of course, be coiled for convenience. The diameter of the flow channel 4 and that of the connecting tube 15 are also important elements to be taken into consideration. The final configuration will of course depend on the range of suction pressures with which the device is to operate and the desired flow rate through the device. For specific applications the force on the tension spring 9 and the compression spring 16 may be adjusted or the springs may be replaceable by more appropriate ones.

Where required a flow control valve may be fitted in the suction hose or flow channel to provide optimal flow rates for any specific cleaning device or setting thereof.

It will be appreciated that the variable volume chamber 12 may take a different form from that described above. Specifically, as shown in
Figure 2, there is envisaged a piston 22 movable in a co-operant cylinder 23 carried by a connecting tube 24 whereby the interior 25 of the piston and cylinder assembly communicates with the flow channel. The piston is biased by a compression spring 26 towards a position in which the interior is distended as required by the invention. The interior can therefore change in volume very much along the lines of the diaphragm arrangement described above.

A further alternative is illustrated in Figure 3 in which the variable volume chamber 7, assumes the form of an enlarged zone of the flow channel, the chamber being defined by an elastomeric wall 28 which is sufficiently rigid so as not to require a spring to urge it towards the distended condition.

Figure 2 also illustrates an alternative form of valve. In this case the valve closure 29 assumes the form of a flap pivotally mounted at a
position laterally off-set above the valve seat 30 which is similarly located to that illustrated in Figure 1. A compression spring 31 serves to bias the valve to the open position such spring being located between the periphery of the valve seat and the pivot 32 carrying the flap valve closure. In this case a adjustable stop 33 may be provided to limit the movement of the flap valve in the direction of opening thereof.

Numerous other variations can be made to the embodiment of the invention described above without departing from the scope of the invention which is limited only to the presence of a variable volume chamber communicating with the flow channel through the device which has a valve biased to the open position in its flow channel.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A swimming pool cleaning device comprising a head having an inlet opening adapted to be located adjacent a submerged surface to be cleaned, an outlet from the head connected to the inlet through a flow channel, a valve associated with the flow channel and biased to an open position, the valve being arranged to move to a closed position to at least substantially close the flow channel intermittently when water flows through the channel in use, and a variable volume chamber communicating with the flow channel downstream of the valve and biased to a distended condition for enhancing operation of the valve in use, the head and flow channel being operative to cause movement thereof across a submerged surface in consequence of the intermittent closure of the valve in use.

2. A swimming pool cleaning device as claimed in
Claim 1, wherein the valve is a spring loaded plunger valve having a closure arranged to co-operate with a valve seat formed in the flow channel.

3. A swimming pool cleaning device as claimed in Claim 1 in which the valve is a spring loaded flap valve.

4. A swimming pool cleaning device as claimed in any one of the preceding claims wherein the variable volume chamber is located in a branch off the flow channel.

5. A swimming pool cleaning device as claimed in any one of the preceding claims wherein the variable volume chamber comprises a cup shaped diaphragm.

6. A swimming pool cleaning device as claimed in any one of claims 1 to 4 wherein the variable volume chamber comprises a spring loaded
piston acting in a cylinder.

7. A swimming pool cleaning device as claimed in any one of Claims 1 to 3 in which the variable volume chamber is formed by an enlarged zone of the flow channel defined by an elastomeric wall.

8. A swimming pool cleaning device as claimed in any one of the preceding claims wherein the bias of the valve in an open condition is adjustable.

9. A swimming pool cleaning device as claimed in any one of the preceding claims wherein the variable volume chamber includes a variable element which is spring biased and the spring biasing is adjustable.

10. A swimming pool cleaning device substantially as hereinbefore described with reference to any one of the accompanying drawings.
11. Any novel device set forth herein, or any novel device component set forth herein, the said device or component being substantially as herein described.

DATED this 4th day of November 1986

Andries Johannes STOLTZ
By His Patent Attorneys

ARTHUR S. CAVE & CO.