

March 10, 1953

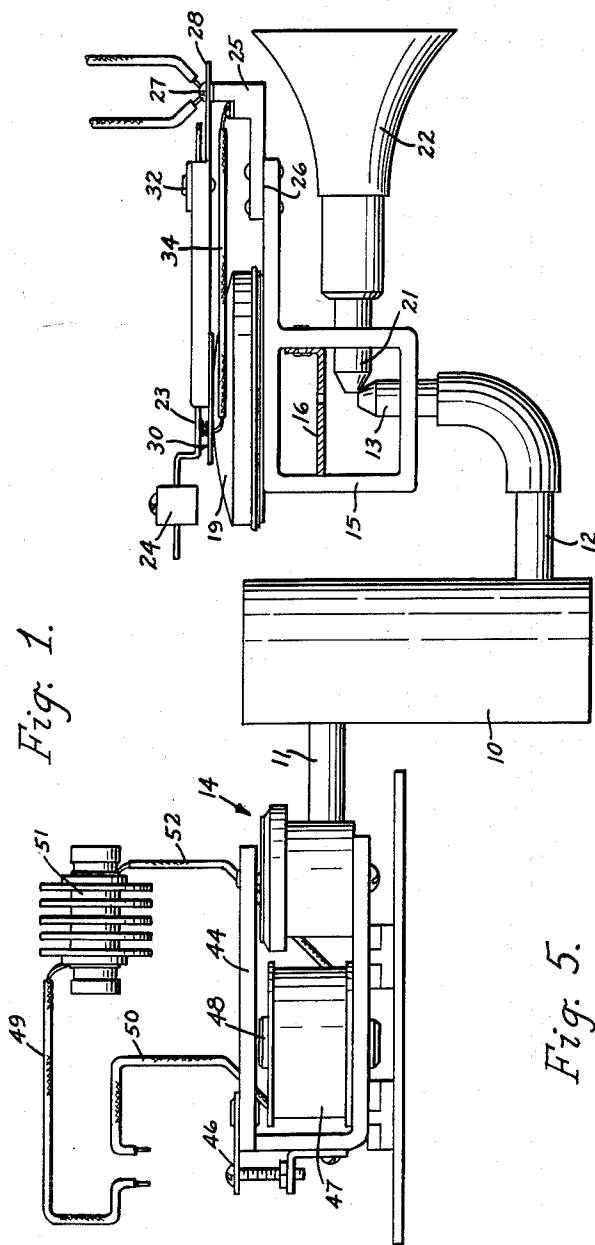
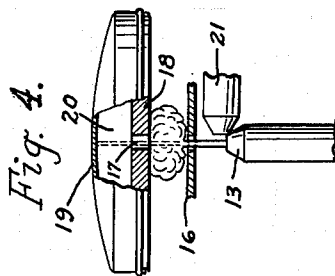
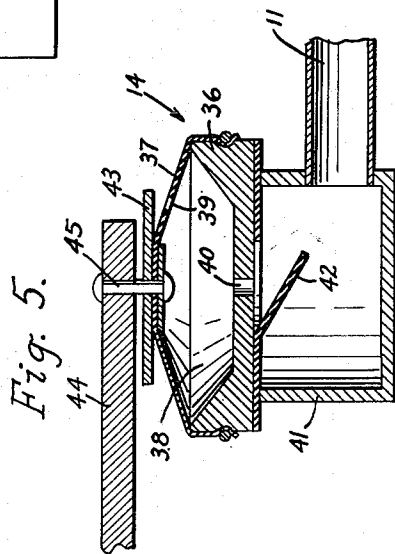
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2,630,873

APPARATUS FOR CONTROLLING VIBRATORY MEMBERS

Filed Sept. 2, 1949

2 SHEETS—SHEET 1



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2 SHEETS—SHEET 2

Fig. 2.

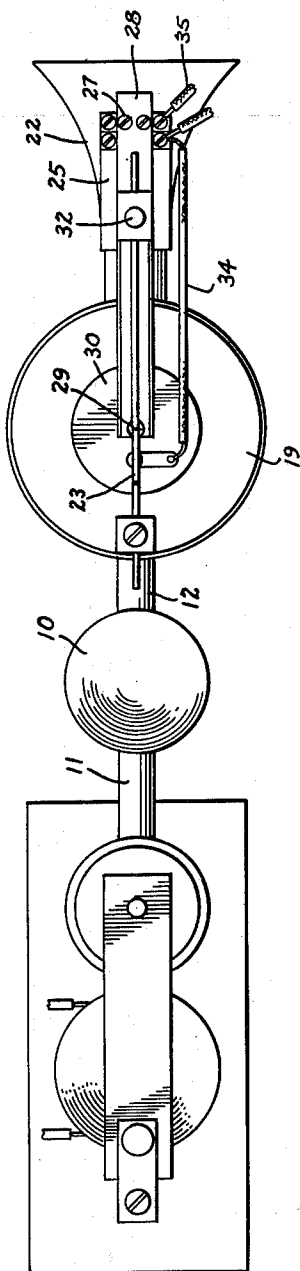
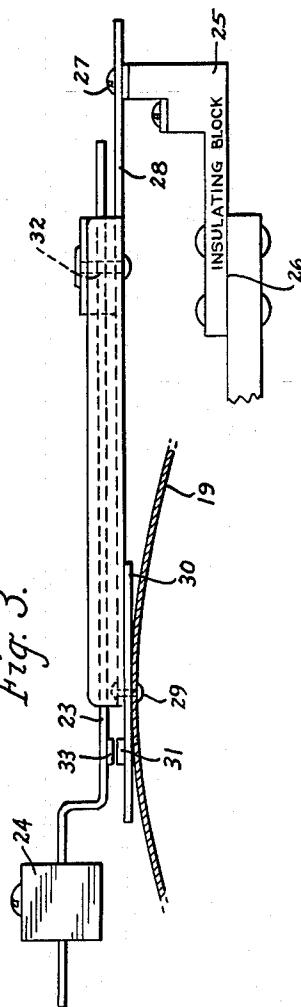


Fig. 3.



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2,630,873

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Application September 2, 1949, Serial No. 113,881

1 Claim. (Cl. 181—5)

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The invention herein presents a system of tuning wherein a group of sound pulses is translated into mechanical pulses adapted to be operative upon a vibratory member to cause its sympathetic vibration, thus to actuate and control said member. As used herein the term sound pulses also includes pulses in the nature of sound pulses.

In the illustrated and described embodiment of the invention, the vibratory member is so-called tuned reed, and sound pulses are translated into mechanical pulses through the instrumentality of a sensitive fluid jet with appurtenances including a reciprocatory diaphragm.

In the accompanying drawings forming a part of this specification,

Fig. 1 is a diagrammatic view of an apparatus made according to the invention;

Fig. 2 is a plan view of the disclosure of Fig. 1, a rectifier of the apparatus being omitted;

Fig. 3 is an enlarged fragmentary side elevational view detailing features of the apparatus of Figs. 1 and 2;

Fig. 4 is an elevational view, partially in section and partially broken away, illustrating a manner in which a sensitive fluid jet is disrupted by sound waves; and

Fig. 5 is an enlarged central sectional view of a pump for providing a sensitive fluid jet employed in the apparatus.

A description of the new and improved apparatus will suffice to make plain the steps of the novel and improved method.

An expansion tank 10 is adapted to receive fluid, desirably air, under pressure from an inlet pipe 11 to the expansion tank, and an outlet pipe 12 from said expansion tank leads to a first nozzle 13. A pump 14, of construction as hereinafter to be set forth, is utilized to continuously deliver fluid or air to the expansion tank 10 in volume to cause substantially constant pressure above atmospheric pressure, to be maintained therein, and the construction and arrangement will be such that a stream of fluid or air under pressure, providing a sensitive fluid or air jet, steadily will flow from the first nozzle 13.

Said first nozzle 13 is situated in a box 15 in facing relation to a perforation through a partition or sound baffle 16, as well as in facing relation to a centrally disposed orifice 17 through a wall 18 of the box between the nozzle 13 and a reciprocatory diaphragm 19 supported upon said box. The wall 18 and the reciprocatory diaphragm 19 are disposed transversely of the fluid

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or air jet with the orifice 17 in alinement with said fluid or air jet, and, together, said wall and reciprocatory diaphragm bound or define a chamber 20 which is closed save for said orifice 17.

A second nozzle 21 is situated in the box 15, in perpendicular relation to the first nozzle 13, to be capable of delivering sound waves to and against the sensitive fluid or air jet at or adjacent to the outlet from said first nozzle 13, and a funnel 22, for conveying sound waves to the second nozzle is disposed exteriorly of said box 15.

Speaking generally, the parts as thus far described are old in the prior art. During operation of the apparatus of the invention, the sensitive fluid or air jet passes through the orifice 17 and continuously maintains the reciprocatory diaphragm 19 at its farthest distance from the wall 18 at all times when no sound waves are impinging said sensitive fluid or air jet. When sound waves impinge the sensitive fluid or air jet this is disrupted to be incapable of passing through said orifice 17 to extend sufficiently to appreciably affect said diaphragm. The reciprocatory diaphragm 19 is tensioned normally to lie closer to the wall 18 when not distended than when distended, and upon cessation of passage of said sensitive fluid or air jet through the orifice 17, said reciprocatory diaphragm will move toward or to its normal position.

In practical operation, several equally spaced sound pulses will be delivered through the funnel 22 to the second nozzle 21, and a group of said equally spaced sound pulses will be translated into mechanical pulses, causing the diaphragm 19 to be reciprocated, through the instrumentality of the sensitive fluid or air jet.

The manner in which a sensitive fluid or air jet is disrupted when impinged by sound waves is well known in the prior art and need not be explicitly set forth herein. Suffice it to say that each of the several equally spaced sound pulses which are to be delivered to the sensitive fluid or air jet to the accomplishment of reciprocation of the diaphragm 19 individually will be the manifestation of uninterrupted sound waves. The construction and arrangement will be such that the sensitive fluid or air jet will be disrupted to some extent during the interval when impinged by each of the equally spaced sound pulses to permit the reciprocatory diaphragm to have movement toward or to its normal position, and unaffected during the intervals between those when impinged by the sound pulses to cause said reciprocatory diaphragm to become

distended. The mechanical pulses, manifested by reciprocatory movement of the diaphragm 19, will be a function of the duration of each of the equally spaced sound pulses and the time which elapses between their occurrence. By variation of the duration of each of the several sound pulses and their spacing, successive mechanical pulses occurring at any rate which may be predetermined obviously can be obtained. Stated otherwise, mechanical pulses recurring at intervals adapted to cause a diaphragm, such as 19, to be reciprocated at any rate which may be selected are capable of procurement by alteration of the duration and spacing of the sound pulses.

A vibratory member of the apparatus is constituted as a tuned reed 23 with a mass 24 supported upon its free end portion for longitudinal adjustment.

An insulating block 25 rigidly supported, as at 26, upon the box 15 itself rigidly supports, as at 27, the outer end portion of a flexible elongated element 28 extending transversely of the sensitive fluid or air jet partially across the reciprocatory diaphragm 19 exteriorly thereof and in adjacent relation thereto. The inner end of said flexible elongated element 28 is secured by a rivet 29 to the center of said reciprocatory diaphragm, said rivet also securing an insulating disc 30 to the diaphragm, against its outer surface and between the inner end portion of the flexible elongated element and said diaphragm. A contactor rigid with the insulating disc 30 and spaced inwardly of the flexible elongated element is denoted 31.

The outer end portion of the vibratory member or tuned reed 23 is rigidly supported, as at 32, upon an intermediate part of the flexible elongated element 28 adjacent its outer end portion, and said vibratory member or tuned reed extends transversely of said sensitive fluid or air jet partially across said reciprocatory diaphragm exteriorly of and in adjacent, parallel relation to said flexible elongated element. The vibratory member or tuned reed 23 and the flexible elongated element 28 are spaced to permit said member or reed to vibrate, and a contactor 33 upon the vibratory member or tuned reed is adapted normally to be in spaced relation to the contactor 31 and to become engaged with and disengaged from said contactor 31 in response to vibration of said member or reed 23.

Lead wires, represented 34 and 35, respectively, extending to the contactors 31 and 33 will be in a circuit (not shown) for accomplishing a useful purpose, as, for example, to control a relay.

The construction and arrangement will be such that mechanical pulses obtained in the manner as hereinbefore described, manifested by reciprocatory movements of the diaphragm 19, will be operative upon the vibratory member or tuned reed 23 to cause its sympathetic vibration, thus to cause the contactor 33 to become engaged with the contactor 31. The vibratory member or reed can be tuned to the frequency of the mechanical pulses in any manner heretofore well known. In the disclosure as made adjustment to bring the member or reed and said mechanical pulses to the same frequency can be accomplished by sliding movement of the mass 24 longitudinally of said member or reed.

In practical installations of the apparatus, the reciprocatory diaphragm 19 responds to mechanical pulses into which a group of sound pulses created by a whistle of a definite pitch are translated, and the vibratory member or reed

23 will be adjusted to have the natural frequency of said mechanical pulses. Stated differently, each installation can incorporate a primary tuning insuring that the sensitive fluid or air jet will be affected only by sound pulses of a definite pitch, or pitches in a selected range, to create mechanical pulses causing the diaphragm to be reciprocated, and a secondary tuning insuring that the vibratory member or reed and the mechanical pulses into which the sound pulses are translated have the same frequency. That is, in any installation of the apparatus its sensitive fluid or air jet system can be tuned to render its diaphragm such as 19 incapable of being reciprocated except when sound pulses of a selected pitch, or of pitches within a selected range, are impinged upon said sensitive fluid or air jet, and its member or reed, such as 23, can be tuned to be incapable of vibrating except when the sound pulses of the group are interrupted for a selected time interval. In short, the apparatus incorporates a secondary tuned system superimposed upon a primary tuned system capable of utilization to render the reciprocatory member or tuned reed, such as 23, of any installation incapable of being actuated in response to sound pulses, or groups thereof, other than groups of sound pulses of pitch and recurring frequency intended to be capable of actuating said reciprocatory member or tuned reed. By way of illustration, and assuming that the contactors 31 and 33 are in a circuit for controlling a motor for actuating a garage door, which could be a use for the apparatus, the construction and arrangement could be such that operation of the vibratory member or reed, such as 23, to cause said contactors to be engaged would be capable of accomplishment only in response to groups of toots on a whistle producing sound pulses of a certain pitch interrupted for a certain time interval.

The pump 14 includes a first casing consisting of a hollow base 36 suitably and conveniently covered by a reciprocable diaphragm 37 to provide a chamber 38 between said reciprocable diaphragm and hollow base. An inlet for fluid, air as shown, through a part of the reciprocable diaphragm 37 spaced from its center, to the chamber 38 is denoted 39, and an outlet from said chamber 38, through a central portion of the hollow base 36, is indicated 40. The outlet 40 leads to the interior of a second casing 41 providing a passageway for fluid to the inlet pipe 11, and a reed check valve 42 in said second casing is for controlling said outlet 40.

A disc valve 43, in uncovering relation to the inlet 39 when the reciprocable diaphragm 37 is at its farthest distance from the hollow base 36 and adapted to cover said inlet upon initial movement of said reciprocable diaphragm toward said hollow base, has its central portion rigidly secured against an outer central surface of the reciprocable diaphragm and its marginal portion arranged in overlying relation to the inlet.

A reciprocable armature 44, for accomplishing to and fro reciprocation of the diaphragm 37 and the disc valve 43, is operable in a manner to be set forth. A single rivet 45 secures both the disc valve 43 and the reciprocable armature 44 to said diaphragm.

The chamber 38 will contain air under atmospheric pressure when the reciprocable diaphragm is at its farthest distance from the hollow base 36 and the disc valve 43 is in uncovering relation to the inlet 39, as in Fig. 5 of the drawings. Said

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disc valve will be moved to covering relation to said inlet in response to initial movement of the reciprocable armature 44 toward said hollow base, and in response to movement of the disc valve and said reciprocable armature toward the hollow base after the inlet is closed, air will be forced from the chamber 38 through the outlet 40 into the interior of the second casing 42 by reason of decrease in size of said chamber. Upon commencement of return movement of the reciprocable armature, together with the disc valve and reciprocable diaphragm as a unit, away from the hollow base of the pump, the reed check valve 42 will be closed by reason of increase in size of the chamber 38 creating pressure at the outlet 40 below atmospheric, and upon approach of said disc valve and reciprocable diaphragm to their farthest distance from said hollow base the disc valve will be removed to uncovering position relation to the inlet 39, as in said Fig. 5. Air will be forced out of the chamber 36 and into the expansion tank 10 in response to each movement of the reciprocable armature 44 toward the hollow base 36, and atmospheric air will enter said chamber 36 with completion of each movement of said reciprocable armature away from said hollow base.

The reciprocable armature 44 is resiliently mounted, as at 46, upon a solenoid 47 adjacent a core 48 thereof in such manner as to be normally situated to retain the reciprocable diaphragm 37 at its farthest distance from the hollow base 36, as in Fig. 5 of the drawings.

Incoming wires 49 and 50 are from a source of supply (not shown) of alternating current electrical energy. The incoming wire 49 extends to a rectifier 51, a lead wire 52 extends from said rectifier to the solenoid 47, and the incoming wire 50 is connected to said solenoid.

The rectifier 51 is for translating the alternating current into pulses of direct current having the frequency of said alternating current in a circuit wherein intermittent working pulses are allowed to pass. Each intermittent working pulse will cause the solenoid 47 to be energized, and interruptions between the intermittent working pulses will cause the solenoid circuit to be broken. The reciprocable armature 44 will be attracted by the core 48 each time the solenoid is energized, thus to cause the reciprocable diaphragm 37 to be moved from its position as in Fig. 5

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toward the hollow base 36, and the resilient connection 46 will cause said reciprocable armature to be situated as in said Fig. 5 each time the solenoid circuit is broken, thus to cause said reciprocable diaphragm 37 to be moved away from said hollow base 36. Evidently, the rate of reciprocatory movement of the armature 44 and the cycles per second of the alternating current employed will correspond. It has been ascertained, by experiment and experience, that a pump such as 14 can be satisfactorily and efficiently operated by employment of as small an amount of electrical energy as a single watt.

What is claimed is:

15 An apparatus of the character described, comprising a frame, a reciprocatory diaphragm upon said frame, a first nozzle, means for forcing a sensitive fluid jet constantly to flow through and from said first nozzle and to impinge against said reciprocatory diaphragm, a second nozzle for delivering a group of spaced sound pulses each the manifestation of uninterrupted sound waves to and against said sensitive fluid jet to repeatedly interrupt its impingement against said reciprocatory diaphragm and thus translate the sensitive fluid jet into spaced mechanical pulses operable upon the diaphragm to accomplish its reciprocation, and a vibratory member upon said frame adjacent the reciprocatory diaphragm and tuned to said spaced mechanical pulses to be sympathetically vibrated in response to reciprocation of said diaphragm.

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