Dec. 11, 1956 N. N. BERGER ET AL 2,773,665

HIGH SPEED OSCILLATING DEVICE

Filed Feb. 18, 1955

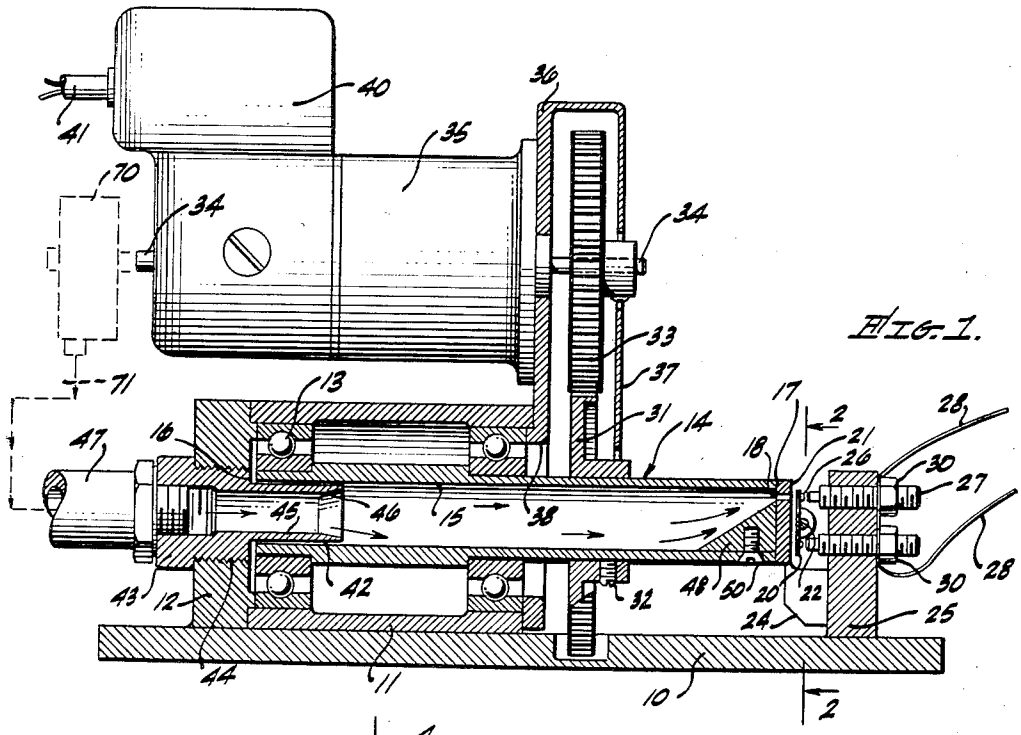


FIG. 1.

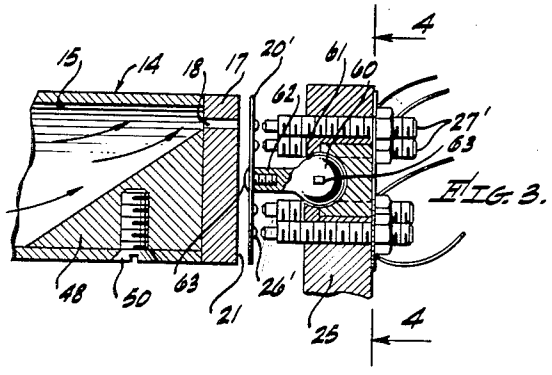


FIG. 3.

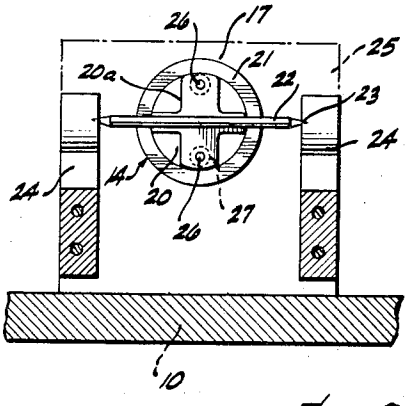


FIG. 2.

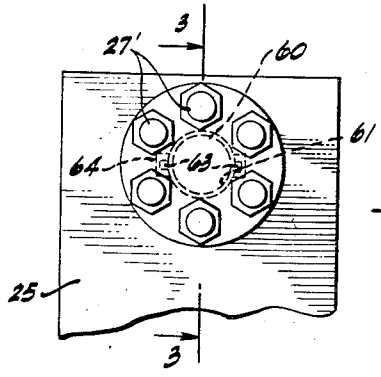


FIG. 4.

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United States Patent Office 2,773,665 Patented Dec. 11, 1956

2,773,665

HIGH SPEED OSCILLATING DEVICE

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Application February 18, 1955, Serial No. 489,402

5 Claims. (Cl. 253—1)

The present invention relates generally to a device for producing oscillatory movement in a member, and relates more particularly to such a device that may be incorporated with switch contact arrangements in order that high speed cyclic operation may be achieved.

In many contemporary mechanical, electrical and pneumatic devices, it has become necessary to produce extremely rapid mechanical oscillations of a member which may be associated with a switch, for example. Such oscillations must be in the nature of from 5000 to 10,000 cycles per minute. In prior high speed mechanically operated switches, or other like oscillating members wherein the particular member was biased in at least one direction by means of a mechanical spring, the mechanical rate of spring action has been an important factor that necessarily must be taken into consideration. In order to increase spring rate, it is well known that the effective force of a spring must be increased, thereby requiring increased operating forces and higher frictional losses with respect to mechanical operating mechanisms. Additionally, with mechanical springs, difficulties have frequently been encountered relative to fluttering of the spring and/or fatigue and failure thereof due to the rapidly moving portions of the metallic spring. Accordingly, it has been found that the best spring flexure type oscillating devices may be operated only up to approximately 1000 complete cycles per minute before fluttering occurs and dangerous situations are encountered that ultimately cause fatigue and breakage of components.

Furthermore, in prior arrangements intended for a similar purpose, considerable power input has been required in order to effect high speed oscillation, thus causing excessive undesirable wear on various components of the mechanism, frequent replacement of parts and associated time consuming and costly maintenance. These various factors necessarily reduce the overall reliability of the oscillating device.

Accordingly, it is one important object of the present invention to provide a pneumatically operated device for producing high speed oscillation of a member.

Another object of the invention is to provide a novel high speed oscillating device wherein input power requirements for operation thereof are maintained at a minimum.

A further important object of the present invention is to provide a novel switch arrangement and a high speed oscillating contact member adapted for association therewith.

Still another important object of the present invention is to provide a novel high cyclic speed switch operating mechanism that is reliable in operation, efficient and effective in use, and which inherently requires very little maintenance.

A still further important object of the invention is to provide a multiple contact switching arrangement wherein such contacts may be closed by high speed oscillation of a contact carrying member in response to the direction of fluid under pressure upon portions thereof.

Other and further important objects of the present invention will become apparent from the disclosures in the following detailed specification, appended claims and accompanying drawing, wherein:

Figure 1 is a longitudinal sectional view, partially in elevation, showing one form of the member oscillating device of the present invention;

Fig. 2 is an enlarged transverse sectional view showing the contact carrying oscillatory member, as taken substantially as indicated by line 2—2, Fig. 1;

Fig. 3 is an enlarged fragmentary sectional view, taken as indicated by line 3—3, Fig. 4, through the fluid directing nozzle, shown in conjunction with a modified form of switching arrangement; and

Fig. 4 is a transverse sectional view taken substantially as indicated by line 4—4, Fig. 3.

With reference to the drawing, the oscillation producing device of the present invention is shown, in Fig. 1, as associated with electrical switching arrangement; however, it is to be understood that the present basic system utilized for oscillating a switch member may be incorporated with other types of mechanisms such as, for example, pneumatic or hydraulic valve arrangements, without departing from the spirit and scope of the present invention. As shown, the device of the present invention includes a base **10** upon which a bearing cage **11** is mounted. One end of the bearing cage **11** is closed by means of a closure member **12**, with ball bearings **13** being supported within the cage. A rotatable member, in the form of an elongated tube **14**, is rotatably journalled in the bearings **13**. The tube **14** has an inner bore **15**, one end of which is open as at **16**. The other end of the tube **14** is closed by means of a closure member **17**. A nozzle **18** is formed through the closure **17** adjacent the outer periphery thereof with the inner end of the nozzle communicating with the interior bore **15** of the tube **14** adjacent the outer periphery of the bore.

An oscillatory member, in the form of plate **20**, having notches cut away as at **20***a*, is positioned in space relationship to an outer surface **21** of the closure **17**. The plate **20** is supported on a transversely disposed shaft **22**, Fig. 2, the ends of which are journalled, by means of needle bearings **23**, in brackets **24** that are disposed outwardly from a support **25** which is, in turn, secured to the base **10**. The upper and lower portions of the plate **20** are adapted to carry a pair of contacts **26** that are arranged on a line disposed substantially normal to the oscillatory axis of the plate.

The support **25** also serves to retain a pair of adjustably disposed contact members **27** that are adapted for cooperation with the contacts **26** carried by the plate **20**. The inner ends of the contact members **27** are positioned in slight spaced relationship to a neutral oscillatory position of the plate **20**, and serve to limit the oscillatory magnitude of the plate. The contact members **27** may have leads **28** connected thereto by means of nuts **30**, the nuts **30** also serving to lock the relative positions of the contact members **27** which threadably engage in suitable openings in the support **25**.

The tube **14** has affixed thereto, adjacent one end of the cage **11**, a gear **31** which is held in position by means of a set screw **32**. The gear **31** is adapted to mesh with a driving gear **33** that is supported on a shaft **34** extending outwardly from a synchronous motor **35**. The motor **35** is supported on a bracket **36** which has a portion **37** that serves as a guard for the gears **31** and **33**. The bracket **36** is supported as at **38** in one end of the bearing cage **11**. In accordance with conventional practice, the electric motor **35** may be controlled through a suitable rheostat **40**, with electrical power input through suitable connections **41**.

A non-rotatable sleeve **42** is adapted for disposition within the bore **15** of the tube **14** through the open end

16 thereof. The sleeve 42 is formed as an inner end portion of a fitting 43 that threadably engages in an opening in the closure 12, as at 44. The sleeve 42 has an axial bore 45, the outer end of which is conically outwardly tapered as at 46. The fitting 43 is adapted for connection with a conduit 47 which, in turn, extends to a suitable source of fluid under constant regulated pressure.

It may, thus, be seen that fluid under pressure as, for example air, may be directed through the bore 45 of the sleeve 42 and into the bore 15 of the tube 14. The air will then flow through the tube 14 and outwardly therefrom, by way of the nozzle 18, for impingement thereafter upon the peripheral area of the upper and lower portions of the plate 20. The air flowing through the tube 14 is directed toward the nozzle 18 by means of a deflection member 48 that is positioned within the bore 15 adjacent the inner surface of the closure 17. The deflection member 48 is retained in position by means of a screw 15.

In operation of the present device, the synchronous motor 35 is energized whereby to rotate the driving gear 33 and to drive the gear 31 and tube 14. Simultaneously, fluid under pressure is admitted through the conduit 47 and sleeve 42 into the interior bore 15 of the tube 14 and outwardly through the nozzle 18. Inasmuch as the nozzle 18 is rotated with the tube 14, the fluid emitting from the nozzle will strike the portions of the plate in an intermittent manner and cause the plate 20 to be oscillated on the shaft 22 to bring one after another of the contacts 26 in alternating contact with one after another of the contact members 27. The cyclic speed of oscillation of the plate 20 may be determined by adjustment of the rheostat 40 and associated control of the rotary speed of the tube 14.

It may thus be seen that very little force will be required to oscillate the plate 20. The relative size and weight of the plate 20 is sufficient to maintain the movable elements of the mechanism at a low inertia level, whereby to permit rapid oscillation thereof. Additionally, it is to be noted that the input power requirements from the motor 35 may be extremely low due to the lack of friction either in the rotatable supporting mechanism of the tube 14 or due to the non-contacting association between the tube and the plate 20. This latter factor may be seen as being especially important when considered in the light of prior arrangements designed for a similar purpose, wherein cams or other mechanical operating arrangements physically cooperate with an oscillating member.

As shown in Figs. 3 and 4 and as indicated hereinbefore, the present device may be utilized with a variety of devices or switching arrangements without departing from the spirit and scope hereof. With reference primarity to Fig. 3, an oscillatory plate 20' may be provided with an annularly disposed ring of contacts 26' that are adapted for cooperation with a plurality of contact members 27'. In this particular arrangement, it is necessary that the plate 20' be universally mounted as by means of a ball 60 disposed in a socket 61 in the support 25. The plate 20' may be attached to the ball 60 by means of an extension stem 62 and a screw 63 disposed centrally through the plate 20'. In order to prevent inadvertent rotation of the disk shaped plate 20', the ball 60 may have a pair of protuberances 63 disposed on an axis thereof and extending outwardly therefrom. The protuberances 63 may be loosely disposed within and spaced from the bottoms of recesses 64 in the sides of the socket 61. This particular construction will enable the plate 20' to move in a universal manner while still preventing undue rotation thereof as would disturb the alignment between the contacts 26' and the contact members 27'. Thus, as the tube 14 is rotated, the nozzle 18 will be directed toward a peripheral area of the plate 20' whereby successively and in a circular manner to effect contact between one after another of the contacts 26' and the contacts 27'.

While the source of the motive fluid is immaterial in the present invention, as shown in Fig. 1, it may be desirable to provide a self-contained unit whereby a suitable compressor 70 may be driven from a free end of the motor shaft 34, with the outlet therefrom being conducted to the tube 14 by way of a conduit 71 connecting with the conduit 47. With an arrangement of this type, it will be seen that the entire switch operating mechanism or member oscillating device may be self-contained.

Having thus described the invention and the present embodiments thereof, it is desired to emphasize the fact that many modifications may be resorted to in a manner limited only by a just interpretation of the following claims.

What is claimed is:

1. In a device for producing oscillatory movement: a member mounted for oscillation about an axis; means positioned adjacent said member for limiting oscillatory movement of said member; a rotatable structure; a nozzle carried by said structure, said nozzle being positioned adjacent to and directed toward said member at a position spaced from the axis of oscillation thereof; passage means forming a portion of said rotatable structure for directing fluid under pressure from a source through said nozzle; and means for rotating said rotatable structure.

2. A device for producing oscillatory movement comprising: a base; a member mounted for oscillation on said base and on an axis; a relatively flat surface formed on said member; a rotatable structure having an end portion disposed adjacent to and in spaced relationship to said surface; a nozzle in said end portion, said nozzle being directed toward a peripheral area of said surface at a position spaced from said axis of oscillation of said member; means carried by said base for limiting oscillation of said member; driving means connected with said structure for rotating said structure; and means connected with said rotatable structure for directing fluid under pressure from a source through said nozzle, whereby to effect oscillation of said member.

3. A device for producing oscillatory movement comprising: a base; a member mounted for oscillation on said base and about said axis; a relatively flat surface formed on said member; an elongated rotatable structure having an end portion disposed adjacent to and in spaced relationship to said surface; a nozzle in said end portion, said nozzle being directed toward a peripheral area of said surface at a position spaced from said axis of oscillation of said member; means carried by said base for limiting oscillation of said member; driving means connected with said structure for rotating said structure; and non-rotatable means directed into said structure for directing fluid under pressure from a source through said structure and said nozzle, whereby to effect oscillation of said member.

4. A device for producing rapid oscillatory movement comprising, in combination: a base structure; a plate; means for mounting said plate for oscillatory movement relative to said base structure and about an axis; means carried by said base structure for limiting oscillatory movement of said plate; a tube; a closure disposed in one end of said tube, said closure being disposed adjacent to and in spaced relationship to said plate; a nozzle provided through a peripheral portion of said closure, said nozzle being directed toward a peripheral area of said plate at a position spaced from the axis of oscillation of said member; means mounted on said base structure for rotatably supporting said tube; driving means connected with said tube for rotating said tube; and means carried by said base structure for directing fluid under pressure into said tube, said fluid being adapted thereafter to flow outwardly from said tube through said nozzle for im-

pingement upon said plate, thereby to effect oscillation thereof.

5. A device for producing rapid oscillatory movement comprising, in combination: a base structure; a plate; means carried by said base structure for mounting said plate for oscillatory movement relative to said base structure and about an axis; means for limiting oscillatory movement of said plate; a tube; a closure disposed in one end of said tube, said closure being disposed adjacent to and in spaced relationship to said plate; a nozzle provided through a peripheral portion of said closure, said nozzle being directed toward a peripheral area of said plate at a position spaced from the axis of oscillation of said member; means mounted on said base structure for rotatably supporting said tube; driving means connected with said tube for rotating said tube; non-rotatable means carried by said base structure for directing fluid under pressure into said tube, said fluid being adapted thereafter to flow outwardly from said tube through said nozzle for impingement upon said plate, thereby to effect oscillation thereof; and means disposed within said tube for directing said fluid toward said nozzle.

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