

April 23, 1957

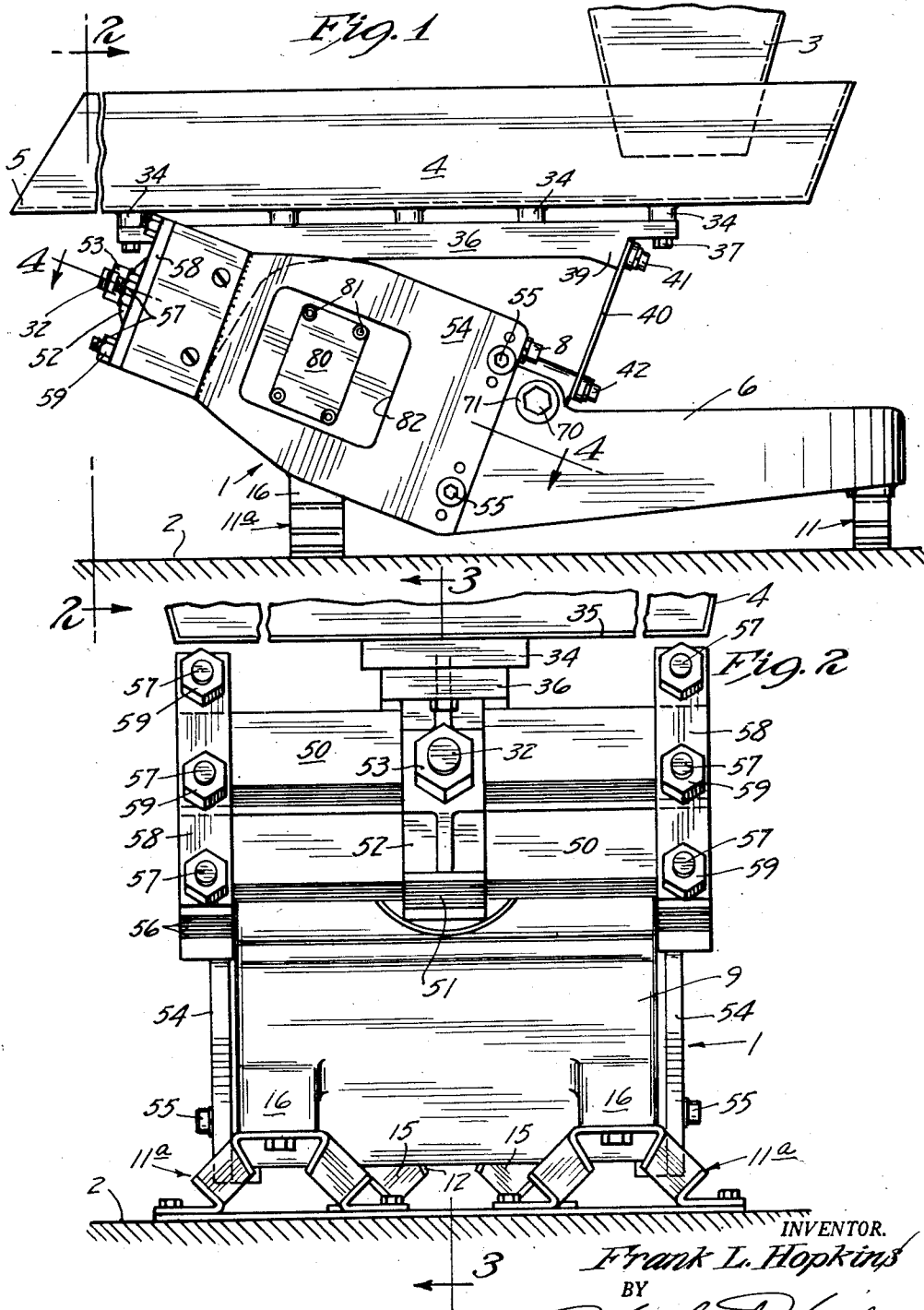
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2,790,097

VIBRATOR MOTOR CONSTRUCTION

Filed Nov. 5, 1954

3 Sheets-Sheet 1



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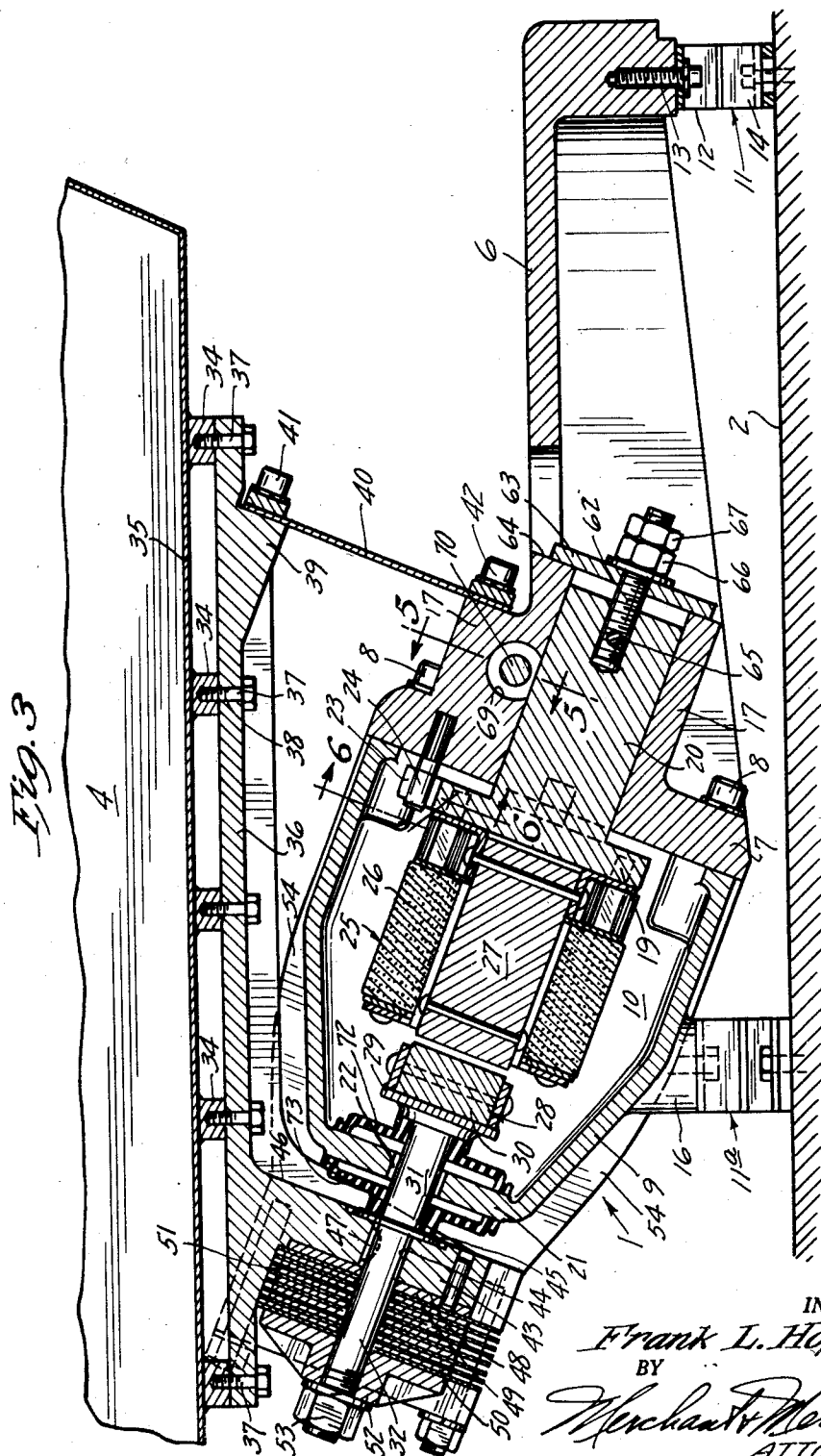
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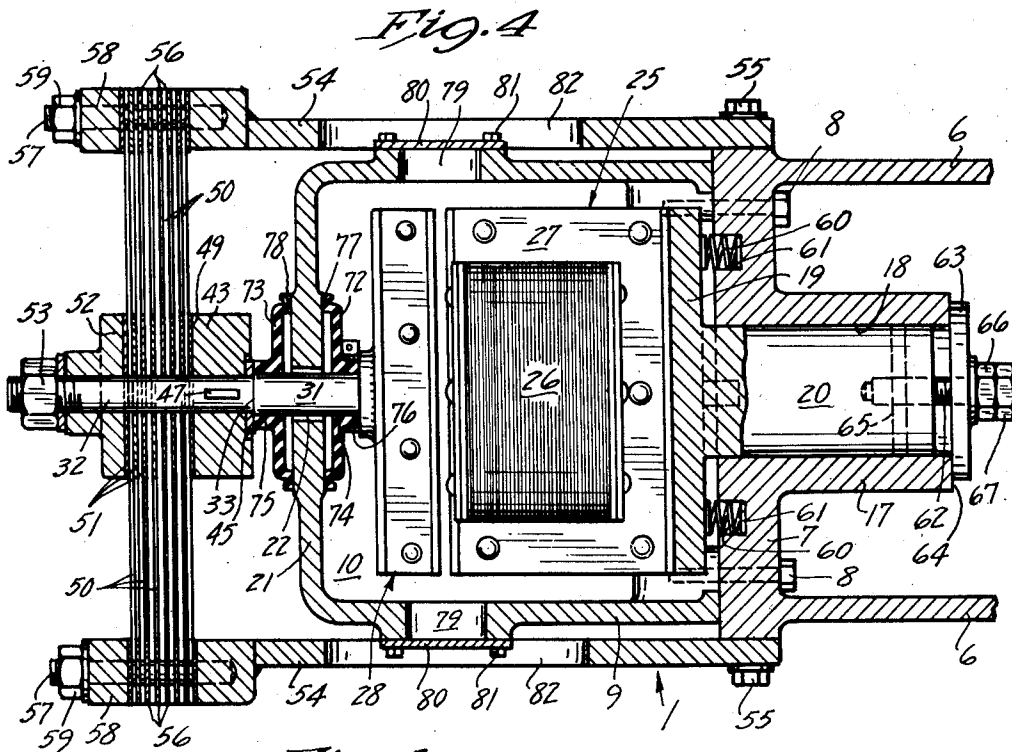
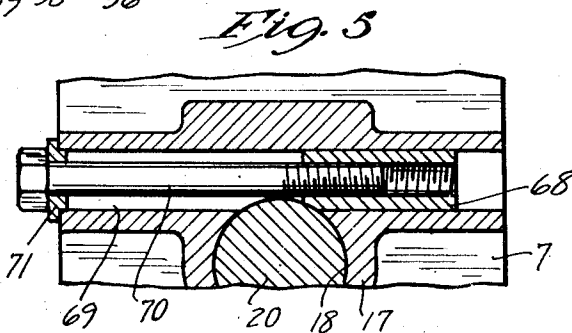
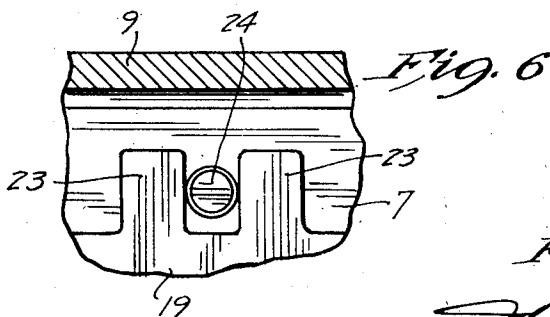
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VIBRATOR MOTOR CONSTRUCTION

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Application November 5, 1954, Serial No. 466,984

7 Claims. (Cl. 310—29)

My invention relates generally to vibrators utilized in connection with material-handling apparatus such as vibratory feeding trays and the like for granular or bulk material.

In the handling or feeding of various powdered or granular materials, the presence of dust from the material often becomes a problem, not only because of its infiltrating into the working mechanisms of the feeding machinery but also because it sometimes creates a distinct fire or explosion hazard, particularly when the material being handled is of a combustible nature.

An important object of my invention is the provision of an electrically-operated vibratory motor having an electromagnet and a cooperating armature which are totally enclosed against entry of dust therebetween. To accomplish this end I provide a housing enclosing the electromagnet and armature and having an opening through which connection is had between the armature and the device to be filtrated thereby, together with novel closure means for said opening, said closure means comprising outer and inner flexible closure elements, the former sealing the opening against entry of dust to the interior of the housing, and the latter confining any explosion which might occur within the housing to the interior thereof, the flexibility of said closure elements permitting free vibratory movement of the armature and said connection.

Another important object of my invention is the provision of a vibrator of the type set forth having novel means for mounting the electromagnet thereof, whereby the magnet may be shifted with respect to its cooperating armature during operation thereof to vary the intensity of vibration, and locked in the desired position. Heretofore, such adjustment has been possible with any degree of ease only when the electromagnet has been deenergized. Thus the operator was under the necessity of making a trial setting of the electromagnet, and after repeated alternate trial energizations and adjustments, would finally reach a satisfactory operating condition. Any slight desired variation of the intensity of vibration would then be obtained by varying the current supplied to the electromagnet, by means of a rheostat or the like. My invention does not necessarily dispense with the use of a rheostat, but does enable the operator to quickly and easily adjust the intensity of the vibration beyond the range covered by the usual rheostat, and makes possible the achievement of maximum efficiency with a minimum of power input, and with a minimum of time involved in making the necessary adjustment.

A still further object of my invention is the provision of means for supporting the armature and device to be vibrated in their proper relationship to the electromagnet, including a novel arrangement of resilient means whereby free vibratory movement may be achieved in said device.

Still another object of my invention is the provision of a vibrator of the type set forth which is relatively simple and inexpensive to manufacture, which is highly

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efficient in operation, and which is rugged in construction and durable in use.

The above and still further highly important objects and advantages of my invention will become apparent from the following detailed specification, appended claims and attached drawings.

Referring to the drawings, which illustrate the invention, and in which like characters indicate like parts throughout the several views.

Fig. 1 is a fragmentary view in side elevation of a vibrator built in accordance with my invention, illustrating its use in connection with a vibratory feeding tray;

Fig. 2 is a view partly in section and partly in front elevation of the structure illustrated in Fig. 1;

Fig. 3 is a longitudinal section taken substantially on the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary horizontal section taken substantially on the line 4—4 of Fig. 1;

Fig. 5 is a fragmentary detail in section taken on the line 5—5 of Fig. 3; and

Fig. 6 is a fragmentary detail taken substantially on the line 6—6 of Fig. 3.

Referring with greater detail to the drawings, my novel vibrator, indicated in its entirety by the numeral 1, is shown as being mounted on a suitable base of support 2 which may be in the nature of a frame member comprising a portion of a conventional scale feeder or the like. Such a scale feeder is well known in the art and usually includes a hopper having a discharge spout the lower end portion of which is indicated by the numeral 3 in Fig. 1. The discharge spout or conduit 3 is adapted to feed powdered or granular material into one end of a vibratory tray 4 which is supported and vibrated by the vibrator 1 in a manner hereinafter to be described, and in a direction to cause material fed thereto from the spout 3 out of the open discharge end 5 and into a container not shown, but which may be assumed to be mounted on a conventional weighing scale also not shown.

My novel vibrator 1 comprises a supporting frame 6 to the front end portion 7 of which is rigidly secured by means of machine screws or the like 8 a housing 9 defining a chamber 10. The supporting frame 6 is supported at its rear end by a bracket 11 which comprises an intermediate bracket section 12 rigidly secured to the rear end of the supporting frame 6 by a machine screw 13, a pair of end sections 14 screwed or otherwise rigidly secured to the base of support 2, and rubber-like cushioning elements 15 interposed between the intermediate section 12 and the outer sections 14 and anchored thereto by suitable adhesive not shown. The housing 9 is provided with a pair of laterally spaced bosses 16 which are connected to the base of support 2 by a pair of brackets identical to the bracket 11 and indicated at 11a.

The forward end portion 7 of the supporting frame 6 includes a rearwardly extending boss 17 which is provided with a longitudinally extending bore 18. A relatively flat platelike base member 19 is contained within the housing 9 and is provided with a leg 20 which is slidably received in the bore 18 of the boss 17. As shown, the base member 19 is movable in a direction generally longitudinally of the housing 9 and toward and away from an end wall 21 of the housing 9, said end wall having a central opening 22 therein. The base member 19 is provided with a pair of laterally spaced ears 23, see Fig. 6, between which is contained a pin 24 which projects outwardly from the front end portion 7 generally toward the end wall 21 of the housing 9. The pin 24 permits movement of the base member 19 in a direction axially of the leg 20 and bore 18 but prevents rotary movement of the base member 19 and parts carried thereby.

An electromagnet 25 within the chamber 10 comprises

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a field coil 26 and a laminated core 27 and is bolted or otherwise rigidly secured to the base member 19 for common movements therewith. An armature 28 comprising a frame 29 and a laminated stack 30 is also contained within the chamber 10 in close proximity to the electromagnet 25. The armature 28 is provided with a stem 31 which extends axially outwardly through the opening 22 in the housing 9 and which is provided with a diametrically reduced portion 32 exterior of the housing 9, the portions 31 and 32 cooperating to define an annular shoulder 33.

The vibratory tray or conveyor element 4 is provided with a plurality of longitudinally spaced laterally extending mounting lugs 34 which are welded or otherwise secured to the bottom 35 of the tray 4. The mounting lugs 34 are adapted to rest upon an elongated mounting bracket 36, and are rigidly secured thereto by means of machine screws or the like 37 which extend upwardly through apertures 38 in the bracket 36, and which are screw threaded into threaded holes in the lugs 34. Adjacent its rear end, the bracket 36 is provided with a lug or boss 39 to which is secured one end of a leaf spring 40 by means of one or more machine screws or the like 41. The lower end of the leaf spring 40 is rigidly secured to the boss 17 by means of a screw or screws 42. The mounting bracket 36 at its front end portion is formed to provide a depending flange 43 having a central aperture 44 through which the reduced portion 32 of the stem 31 projects. A washer 45 mounted on the reduced stem portion 32 has one side in abutment with the shoulder 33 and its opposite side abutting the rear face 46 of the flange 43. A key or the like 47 locks the shaft 31 against rotation with respect to the bracket 36 and insures operative alignment between the armature 28 and the core or field piece 27 of the electromagnet 25. The front surface 48 of the flange 43 is provided with a friction plate 49, and operatively engages the central portions of mounting means for the stem 31 and armature 28. This mounting means is in the nature of a plurality of spaced parallel resilient leaf springs 50 arranged in two parallel rows extending transversely above and below the reduced portion 32 of the stem 31. Between each leaf spring 50 in both rows thereof is one of a plurality of generally rectangular spacer plates 51 which have central apertures receiving the reduced stem portion 32. A clamping block or the like 52 likewise has a central opening therein which receives the front end portion of the reduced stem portion 32, said clamping plate resting on the outermost spring 50 of both rows thereof. The extreme outer or front end of the reduced stem portion 32 is screw threaded to receive a lock washer-equipped clamping nut 53 by means of which the flange 43, leaf springs 50, spacers 51 and clamping plate 52 are rigidly secured together.

Means for supporting the opposite ends of the leaf springs 50 in laterally spaced relationship to the clamping plate 52 comprises a pair of relatively stationary plate-like mounting elements 54 that are rigidly secured to the front end portion 7 of the supporting base 6 by means of machine screws or the like 55, in laterally outwardly spaced relation to the housing 9. The opposite ends of the several leaf springs 50 overlie the front ends of the mounting plates or elements 54. Spacer plates 56 are interposed between each of the leaf springs 50 at their outer ends and are provided with suitable apertures to receive threaded studs 57 which extend longitudinally outwardly from the front ends of the mounting elements 54. It will be noted that the outer ends of each row of leaf springs 50 are contained between adjacent ones of the studs 57. Clamping bars 58, like the spacer plates 56 are provided with suitable apertures for the reception of the studs 57 and clamping nuts 59 are screw threaded onto the threaded outer ends of the studs 57 whereby to rigidly clamp the spacer plates 56 and the opposite ends of both rows of leaf springs be-

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tween the clamping bars 58 and the outer ends of their respective mounting elements 54. With the above described arrangement, the several leaf springs of each row thereof are held in spaced parallel relationship whereby the front end of the tray-supporting bracket 36 and the armature 28 are supported in proper position, and for free vibratory movement with respect to the electromagnet 25. The several spacer plates 51 and 56 at the central portions and outer ends respectively prevent the leaf springs 50 from coming into frictional engagement with each other during operation of the device and insure freedom of operation of the vibrating elements. The leaf spring 40 which supports the rear end portion of the bracket 36 is sufficiently rigid to properly support the conveyor element or tray 4, but is sufficiently resilient to avoid placing undue load on the vibrator during operation thereof.

With reference particularly to Fig. 4 it will be seen that the base member 19 and electromagnet 25 are yieldingly urged toward the armature 28 by means of a pair of coil compression springs 60 which are contained within recesses 61 in the front end portion 7 of the supporting frame 6 and which bear against the rear surface of the base member 19. A threaded stud 62 extends rearwardly from the leg 20 through the bore 18 and has loosely mounted thereon a washer 63 which engages the rear surface 64 of the boss 17. A cross pin 65 extends transversely through the leg 20 and stud 62 whereby to prevent rotation of the stud 62 within the leg 20. An adjustment nut 66 and lock nut 67 are screw threaded onto the rear end portion of the stud 62, the former operatively engaging the washer 63. Rotation of the adjustment nut 66 in one direction will cause the mounting base 19 and electromagnet 25 to be moved rearwardly with respect to the armature 28 against bias of the springs 60. Obviously, rotation of the adjustment nut 66 in the opposite direction will permit the springs 60 to move the electromagnet 25 toward the armature 28. It will be noted that, with my novel mounting means for the electromagnet 25, that this adjustment may be made while the coil 26 of the electromagnet is energized. When the electromagnet 25 is located the desired distance from the armature 28, the lock nut 67 is tightened against the adjustment nut 66 to prevent rotation thereof on the stud 62. To rigidly lock the electromagnet 25 against the movement with respect to the supporting base 6 I provide an internally threaded tubular wedge element 68 that is axially slidably mounted in a transverse passage 69 extending generally tangentially with respect to the leg 20, see particularly Fig. 5. A clamping screw 70 extends through the passage 69 and has threaded engagement with the tubular wedge element 68. A washer or bushing 71 is interposed between the adjacent side wall surface of the front end portion 7 and the head of the clamping screw 70 which, when tightened, causes the tubular wedge element 68 to move into clamping engagement with the adjacent peripheral portion of the leg 20 whereby to frictionally lock the same against movement with respect to the supporting frame 6.

For the purpose of preventing dust from entering the chamber 10 through the opening 22 in the housing wall 21, I provide closure means for the opening 22 in the nature of a pair of annular closure members 72 and 73, see Figs. 3 and 4. The closure members 72 and 73 are preferably made from flexible resilient material such as rubber or the like, the former being contained within the chamber 10 and the latter being located adjacent the outer surface of the wall 21 exterior of the housing 9. The annular closure members 72 and 73 have inner marginal portions or collar elements 74 and 75 respectively, which snugly encompass the stem 31, the former adjacent the armature frame 29, and the latter adjacent the washer 45 associated with the bracket flange 43. Preferably, and as shown, the inner marginal portion 74 is encompassed by a conventional clamping band 76

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which holds the annular member 72 firmly positioned on the stem 31. The outer marginal portions 77 and 78 of the annular members 72 and 73 respectively have sealing engagement with inner and outer wall surface portions respectively of the housing end wall 21 radially outwardly of the opening 22. The flexibility of the annular members 72 and 73 permits free movement of the armature 28 and stem 31 while excluding dust from the chamber 10. Furthermore, the members 72 and 73 provide a safeguard against explosion which might otherwise result should sparking occur within the chamber 10 from any cause. Thus, my improved vibrator can be safely used in places where dust conditions are prevalent and the danger of explosion may be present. With reference to Figs. 1 and 4 it will be noted that the housing 9 is provided with a pair of inspection openings 79 that are closed by closure plates 80 removably secured to the side walls of the housing 9 by machine screws or the like 81. Access is had to the closure plates 80 through relatively large openings 82 in the mounting elements 54.

From the above it will be seen that I have provided a vibrator structure which is fully capable of accomplishing the objectives set forth; and while I have shown and described a preferred embodiment of my novel device it will be understood that the same is capable of modification without departure from the spirit and scope of the invention as defined in the claims.

What I claim is:

1. A vibrator comprising, a housing defining a chamber and having an opening in one of the walls thereof communicating with said chamber, a relatively stationary electromagnet and a cooperating relatively movable armature in said chamber, said armature having a stem extending loosely through said opening to the exterior of said housing, a support exterior of the housing, resilient means mounting said stem to said support for limited movements of the stem and armature toward and away from said electromagnet, and closure means for said opening, said closure means comprising inner and outer flexible annular members having their inner marginal portions snugly engaging said stem at opposite sides of the wall through which the stem projects, the outer marginal portions of said annular members having sealing engagement with adjacent surface portions of said wall about said opening.

2. A vibrator comprising, a housing defining a chamber and having an opening in one of the walls thereof communicating with said chamber, an electromagnet and a cooperating armature in said housing, means mounting said armature for vibratory movement with respect to said electromagnet, said means including a stem projecting through said opening in the housing wall to the exterior thereof, a flexible annular closure member having its inner marginal portion snugly engaging said stem and its outer marginal portion in sealing contact with a wall surface portion of said housing about said opening, means mounting and guiding said electromagnet for movements toward and away from said armature, said last-mentioned means comprising a base member rigidly secured to said electromagnet and a leg on said base member extending in the direction of said movement of the electromagnet, said housing having a mounting aperture in one of the walls thereof slidably receiving said leg, means for imparting said movement to the electromagnet and base member in the desired direction, and means for releasably locking said leg in desired set position between its limits of movement in said mounting aperture.

3. A vibrator comprising, a housing defining a chamber and having an opening in one of the walls thereof communicating with said chamber, an electromagnet and a cooperating armature in said housing, means mounting said armature for vibratory movement with respect to said electromagnet, said means including a stem projecting through said opening in the housing wall to the exterior thereof, a flexible annular closure member having

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its inner marginal portion snugly engaging said stem and its outer marginal portion in sealing contact with a wall surface portion of said housing about said opening, means mounting and guiding said electromagnet for movements toward and away from said armature, yielding means urging said electromagnet in one direction of its movement with respect to said armature, a screw device operative to move said electromagnet in the opposite direction against bias of said yielding means, and means for releasably locking said electromagnet against said movements in either direction.

4. A vibrator comprising, a housing defining a chamber and having an opening in one of the walls thereof communicating with said chamber, an electromagnet and a cooperating armature in said housing, means mounting said armature for vibratory movement with respect to said electromagnet, said means including a stem projecting through said opening in the housing wall to the exterior thereof, a flexible annular closure member having its inner marginal portion snugly engaging said stem and its outer marginal portion in sealing contact with a wall surface portion of said housing about said opening, means mounting and guiding said electromagnet for movements toward and away from said armature, said last-mentioned means comprising a base member rigidly secured to said electromagnet and a leg on said member extending in the direction of said movement of the electromagnet, said housing having a mounting aperture in one of the walls thereof slidably receiving said leg, a spring interposed between said base member and the adjacent housing wall and yieldingly urging said base member and electromagnet toward said armature, a screw device operatively engaging said leg to impart movement to said base member and electromagnet in a direction away from said armature against bias of said spring, and clamping means mounted in said one of the walls of the housing and engaging said leg for releasably locking said base member and electromagnet against said movement in either direction.

5. The structure defined in claim 4 in which said closure member is disposed externally of said housing, the outer marginal edge of said closure member engaging the outer wall surface of the housing, and in further combination with a second flexible annular closure member within said chamber in opposed relation to the first said one thereof, the inner marginal portion of the second closure member snugly encompassing said stem adjacent the armature, the outer marginal portion thereof having sealing engagement with the inner wall surface of the housing about said opening.

6. A vibrator comprising, a relatively stationary electromagnet and a cooperating relatively movable armature, a stem on said armature extending in a direction away from said electromagnet, a support element, means including a resilient member mounting said stem to said support element for limited vibratory movements of said stem and armature toward and away from said electromagnet, a base element on said electromagnet, one of said elements having a mounting aperture extending in the direction of movement of said armature, a leg on the other of said elements slidably received in said mounting aperture, adjustment screw means on said leg and extending axially of said mounting aperture and engaging said one of the elements whereby said electromagnet may be moved toward and away from said armature, and means for releasably locking said leg against movement in said aperture.

7. A vibrator comprising, a relatively stationary electromagnet and a cooperating relatively movable armature, a stem on said armature extending in a direction away from said electromagnet, a support, means including a resilient member mounting said stem to said support for limited vibratory movements of said stem and armature toward and away from said electromagnet, a base element on said electromagnet, said support having a mount-

ing aperture extending in the direction of movement of said armature, a leg on said base member slidably received in said aperture, an adjustment screw extending axially of said leg and mounting aperture and having engagement with said support whereby said electromagnet may be moved toward and away from said armature, and leg engaging clamping means in said support for releasably locking said leg against axial movement in said aperture.

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