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ELECTROMAGNETIC FEEDING DEVICES

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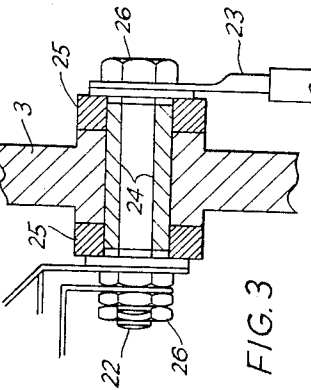
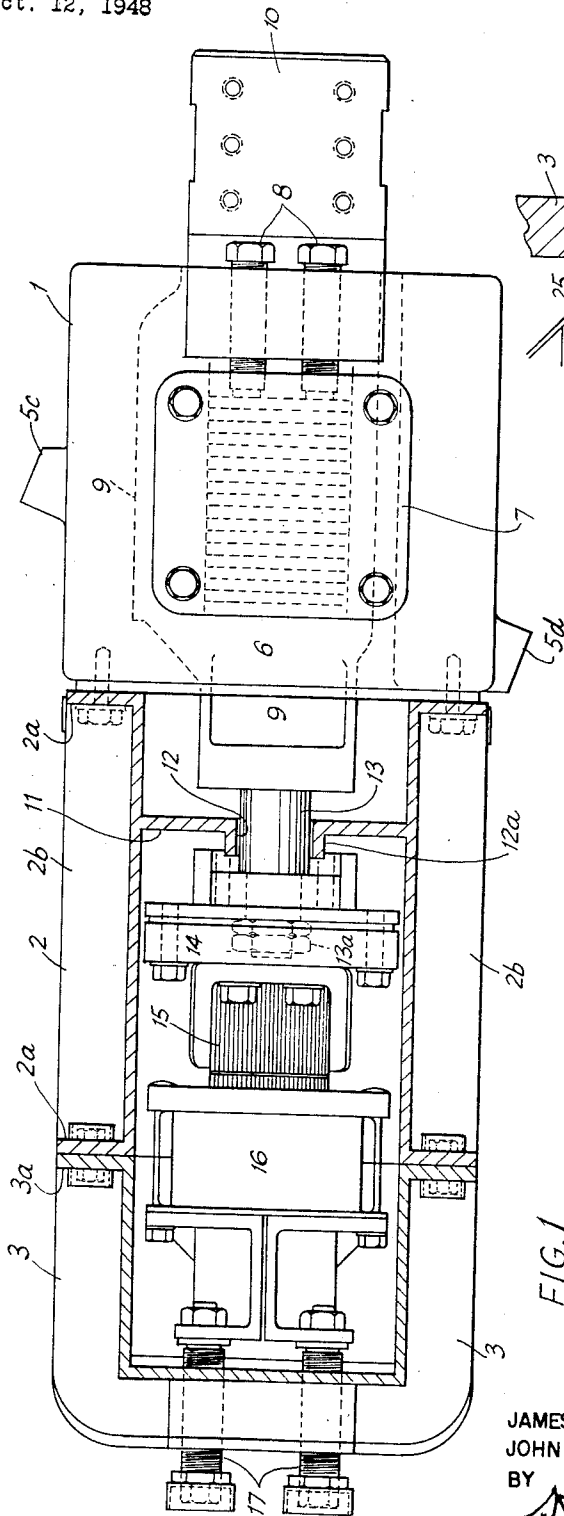


FIG. 3

FIG. 1

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ELECTROMAGNETIC FEEDING DEVICE

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4 Claims. (Cl. 172—126)

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This invention relates to electro-magnetic vibratory feeders for use in situations where explosive conditions may arise, for example in underground coal mine workings, and where, in consequence, it is essential that no spark-producing apparatus be exposed to the explosive atmosphere.

The invention aims at providing flame-proof electrical equipment for an electro-magnetic vibrator which will satisfy the official standards laid down for flame-proof machinery.

With a vibratory motor as hitherto applied to its work, not too much care has been necessary to prevent the vibratory parts moving laterally of the direction of vibration, during their vibration, so long as the width of the air gap between the magnet and the armature, in the direction of vibration has been correct. With a flame-proof device however, where the vibrations are generated within a flame-proof casing, and yet have to be applied to mechanism exterior to that casing, it is essential that there be not more than a specified maximum clearance laterally of the direction of vibration, between the said casing and that part of the vibratory mechanism which passes through it. Therefore, lateral movement of the casing or of the said part which passes through it must be avoided.

The object of the present invention, in its broadest aspect, is to provide a vibratory motor, having a magnet and armature within a flame-proof casing, the armature being connected to reaction springs external to the casing, wherein all the vibrating parts are mounted so as to have their centre line, in the direction of vibration, fixed relatively to the casing. This means that the portion of the vibrating parts which passes through the wall of the casing may have the least possible radial clearance with that wall, say not more than .004", since there is no movement laterally of the opening in the casing.

A representative example of the invention is illustrated in the accompanying drawing, wherein:

Fig. 1 is a part-sectional elevation of the complete vibrator;

Fig. 2 is a plan of the same; and

Fig. 3 is a sectional elevation of a detail part showing the "lead-in" for the electrical connections.

In general structure the vibrator comprises a main frame 1, which is at the right-hand end in the drawing, carrying the springs for the armature of an electro-magnet and adapted to be mounted to the member to be vibrated (not shown), which may be for example a bin, deck, platform, conveyor or the like; a central casing 2 of generally-tubular form, with end flanges 2a and longitudinal ribs 2b; and a cap-like end casing 3, having end flanges 3a and adapted to form

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a closure for the said central casing 2. The casing 3 carries the frame and coils of the electro-magnet, whilst the casing 2 carries a partition, described below, through which the desired connection between the internal and external vibratory parts may be made, and which is intended to isolate from the outer atmosphere any sparking which may occur within the casing.

In greater detail, the frame 1 is of rectangular shape in plan and has two longer cross members 4 joined at the ends by two shorter end members 5, these last being apertured horizontally at 5a to receive the ends of an assembly of flat springs 6, the centre portions of which lie within the central cavity of the frame. There are integral top and bottom plates 5b at the ends of the frame and on to the top plates are formed integral inclined lugs 5c which may be drilled and tapped to receive screwed studs by which the frame 1 may be suspended from a support. Similar lugs 5d on the bottom plates 5b of the frame serve for a floor mounting for the vibrator, if required.

The ends of the springs 6 are ground to size widthwise and lengthwise. The widthwise grinding is such that the springs just fit the aperture 5a and are not free to move up and down in that aperture, whilst the endwise grinding is such that the plates 7 secured to the outer ends of the frame 1 abut against the ends of the springs to prevent any lengthwise movement of the springs. The springs 6 are clamped in position in the apertures 5a by means of the screws 8.

Carried on the centre part of the assembly of springs is a clamp 9, the rear end of which is formed as or carries an extension 10 whereby it may be attached to the member to be vibrated, such as a conveyor deck, barrel packer, bin or the like. The bracket 9 and the left-hand spring 6 are provided with a mutually-engaging socket and projection formation so as to prevent any relative lateral movement of the clamp with respect to the springs. If desired, all the springs may have mutually-engaging parts to assist in the prevention of relative lateral movement between spring and spring. This accurate securing of the ends of the springs in the frame, and of the clamp on the centre of the springs, results in the centre line of the vibratory mass being fixed in space.

The forward end of the clamp 9 is of reduced size to enter the adjacent end of the central casing 2. Within such casing is a partition 11 having a central opening 12 therein, surrounded by a boss 12a, through which opening passes the shaft 13 extending from the clamp 9. This shaft 13 is shown as integral with the clamp 9, but it could, if desired, be formed as an attachment thereto. The end of the shaft passes through an armature-carrying frame 14, to which it is secured by the nuts 13a, and in which is a laminated armature

15. The relative diameters of the shaft 13 and the opening 12 are such that the radial clearance between the shaft and the wall of the opening does not exceed a specified maximum, for example .004", so that any sparking which may occur within the left-hand portion of the chamber may not pass through the partition 12 to the explosive atmosphere.

Carried within the outer part 3 of the casing is a high-frequency 2-pole magnet 16 having laminated poles which lie opposite the said armature 15. This magnet is adjustable axially of the casing by means of the adjustment screws 17 so that the width of the air gap between the magnet and the armature may be varied within fine limits. The central part 3 of the casing is provided with sight holes 18, covered by removable plates 19 opposite the air gap.

The electric leads from the mains are received by a terminal member 20 from which connection is made within the closed box 21 to the outer end of a lead-in member 22, whose inner end is within the casing 3 (see Fig. 3) and from such inner end of the lead-in member are the leads 23 to the coils of the magnet 16. An insulating bush 24 surrounds the member 22, and insulating washers 25 take the thrust of the clamping nuts 26.

In the assembling of the apparatus, in order to ensure the desired fixity of alignment, the springs 6 are first located in the frame 1 and are clamped in position, after which the bracket 9 is secured in place on the springs. This determines the constancy of the centre line of the vibrating parts. Thereupon the central part 2 of the casing is fixed in position on the frame 1, with the shaft 13 projecting concentrically through the opening 12 and when these parts are located in accurate relative positions and secured therein by studs 2a they are dowelled together by means of dowells 2b (see Fig. 2) so as to ensure that, after any subsequent removal and replacement of the part 2, the axial alignment will be unaffected. Next, the armature carrier 14 is attached to the protruding end of the shaft 13, the magnet 16 is secured within the part 3 of the casing, and such part is then bolted against the flanged end of the central casing 2. Constant axial alignment between the magnet and the armature is not essential, provided the air gap is within the prescribed limits, but it is essential that the central part 2 of the casing and the clamp 9 on the springs be in constant alignment to ensure that the radial clearance around the shaft 13 is not excessive at any point in the circumference.

If desired, a flexible diaphragm or bellows member may be provided around the shaft 13 with one edge clamped to the shaft and the other edge clamped to the partition 12.

What we claim is:

1. An electro-magnetic vibrator for use in explosive atmospheres comprising a completely enclosed casing, an electro-magnet secured therein at one end, an armature for said electro-magnet in the other end of said casing, said casing having an opening in said other end, a shaft secured to said armature and passing through and substantially filling said opening, said shaft adapted to vibrate longitudinally in said opening, a frame having one end fixed to said casing adjacent to said shaft, a set of superposed flat springs in said frame with the faces of said springs transverse of the axis of said shaft, means fixed to said frame and contacting the ends of said springs to render

them non-shiftable, and a clamp around said springs and fixed to said shaft, rendering said shaft non-shiftable relative to said frame.

2. An electro-magnetic vibrator for use in explosive atmospheres comprising a completely enclosed casing, an electro-magnet secured therein at one end, an armature for said electro-magnet in the other end of said casing, said casing having an opening in said other end, a boss surrounding said opening forming a passageway, a shaft secured to said armature and passing through and substantially filling said opening, said shaft adapted to vibrate longitudinally in said opening, a frame having one end fixed to said casing adjacent to said shaft, a set of superposed flat springs in said frame with the faces of said springs transverse of the axis of said shaft, means fixed to said frame and contacting the ends of said springs to render them non-shiftable, and a clamp around said springs and fixed to said shaft, rendering said shaft non-shiftable relative to said frame.

3. An electro-magnetic vibrator for use in explosive atmospheres comprising a completely enclosed casing, an electro-magnet secured therein at one end, an armature for said electro-magnet in the other end of said casing, said casing having an opening in said other end, a shaft secured to said armature and passing through and substantially filling said opening, said casing being split transversely to the axis of said shaft, means for securing together the parts so formed of said casing, said electro-magnet being held in one of said parts and said armature being held in the other of said parts, said shaft adapted to vibrate longitudinally in said opening, a frame having one end fixed to said casing adjacent to said shaft, a set of superposed flat springs in said frame with the faces of said springs transverse of the axis of said shaft, means fixed to said frame and contacting the ends of said springs to render them non-shiftable, and a clamp around said springs and fixed to said shaft, rendering said shaft non-shiftable relative to said frame.

4. An electro-magnetic vibrator for use in explosive atmospheres comprising a completely enclosed casing, an electro-magnet secured therein at one end, an armature for said electro-magnet in the other end of said casing, said casing having an opening in said other end, a shaft secured to said armature and passing through and substantially filling said opening and having a clearance of not over .004 inch, said shaft adapted to vibrate longitudinally in said opening, a frame having one end fixed to said casing adjacent to said shaft, a set of superposed flat springs in said frame with the faces of said springs transverse of the axis of said shaft, means fixed to said frame and contacting the ends of said springs to render them non-shiftable, and a clamp around said springs and fixed to said shaft, rendering said shaft non-shiftable relative to said frame.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,362,049	Starker	Dec. 14, 1920
2,153,243	Flint	Apr. 4, 1939