

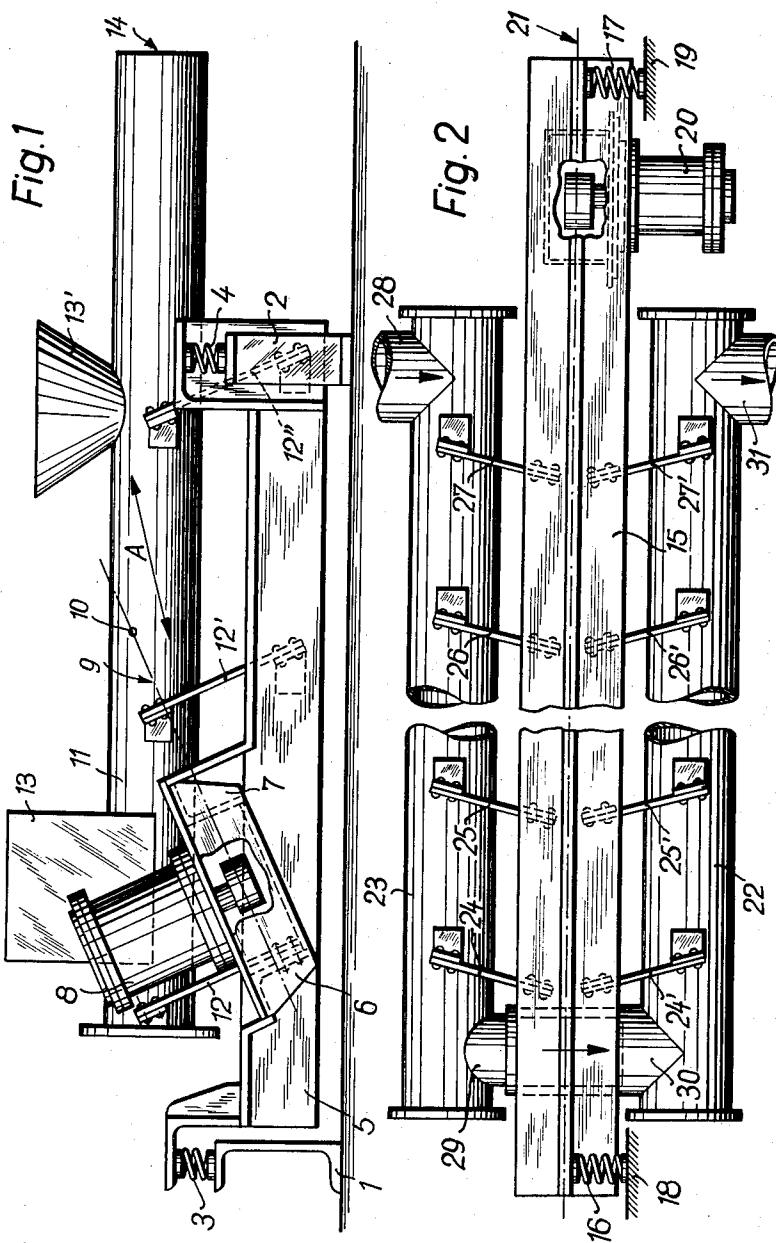
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NEIGHBOURHOOD OF RESONANCE

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OSCILLATING SYSTEM EXCITED AT OR IN THE NEIGHBOURHOOD OF RESONANCE

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This invention relates to oscillating systems excited at or in the neighbourhood of resonance and has for its object to balance the masses of such systems and in addition to ensure that the oscillating drive remains substantially at rest.

In the known oscillating systems of this type the drive is directly and fixedly mounted on the part to be oscillated when the latter is not directly driven, for example by sliding-block linkages or eccentrics. With this type of drive the oscillator is subjected to considerable stressing which has a particularly disadvantageous effect on the mounting of the masses generating the oscillations. The invention aims at providing a system in which the oscillating drive remains substantially at rest so that, for example, when an electric fly-weight oscillator is employed, the stressing to which the bearings are subjected is reduced to a minimum.

This fundamental aim of the invention is achieved by virtue of the fact that the drive is directly and fixedly connected to the mass of a resiliently mounted base frame which is connected through resilient members to the body to be oscillated, the natural frequency of the system consisting of the body to be oscillated and of its resilient mounting corresponding at least approximately to the exciting frequency of the oscillator, while the plane of the oscillations contains the centre of gravity of at least this system, and in the case of torsional oscillations the axis of oscillation coincides with an axis through the centre of gravity of the oscillating system.

Accordingly the principle of the invention can be applied with advantage not only to systems oscillating with a translational movement but also to systems carrying out torsional oscillations, and may be varied in many ways.

The system may consist, for example, of a base frame resiliently mounted on the ground, on which base frame there is fixedly mounted an oscillator, the axis of which is so inclined in a vertical plane with respect to the horizontal that the plane perpendicular to the said axis and containing the rotating fly-weight body extends through the centre of gravity of the oscillating system. The body to be oscillated, for example a tube, a trough or a sieve of corresponding form, is mounted on the said base frame through spring elements which permit deflections in the direction of the above-defined plane of oscillation. The natural frequency of the system consisting of the said spring elements and of the body to be oscillated is substantially adapted to the frequency of the fly-weight oscillator mounted on the main frame, that is to say the arrangement operates in such manner that the frequency applied by the fly-weight oscillator and transmitted to the main frame is substantially completely absorbed by the oscillating system, so that the main frame remains substantially at rest.

In another possible method of carrying this underlying

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idea into practice, the bodies to be oscillated are disposed symmetrically in relation to the resiliently mounted main frame supporting the oscillator or oscillators, which is particularly advantageous, for example, when two tubes are to be oppositely oscillated, so that a medium in one tube can be conveyed to one end thereof, at which it passes through a connection to the other tube, and advances to the end of the latter which is opposite the entry end of the first tube. In this way multi-stage assemblies can be constructed in which, however, the individual oscillators remain substantially at rest. Without the connection of the two tubes this arrangement permits the conveyance of, for example, two different materials in opposite directions. With this arrangement, the plane of oscillation lies parallel to and between the two oscillating bodies, since the centre of gravity thereof lies substantially exactly between them.

According to another method of carrying the principle of the invention into effect, the plane of the rotating fly-weight body is disposed at the level of the resiliently mounted body to be oscillated, so that at least the oscillation components set up parallel to the said plane are not transmitted to the base member. The remaining vertical component can then be simply intercepted by a counter-mass which is resiliently mounted on the base member.

The principle of the invention can also be applied with advantage to systems in which torsional oscillations are to be imparted to a body. This is the case, for example, when granular or pulverulent materials are to be conveyed upwards or downwards in a helical trough. With this arrangement, an axis through the centre of gravity of the oscillating body coincides with the axis of oscillation of the system. For example, an arrangement may be chosen in which a resiliently mounted base frame is disposed around the body to which torsional oscillations are to be imparted, said resiliently mounted base frame being connected to the body to be oscillated through spring systems permitting torsional oscillations and supporting oscillators disposed at equal angular distances around the central axis of the system. The resilient mounting may engage directly with the body to be oscillated, in which case the base frame is freely suspended through the spring systems permitting the torsional oscillations.

Various examples of the subject-matter of the invention are illustrated in the accompanying drawings, in which:

Figure 1 is a side elevation of one constructional form of system according to the invention,

Figure 2 is a side elevation of a second constructional form according to the invention,

Figure 3 illustrates diagrammatically a further possible construction for applying the principle of the invention, and

Figure 4 illustrates, also in diagrammatic manner, the application of the principle of the invention to a body to which torsional oscillations are to be imparted.

In Figure 1, reference numeral 1 indicates a support, for example of channel section, while 2 is a similar support which is fixedly mounted on the floor of the machine shop or the like, in the same way as the support 1. Resting on the said supports 1, 2 through springs 3, 4 is the base frame 5 on which there is mounted through brackets 6, 7 the oscillator 8, to which there corresponds another oscillator (not shown) on the other side, the plane 9 in which the fly-weights rotate extending through the centre of gravity 10 of the system.

In the constructional example illustrated the system

consists of a tube 11 which is connected to the base frame 5 through leaf-springs 12, 12', 12''. The tube 11 may have an inlet aperture 13 and an inspection aperture 13' and opens freely at 14, for example, into a container or into a further conveyor trough or a sieve operating in accordance with the oscillation principle. When the oscillator 8 is started, the tube 11 carries out strong oscillations in the direction of the double-headed arrow A. However, the frame 5 and consequently the oscillators 8 secured thereto through the brackets 6, 7 remains completely at rest, so that the bearings of the oscillators are not additionally loaded as a result of the oscillations produced at the system 10 and 12 to 14.

Figure 2 shows a further constructional form, in which the base frame 15 is suspended or mounted through springs 16, 17 on fixed supports 18, 19. These fixed supports 18, 19 may be disposed on the floor of the machine shop, or they may equally well be parts of cross members on which the base frame 15 is suspended. Disposed between the base frame parts 15 is the oscillator 20 generating directed oscillations, the fly-weights of the oscillator rotating in a centre plane 21 of the base frame 15. The oscillating members 22, 23, in the present case oscillating tubes, are disposed symmetrically in relation to the base frame 15 through the springs 24, 25, 26, 27 and 24', 25', 26', 27'. The oscillating tube 23 comprises an inlet branch 28 and an outlet branch 29, such outlet branch opening into the inlet branch 30 of the oscillating tube 22. The latter furthermore comprises an outlet branch 31. When the oscillator 20 is started, the tubes 22, 23 are oscillated in planes parallel to the plane 21, the material travelling through the branch 28, the tube 23 and the branches 29, 30 into the tube 22 and from there to the outlet branch 31. Here again, only the tubes 22, 23 oscillate on their springs 24 to 27, and 24' to 27', while the base frame 15 with the oscillator 20 mounted thereon remains at rest.

Figure 3 illustrates a further possible construction according to the underlying principle of the invention. Reference numerals 32 and 33 designate the anchorages of the resilient suspension means 34, 35 of the base frame 36. As in the cases already described, the base frame 36 may be either mounted on the ground through the springs 34, 35 or suspended from cross members. The body 37 to be oscillated, for example a trough, is secured to the base frame 36 through the springs 38, 38', 38''. The oscillator 39 generating directed oscillations is fixedly mounted on the base frame 36 and the plane in which its fly-weight 40 rotates extends substantially through the centre of gravity 41 of the oscillating system consisting of the springs 38, 38', 38'' and the body 37. The component 42 of the oscillations indicated by the arrow 43 is thus withheld from the base frame 36; the component 44 remains, but in the present constructional example it is intercepted by the counter-member 45 which is mounted on the base plate 36 through the springs 46, 46', 46''.

Finally, Figure 4 shows the application of the principle of the invention to bodies to which torsional oscillations are to be imparted. The oscillating body 47, is, for example, a helical conveyor, as illustrated in the figure, which is mounted on the floor 50 or on a cross member through the springs 48, 49. Secured to the said helical conveyor 47 through the fixed annular members 51, 52 are springs 53, 53', 53'', 53''', which are connected to the base frame 54. The latter supports the diametrically illustrated oscillators 55, 55', etc. The axis of oscillation is perpendicular to the plane extending through the fly-weights of the oscillators 55, 55', etc. and coincides at least approximately with the axis A—A through the centre of gravity of the oscillating system consisting of the springs 53, 53', 53'', 53''' and the helix 47. The oscillating body carries out torsional oscillations about said axis A—A, but the base frame 54 remains substantially at rest and the oscillators 55, 55', 75

etc. are thus protected from the effects of the oscillations. In the drawing, another form of suspension of the system is illustrated in chain-dotted lines at 56, 56'. The springs 56 and 56' in this alternative form engage with the base frame 54 and are suspended at their other ends, for example, from cross members in the machine shop.

It will be understood that the invention is not limited to the embodiments described in the foregoing and illustrated in the drawings but that numerous modifications may be made thereto without departing from the underlying idea of the invention.

We claim:

1. An oscillating system excited in the neighbourhood of resonance comprising a resiliently mounted base frame, an oscillator directly and fixedly secured on said base frame, a flyweight in said oscillator, electric means in said oscillator for rotating said flyweight, a body to be oscillated spaced from and in substantially parallel relation to said base frame, a plurality of spaced inclined springs connecting said body to said base frame, said oscillator being at such an angle to said body so that the plane passing through the center of gravity of said body and containing said flyweight is perpendicular to the axis of rotation of said flyweight, whereby there are generated directed oscillations in a plane passing substantially through the centre of gravity of the system consisting of said body and said resilient members, the natural frequency of said system corresponding approximately to the exciting frequency of said oscillator.

2. An oscillating system excited in the neighbourhood of resonance comprising in combination a body to be oscillated, a resiliently mounted base frame, said frame and body being in horizontal planes, spring elements through which said base frame is connected to said body, and an oscillator directly and fixedly connected to said base frame at such an angle to said planes so that the plane perpendicular to the axis of said oscillator and containing the flyweight thereof extends through the center of gravity of said oscillating system, said oscillator adapted so that its plane of oscillation extends through the centre of gravity of the system consisting of said body and said spring elements, the natural frequency of said system corresponding approximately to the exciting frequency of said oscillator.

3. An oscillating system excited in the neighbourhood of resonance comprising in combination a resiliently mounted base frame, said frame and body being in horizontal planes, two bodies to be oscillated which are arranged substantially symmetrically in relation to said base frame, resilient members through which said base frame is connected to said bodies, and an oscillator directly and fixedly connected to said base frame at such an angle to said planes so that the plane perpendicular to the axis of said oscillator and containing the flyweight thereof extends through the center of gravity of said oscillating system, said oscillator adapted to generate directed oscillations in a plane passing substantially through the centre of gravity of the system consisting of said bodies and said resilient members, the natural frequency of said system corresponding approximately to the exciting frequency of said oscillator.

4. An oscillating system excited in the neighbourhood of resonance comprising in combination a resiliently mounted base frame, an oscillator directly and fixedly secured on said base frame, a flyweight in said oscillator, electric means in said oscillator for rotating said flyweight, a body to be oscillated spaced from and in substantially parallel relation to said base frame, a plurality of spaced inclined springs connecting said body to said base frame, said oscillator being at such an angle to said body so that the plane passing through the center of gravity of said body and containing said flyweight is perpendicular to the axis of rotation of said flyweight, whereby there are generated directed oscillations in a plane passing substantially through the centre of gravity of the

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system consisting of said body and said resilient members, a component of said oscillations extending parallel to said base frame through the centre of gravity of said system while another component extends perpendicular to said first component, and a second oscillating body resiliently mounted on said base frame to absorb said other component of said oscillations, the natural frequency of said system corresponding approximately to the exciting frequency of said oscillator.

5. An oscillating system according to claim 1, characterized in that there are provided fixed supports, springs vertically mounted on said support, said base frame mounted on said support springs.

6. An oscillating system according to claim 1, characterized in that there are provided fixed supports, springs vertically mounted on said support, said base frame having brackets extending upwardly, said brackets resting on said support springs, said base frame being suspended between said supports.

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