May 14, 1940. S. ROSENZWEIG 2,200,561

VIBROISOLATOR

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Fig. 1.

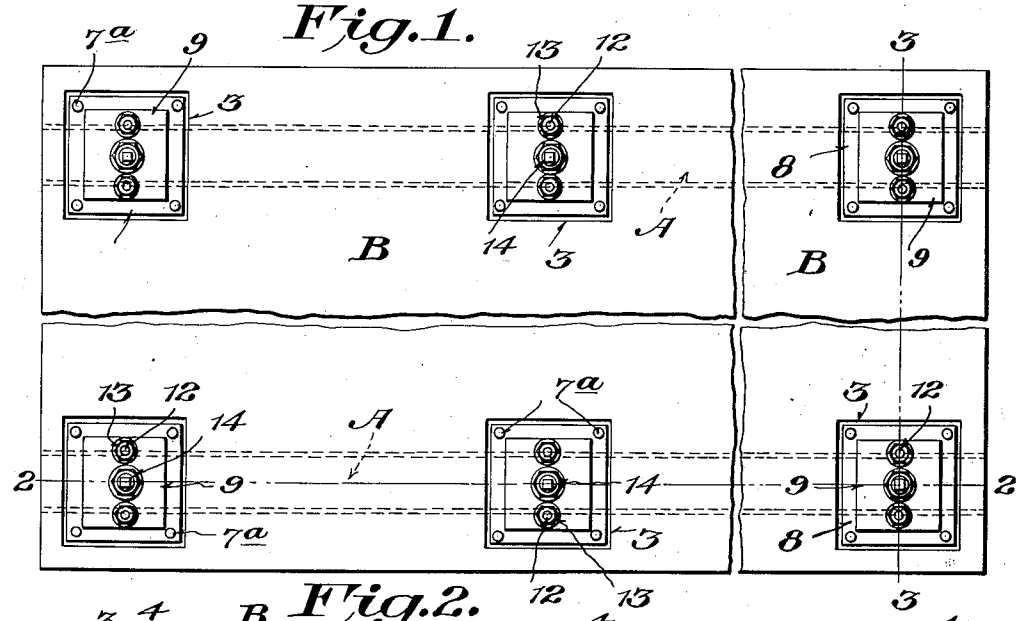


Fig. 2.

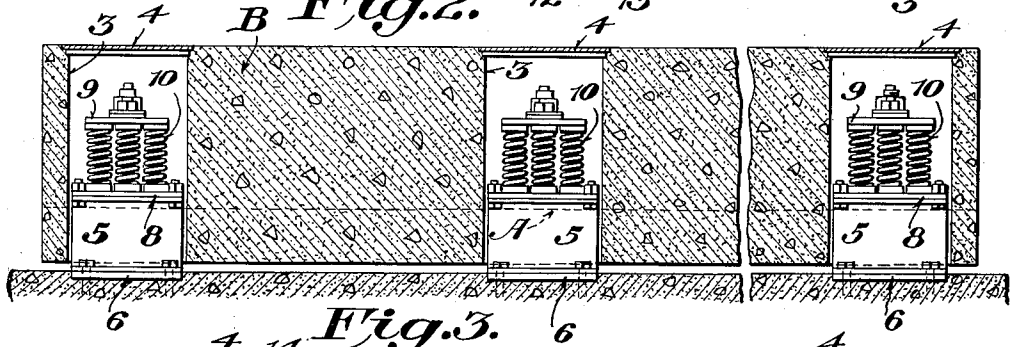


Fig. 3.

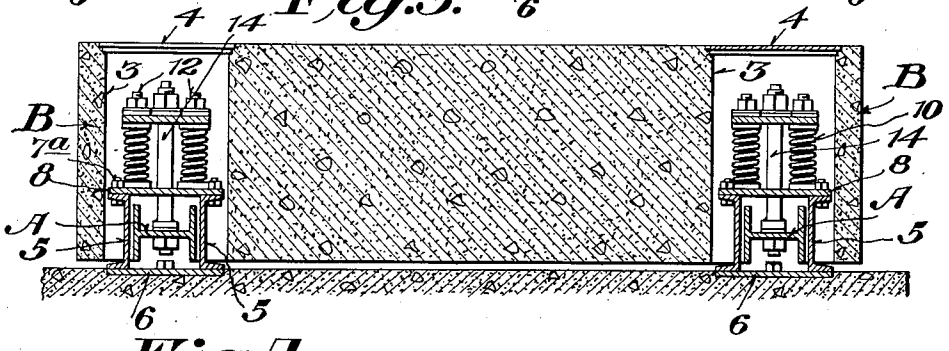
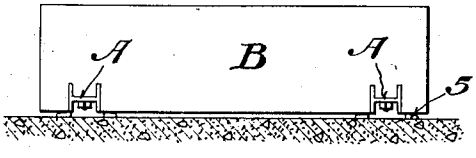


Fig. 4.



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Fig.5.

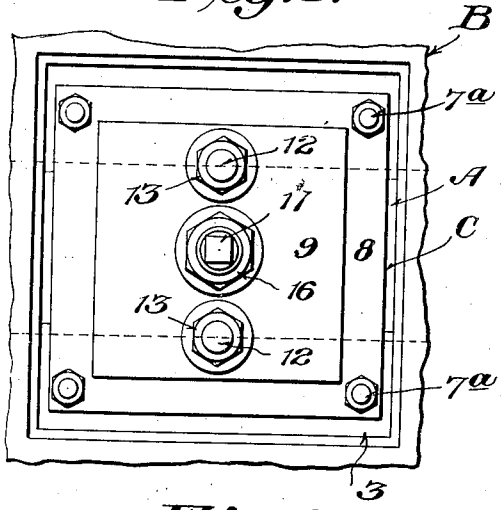


Fig.7.

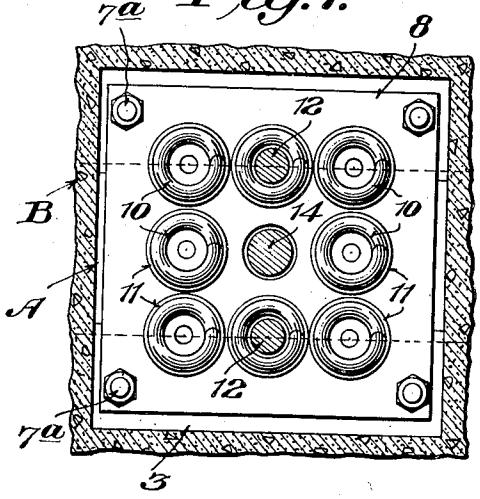


Fig.6.

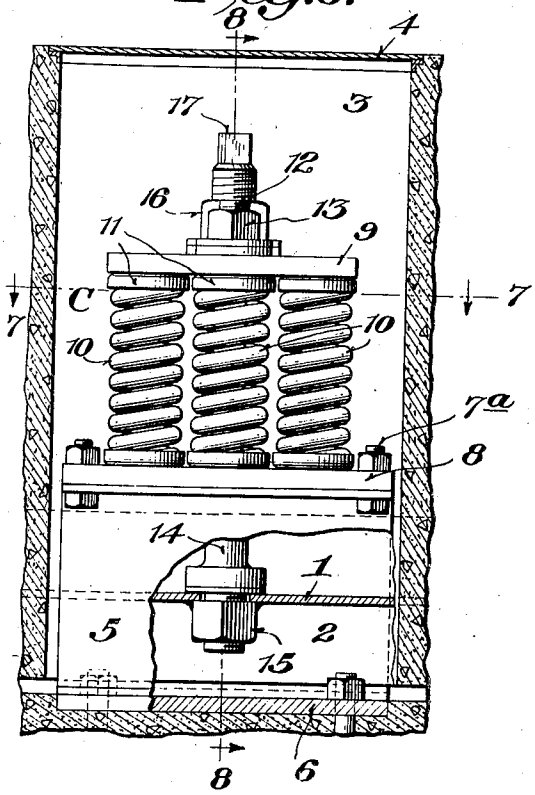
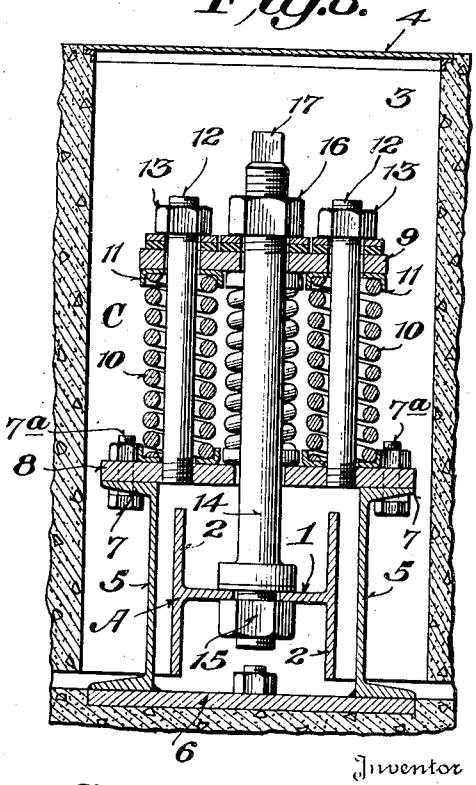


Fig.8.



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Fig. 9.

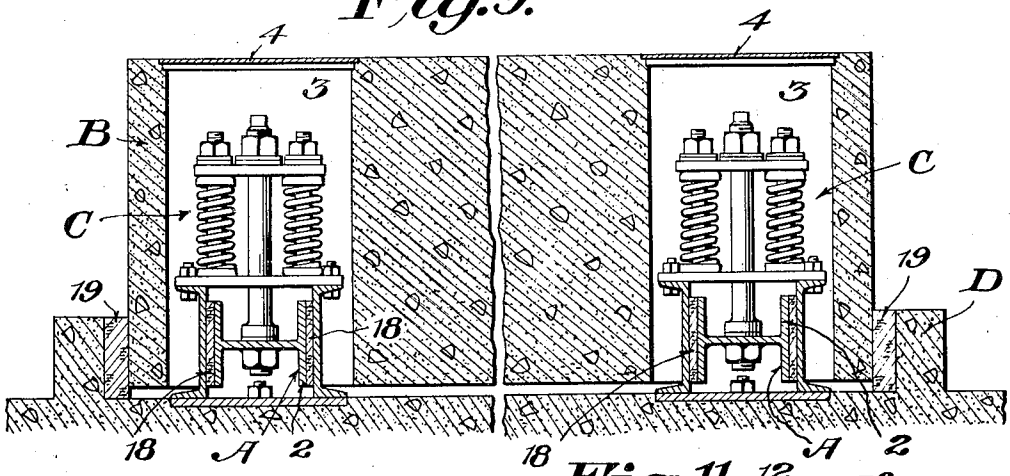


Fig. 10.

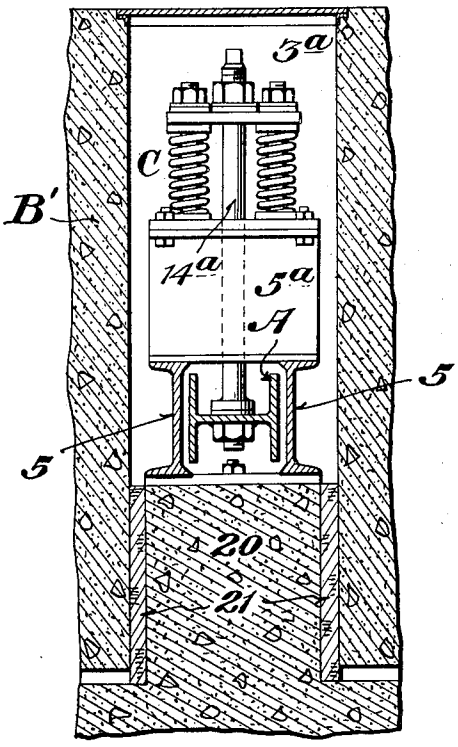


Fig. 11.

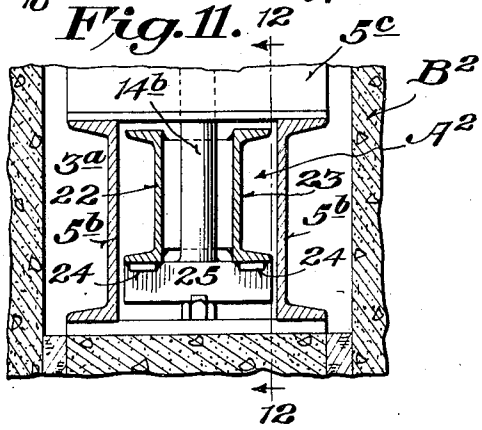
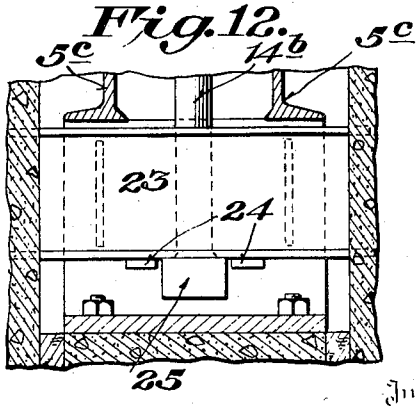


Fig. 12.



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UNITED STATES PATENT OFFICE

2,200,561

VIBROISOLATOR

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Application May 16, 1939, Serial No. 274,048

4 Claims. (Cl. 248—20)

This invention relates to a construction for isolating engine or machinery foundations from a floor or sub-base.

A primary object of the invention is to provide suspension means for the foundation having a portion thereof embodied therein at the time the same is constructed, and which cooperates with a novel vibroisolator from which the suspension means is hung so that in effect the foundation is pendulum suspended. That is to say, the invention contemplates embedding one or more structural steel elements in a concrete foundation at the time the same is poured, in situ, and then the vibroisolator construction may be installed and connected with the suspension means so as to lift the foundation from its position on the floor or sub-base and thereafter support the same in such a way that vibrations induced by the operating machine are effectively damped by vibration absorbing elements forming a part of the permanent structure.

Another object of the invention is to provide a vibroisolator which can be prefabricated to the required specifications, and, therefore, made up as a unit which greatly facilitates its initial manufacture as well as its subsequent installation at the site where the foundation has been constructed.

A further object of the invention is to provide a suspended foundation structure wherein the vibroisolator units are easily accessible both for purposes of initial installation and subsequent manipulation for setting and adjusting, thereby making it possible to position the foundation to a fraction of an inch.

All of the foregoing objects contribute to produce an isolation mounting for machines, particularly machines of heavy duty type, in a practical and expeditious manner which effects considerable economies both from the standpoint of manufacture and installation.

A preferred and practical embodiment of the invention is shown in the accompanying drawings in which:

Figure 1 is a plan view of a foundation embodying the preesnt improvements, the foundation being broken into sections merely for the purpose of conserving space and illustration.

Figure 2 is a vertical longitudinal sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a vertical transverse sectional view taken on the line 3—3 of Figure 1.

Figure 4 is an end elevation of the foundation shown in Figs. 1–3, inclusive.

Figure 5 is an enlarged top plan view of one of the vibroisolator units.

Figure 6 is an enlarged vertical sectional view of one of the vibroisolator units.

Figure 7 is a horizontal cross-sectional view taken on the line 7—7 of Fig. 6.

Figure 8 is a vertical sectional view taken on the line 8—8 of Fig. 6.

Figure 9 is a vertical cross sectional view of a concrete foundation embodying the construction of Figs. 1–8, inclusive, but illustrating the use of cork shims between the suspension means and the stool, and also showing a curbing on the subbase and surrounding the bottom edge of the foundation.

Figure 10 is a detail vertical sectional view of a modified form of construction wherein the isolator is raised to come closer to the floor level and center of gravity of the whole assembly, as for example, in installations requiring deep foundations.

Figure 11 is a detail vertical sectional view illustrating the use of a modified form of suspension means.

Figure 12 is a vertical sectional view taken on the line 12—12 of Figure 11.

Similar reference characters designate corresponding parts throughout the several figures of the drawings.

According to the embodiment of the invention shown in the drawings it is proposed to embed a support A directly in a concrete foundation designated generally as B. While the support A may be of any desired structural steel shape, nevertheless, it is preferred to utilize a beam of substantially H-shaped formation including the web 1 and flanges 2. The manner of placing the beam in the foundation will be later referred to, but for the present, it is to be understood that the same is embedded in the material of the foundation at opposite sides thereof, and although shown in the drawings as being co-extensive in length with the foundation, nevertheless, it will be understood that it is within the scope of the invention to extend the structural shape constituting the beam beyond the ends of the foundation if desired.

At suitable locations in the foundation where it is desired to install vibroisolator devices for supporting and suspending the beam A, the said foundation is provided with isolator pockets or chambers 3 which may be provided with cover plates 4. Each device installed in these pockets or chambers includes an isolator unit designated generally as C and a stool on which the unit is

mounted, said stool being formed of opposite channel members 5 having their flanges turned outwardly. The lower flanges of the channels preferably rest upon a plate 6 secured to the floor or sub-base, and the upper flanges 7 are intended to constitute supporting surfaces for the vibroisolator proper. It will thus be apparent that the beam A is arranged between the inner faces of the channels 5—5 constituting the stool or support for the vibroisolator proper.

The isolator unit C preferably consists of the bottom and top steel plates 8 and 9 having therebetween a plurality of springs 10 which have their opposite ends anchored to the plates by suitable spring retainers 11. The said springs 10 are compressed between the plates 8 and 9 by the bolts 12. These bolts have their lower ends screw threaded to fit in tapped openings in the base plate 8 while upper ends are also threaded to receive the nuts 13 bearing on suitable washers or shims which back up the top plate 9. Moreover, the bolts 12 are arranged transversely of the plates 8 and 9 and pass through the coils of one pair of opposite outer springs 10. It will, of course, be understood that any desired number of springs 10 may be used between the plates, but in the construction shown eight springs are used, and, since as previously indicated, the end of each spring is placed in a spring retainer the springs will not move or shift laterally relative to the plates.

The bottom and top plates 8 and 9 are provided with centrally arranged registering openings for the purpose of receiving an elongated suspension bolt 14. The lower end of the suspension bolt 14 is provided adjacent its end with an annular shoulder, and the portion between the shoulder and the extremity is threaded to fit into a nut 15 which is welded to the underside of the web 1 of the beam A. Thus, it is possible to insert the suspension bolt 14 from the top of an isolator pocket into the beam, and, by screwing it into the nut 15, using a lock washer between the shoulder and the upper face of the beam, the suspension bolt may be securely affixed to the beam. The upper end of the bolt 14 is externally threaded to adjustably receive a nut 16 which may be brought into contact with suitable washers bearing against the upper face of the top 9. Also, it will be noted that the upper extremity of the suspension bolt 14 is provided with an angular tool engaging portion 17 to facilitate the screwing of the bolt to the nut.

In connection with the vibroisolator units C it may be pointed out that the same are fabricated according to the desired specification, as complete units, before installation, so that they may be readily handled at the point of use. It will, therefore, be understood that prior to assembling the isolator units with the foundation they comprise the bottom plate 8, and top plate 9, having the springs 10 therebetween, the said plates and springs being held together by the bolts 12. The nuts 13 on the bolts 12 are utilized to precompress the springs 10 prior to the installation of the unit. The initial compression may only be sufficient to hold the unit together but at the time of installation the springs are compressed sufficiently to float the foundation as will presently appear.

Referring now to the manner of making the installation, it may be pointed out that the selected site or location is first provided with the plates 6 which may be screwed, bolted or otherwise anchored to the sub-base or floor. The spaced channel members 5 forming the stool are then welded to the plates 6. A suitable form to receive the poured concrete foundation is then erected about the installation site, the usual precaution being taken to prevent adherence of the concrete to the floor or sub-base, and proper forms being used to provide the isolator pockets or openings 3 at the locations of the stools where the vibroisolator units are to be mounted.

The beams A are then laid on top of the plates 6, between the channels 5, and the foundation is ready to be cast. It will, thus, be apparent that the foundation will envelop the beams A at all points except where the isolator pockets or chambers 3 are located. When the concrete hardens or sets the beams A will, therefore, become an integral part of the entire foundation.

The lower threaded ends of the suspension bolts 14 are then screwed into the nuts 15 welded to the underside of the web 1 of the beam A. The suspension bolts may, therefore, be rigidly placed in position on the beams prior to placing the vibroisolator units C on the stool. In order to assemble the units on the stool as will be presently described it will, of course, be understood that it is necessary to remove the nuts 16 from the suspension bolts in order to permit the said bolts to be threaded through the openings in the plates 8 and 9.

The vibroisolator units C may now be placed over the suspension bolts 14 and on the stools formed by the channels 5—5. As previously indicated the vibroisolator unit C including the plates 8 and 9 and the springs 10 are made up so that they can be readily positioned on the upper flanges 7 of the channels 5. In that connection, it may be pointed out that the said flanges 7 of the channels 5 are provided at each corner thereof with bolts 7^a whose heads are welded to the underside of the flanges so that the threaded shanks of the bolts project above the flanges thereby to receive openings in the bottom plate 8 of the isolator. As will be apparent from Figures 1, 5 and 7, the bolts 7^a are so positioned that they are accessible from the top of the pocket 3 thereby conveniently to receive nuts for fastening the bottom plate of the isolator to the stool.

Since the springs 10 were precompressed before the isolator unit was fitted to the stool, it will be apparent that by backing up the nuts 13 on the bolts 12 the energy stored in the springs 10 will force the top plate 9 upwardly and carry the suspension bolt 14 with it until the plate 9 comes into engagement with the nuts 13 in their packed up position. The foundation is thus lifted from the sub-structure. The usual clearance between the sub-structure and the bottom of the foundation is approximately one-half to three-fourths of an inch, and the required amount of clearance can be obtained by adjusting the nuts 16. After the foundation has been leveled, the nuts 13 are screwed down to contact the top plate 9. This is done to prevent over-extension of the springs under working conditions. Since all nuts and bolts are properly isolated no vibration transmission is induced through any part of the construction.

The primary form of construction just described may be carried into effect with various supplemental parts and structures.

For example, Figure 9 of the drawings illustrates the constructions shown in Figures 1 to 8 with the addition of cork shims between the flanges of the beam A and the inner sides of the channel forming the stools. That is to say, the space otherwise existing between the outer faces of the flanges 2 of the beam and the plates 5

may be filled with cork plates or shims 18. Also, the entire foundation B may be surrounded with an upstanding curb D which is suitably spaced from the foundation to accommodate a cork or equivalent insert 19. It will also be recalled that the pockets 3 which receive the vibroisolator units C are covered by the plates 4. Thus, all of the interior of the foundation which houses the vibroisolator and their associated parts is sealed sufficiently to trap or pocket air beneath the foundation, and also beneath the beam A and within the pockets 3, so that, in addition to the isolation effect obtained by the vibroisolators, it is possible to bottle up the air below the foundation and in this manner obtain a steadying effect in operation. In other words, it is possible to take advantage of trapped air to increase the total isolating effect of the installation.

Where an installation requires an especially deep foundation, which has a higher center of gravity, than a shallow foundation, it is desirable to elevate the entire suspending and vibration isolating means, such, for example, as indicated in Figure 10. From this figure it will be observed that the vibroisolator unit C may be mounted on a stool extension 5^a while the suspension means A is carried by a longer suspension bolt 14^a. At the same time, it will be noted that the stool 5 is mounted on a concrete or other pedestal 20 carried by the floor or sub-base and extending upwardly into the elongated chamber 3^a of the deepened foundation B'. Here again, if desired, cork isolating plates 21 may be utilized. In this instance, however, the cork plates or shims 21 are arranged between the sides of the pedestal and the sides of the pocket 3^a.

Although it is preferred to use a suspension means in the form of an H beam as previously indicated it may be desirable in the case of unusually heavy foundations to use other structural shapes, such, for example, as channel members arranged with their back faces in spaced relation and their webs vertically disposed in order to obtain greater stiffness. This contingency is illustrated in Figs. 11 and 12. Referring to Fig. 11, it may be pointed out that the foundation B^2 may be formed with pockets 3^a for receiving the vibroisolator and its associated parts which are of the same construction as heretofore described. However, the beam A^2 consists of channel members 22 and 23 having their flanges turned outwardly and the inner faces of their webs spaced to receive a suspension bolt 14^b having a modified lower end construction. That is to say, the beam A^2 in the form of channel members is embedded in the concrete foundation B^2 in the same way as the beam A, and said members may be provided at their undersides with spaced lugs 24 to receive the cross bar or T-head 25 formed on the lower end of the suspension bolt 14^b. In the construction shown in these figures, it will be understood that the vibroisolator of the same construction as the unit C will support and suspend the bolt 14^b and the isolator unit is supported on the main stool 5^b and the supplemental stool 5^c. In other words, the principal modification intended to be illustrated by Figures 11 and 12 is to show how a stiffer beam construction may be used when the occasion demands.

From the foregoing it will be apparent that the present invention aims to provide an isolating suspension for machinery foundations wherein the latter is supported by a beam suspended by means of the bolts 14, 14^a and 14^b substantially after the fashion of a pendulum thereby allowing complete freedom to the foundation and permitting the springs 13 of the isolator adequately to absorb all of the vibrations of the apparatus transmitted to the foundation. Moreover, the construction lends itself to an arrangement whereby the vibroisolator units may be placed near the center of gravity of the entire installation, thus, more effectively and thoroughly isolating the foundation from the floor or sub-base. In addition the construction permits of fabricating the vibroisolator units with precision methods at the shop before being taken to the point of installation, and, when reaching such point of installation, the units may be readily assembled with a minimum of expenditure of time and labor and the entire foundation may be lifted from the sub-base by the very means on which it is to be ultimately supported.

Without further description, it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will, of course, be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention and scope of the appended claims.

I claim:

1. A vibration isolating construction for isolating machinery from a sub-base, including in combination, a cast foundation having a plurality of pockets formed therein and normally accessible from the top of the foundation, beams embedded in said foundation and exposed in said pockets, and isolating means for supporting said beams, said means comprising a plurality of devices located in said pockets and each including a stool consisting of spaced structural members insertable from the top of the pockets and receiving the beam therebetween, an isolator unit including top and bottom plates, the latter bridging said structural members, a plurality of springs between said plates, means for adjustably connecting said plates to compress the springs, and a suspension bolt passing through said top and bottom plates and having its upper end adjustably connected with the top plate and its lower end connected with the beam.

2. A vibration isolating construction, including in combination, a sub-base, a cast foundation having pockets accessible from the top of the foundation, beams consisting of spaced structural members vertically embedded in said foundation and having portions exposed in said pockets, and isolating means for supporting said beams, said means comprising a plurality of devices located within said pockets and each including a stool supported on the sub-base and consisting of spaced structural members having the structural members of the beam arranged therebetween, a resilient unit including top and bottom plates having springs compressed therebetween, said bottom plate resting on the upper portions of the structural members constituting the stool, and a suspension bolt comprising a shank passing through said top and bottom plates and having a cross member at its lower end for engaging beneath the channel members constituting the beam, and means engaging the upper end of the shank of the suspension bolt for adjustably supporting the same on the top plate of the resilient unit.

3. A vibration isolating construction for supporting a cast foundation above a sub-base, including, beams embedded in said foundation and

having exposed portions, and isolating means for supporting said beams, said means comprising a plurality of devices located at the exposed portions of the beam and each including resilient means supported from the sub-base and arranged above its related beam and including a suspension member connected to said beam and supported by said resilient means, and a curbing formed on the sub-base about the foundation, and means between the curbing and the foundation for trapping a substantial portion of the air confined between the lower portion of the foundation and the curbing.

4. A vibration isolating construction, including, a foundation cast in situ on a sub-base and formed with a plurality of pockets, beams embedded in said foundation and exposed at the location of said pockets, and isolating means for supporting said beams, said means comprising a plurality of devices located in said pockets and each including a stool consisting of spaced members receiving a beam therebetween, cork shims between the flanges of the beam and the channels constituting the stool, resilient means supported on the stool, a suspension member connected to the beam and supported by said resilient means, a curbing formed on the sub-base about the foundation, and means between the curbing and the foundation for trapping substantial portion of the air between the lower portion of the foundation and the curbing to provide a vibration damping air cushion.

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