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CENTRIFUGAL EXCITER FOR VIBRATORY POWER DEVICES

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FIG. 1

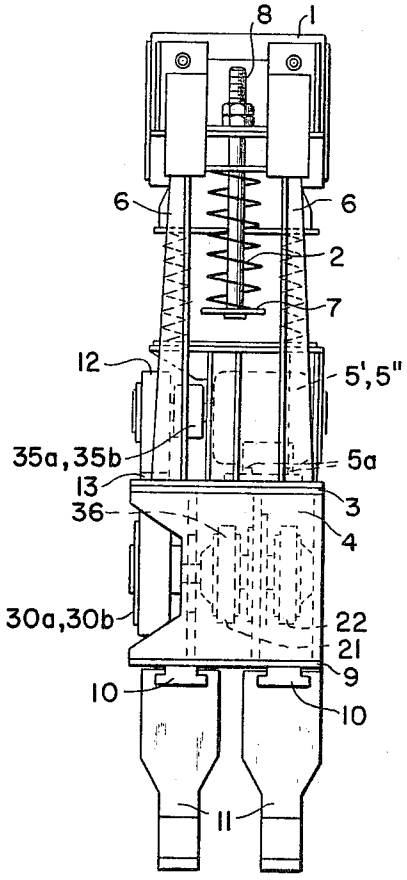


FIG. 2

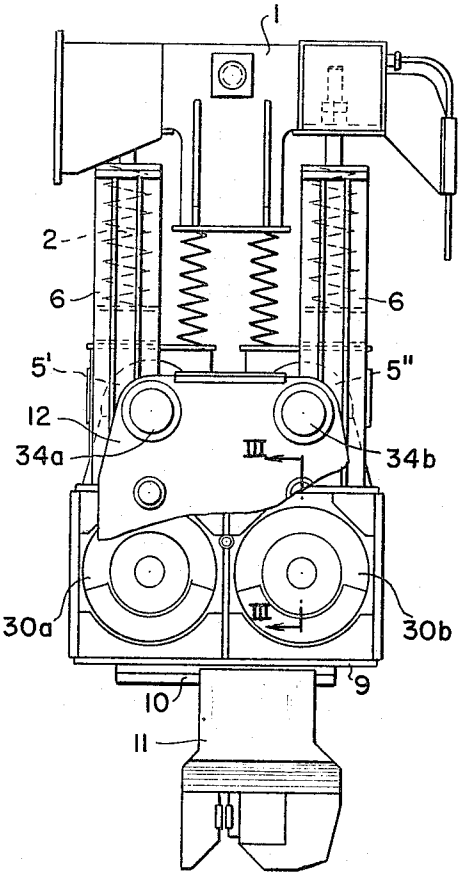


FIG. 3

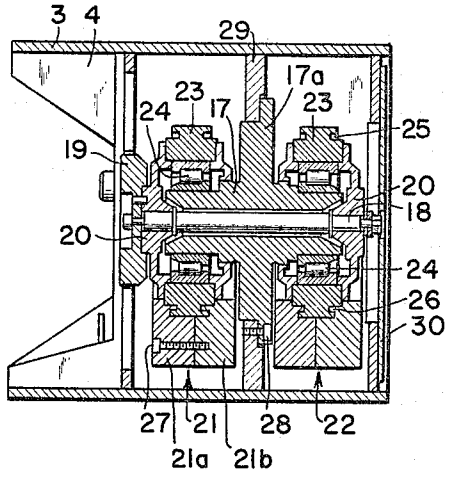

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FIG. 5

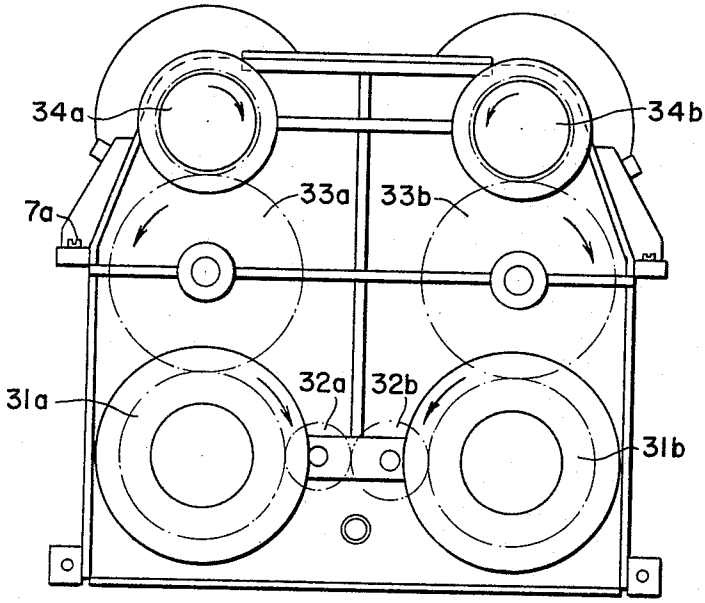
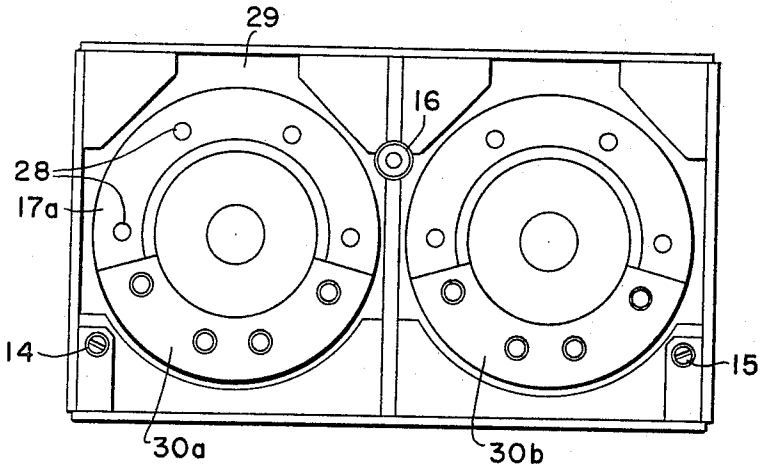



FIG. 4



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# CENTRIFUGAL EXCITER FOR VIBRATORY POWER DEVICES

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10 Claims. (Cl. 74—61)

My invention relates to a centrifugal exciter for vibratory power devices and more particularly for vibratory rams which employ two unbalance masses rotating synchronously in opposite directions for generating directional oscillations.

Centrifugal exciters of this general type are known and are provided with unbalance masses which are secured at both ends of the drive motor for producing alternating forces. Since the alternating forces impose a great stress on the bearing and the drive motor, the replacement of the entire assembly for the most part cannot be avoided whenever breakdowns occur. Repair of contrifugal exciters of this type on the spot is particularly impossible of accomplishment when they are used in combination with vibratory rams. Furthermore, centrifugal exciters of this type are rarely available as replacements at short notice so that a rather lengthy downtime of the vibratory power device due to failure of the exciter must be expected. It is also impossible with such centrifugal exciters to adust the frequency of the alternating load to the fundamental or natural frequency of the supporting base of the apparatus, and to adust the amplitude of the alternating force to the resistance of the base when used with vibratory rams. In order to be able to change the amplitude of the alternating force within specific limits, it has been known to arrange several directional exciter units in series connection in such a way that the force vectors of the directional exciter units extend along one effective line, and the directional exciter units can be disconnected from one another. This known method of changing the amplitude of the alternating load nevertheless is disadvantageous in that during the construction or dismantling of an exciter unit, the neighboring units must be disconnected and the oscillating apparatus consequently taken apart.

It is accordingly an obect of my invention to provide a vibratory or oscillatory exciter that will permit the freqency and the amplitude of the alternating load to be changed in a simple manner, and in which replacing defective components is reduced to a minimum of assembly work.

With the above and other related objects in view, and in accordance with my invention, I provide a vibratory force applicator or power device with support means for holding a drive motor and a centrifugal exciter and with an additional support for holding transmission means interconnecting the drive motor and the centrifugal exciter; and the drive motor, centrifugal exciter and transmission means are constructed as easily replaceable structural entities.

According to other aspects of my invention, two of the aforementioned combinations of units are arranged adjacent each other, employing centrifugal exciters for producing directed oscillations, with a common transmission for both drive motors and both centrifugal exciters, however, which simultaneously ensures synchonizing of the oppositely rotating unbalance masses of both centrifugal exciters. In the construction of a directional exciter of this type, both centrifugal exciters are similar to one another and possess no gears at all or other structural elements for producing synchonous contrarotation.



Both of the drive motors are also similar to one another and are provided at the drive shaft with a clutch which serves to connect the shaft of the motor with the transmission.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims.

While the invention has been illustrated and described as embodied in a centrifugal exciter for vibratory power devices, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention. Such adaptations should, and are intended to, be comprehended within the meaning and range of equivalents of the appended claims.

The invention itself both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of a specific embodiment when read in connection with the accompanying drawings in which:

FIG. 1 is a front elevational view of a centrifugal exciter in combination with a vibratory power device constructed in accordance with my invention;

FIG. 2 is a side elevation of FIG. 1 with the transmission mechanism partly broken away so as not to obscure the centrifugal exciter;

FIG. 3 is a sectional view through the centrifugal exciter of FIG. 2 along the line III—III taken in the direction of the arrows;

FIG. 4 is an enlarged view of the exciter cell components mounted in their housing shown in FIG. 2; and

FIG. 5 is an enlarged view of the transmission mechanism shown in FIGS. 1 and 2.

Referring now to the drawings and particularly to FIGS. 1 and 2, there is shown a vibratory ram secured to a yoke **1**, for example such as at the hook of a building crane. Helical springs **2** are connected by stirrup-shaped brackets **6** with the top flange **3** of a housing **4**, which holds the exciter. The housing **4** supports the electric motors **5'**, **5''**, which are mounted as readily replaceable structural components or modular units on the upper flange **3** and secured thereto with screws **5***a*. The yoke **1** is resiliently connected by the springs **2** across the brackets **6**, the bridge **7** and spindles **8**.

As seen in FIGS. 1 and 2, the upper end of the spindle **8** is retained in the yoke **1** by a pair of threaded nuts while the lower end of the spindle **8** which carries a bridge or abutment plate **7** extends downwardly alongside the stirrup-shaped bracket **6**. The helical springs **2** shown at the left and right sides of FIG. 2 coaxially surround the spindles **8**, the lower end of the springs **2** being secured by any suitable means to or merely freely abutting against the bridge **7** and the upper end of the springs **2** similarly secured to or abutting against the upper portion of the stirrup-shaped brackets **6**. These helical springs are compression springs which are constrained by the spindles **8** to permit directional vibration of the apparatus suspended thereon only vertically, as seen in FIGS. 1 and 2. The two center helical springs **2** shown in FIG. 2 are tension springs whose ends are secured by any suitable means respectively to the center leg of the yoke **1** and a frame structure around the motors **5'**, **5''** which is fixed to the housing **4**. The centrifugal exciter is located in the housing **4**. Rails **10** for fastening devices **11** for attaching ram heads (not shown) to the illustrated apparatus are located at the bottom flange **9**. A transmission mechanism **12** provided with a flange **13** is secured thereby to the upper flange **3** of the exciter housing **4** with any known securing means. The transmission mechanism **12** is furthermore fixed to the exciter housing **4** with threaded bolts, machine screws or the

like at the locations **14**, **15**, **16** and **7***a* shown in FIGS. 4 and 5.

The centrifugal exciter is shown in FIG. 3 built on a centrally apertured support component **17**. A shaft **18** extends through this support component **17**. At both ends of the shaft **18** there are provided entrainer members **20** for annular structural components **23** which carry the unbalance masses **21** and **22**. These annular structural components **23** are rotatably supported by the roller bearings **24** on the support component **17** and are caused to rotate with the shaft **18** by the entrainer members **20** which engage them. Each of the circular structural components **23** is provided with circular grooves **25** in which corresponding annular projections **26** of the components **21***a* and **21***b* of the respective unbalance mass are received. The two components **21***a* and **21***b* of the unbalance mass **21**, and of the unbalance mass **22** accordingly, are pressed together by a screw **27** and are securely stressed against the annular structural component **23**.

At the left end of the shaft **18**, as shown in FIG. 3, a clutch component **19** is located. By means of the radially extending hub **17***a* of the support portion **17**, the exciter cell or unit is secured by a screw **28** to a circularly cutout clamping plate **29**, fixed as by welding or the like to the housing **4**. Depending on the size of the unbalance masses, it may be expedient to attach the unbalance masses to the centrifugal exciter proper only after mounting the centrifugal exciter in the housing **4**. The exciter housing **4** is closed at its right or rear side, as viewed in FIG. 3, by a cover plate **30** secured to the housing **4** by suitable fastening means. The drive motors **5'** and **5''** can be fixed in a corresponding manner to the exciter housing **4** on which they are mounted.

The embodiment of a vibratory ram constructed in accordance with my invention that is shown in the drawings is provided with two contrarotating centrifugal exciters for producing rectilinear oscillatory movements (FIG. 2). In the transmission case **12** both of the centrifugal exciters **30***a* and **30***b* are operatively connected to each other by the gears **31***a*, **32***a*, **32***b* and **31***b* (FIG. 5). The clutch halves of the clutch component **19** are secured to the spur gears **31***a* and **31***b* respectively for thereby connecting the contrifugal exciters **30***a*, **30***b* with the respective spur gears **31***a* and **31***b*. The spur gears **31***a*, **31***b* are in turn operatively connected respectively by the gars **33***a*, **33***b* with the respective gears **34***a* and **34***b*. The gears **34***a*, **34***b* are in force-constrained connection with the drive motors **5'** and **5''** respectively by means of clutches **35***a* and **35***b* respectively (FIG. 1). As shown in the drawing, the illustrated transmission mechanism can be interchanged, without great difficulty and also by employees with little experience, with other transmission mechanisms having different transmission ratios so as to thereby be able to adjust the frequency of the alternating load to the natural or fundamental frequency of the ram base (not shown). It is furthermore possible to furnish the transmission mechanism with various transmission ratios which can be selectively rendered operative whenever there is a possibility of the ram being installed on bases that have frequently changing characteristics. As can be concluded from the foregoing description of the erection or construction of the ram, in an embodiment constructed in accordance with the invention, it is also possible without much difficulty to replace a defective structural component thereof with another.

Since the exciters **36** are of the same construction, when several rams are employed, it is necessary that only one structural component of this type should be stocked as a replacement; this is also true for the motors **5'**, **5''**. If one electric motor should fail, the ram under certain circumstances can be operated further with the one remaining motor only and without stopping the ram entirely, if at that time the available power is sufficient for maintaining running operation. It can consequently be directly concluded therefrom that for specific loads for which only half of the driving power is necessary, one drive motor can be installed right from the start, which makes it unnecessary for both drive motors to be replaced with others having half the rated power.

The invention is not limited to the embodiment shown and described but rather can also be used for other vibratory power devices in which for example no directional oscillations are necessary.

I claim:

**1.** For use with a vibratory power device, the combination comprising centrifugal exciter means, drive motor means, and transmission means operatively interconnecting said centrifugal exciter means and said drive motor means for transmitting a driving force from said motor means to said centrifugal exciter means, and skeletal supporting structure for carrying said centrifugal exciter means, drive motor means and transmission means, said centrifugal exciter means, motor means and transmission means each comprising modular units detachably mounted on said skeletal supporting structure and being individually replaceable independently of the other modular units and while the other modular units remain attached to said skeletal structure.

**2.** For use with a vibratory power device, the combination comprising centrifugal exciter means, drive motor means, and transmission means operatively interconnecting said centrifugal exciter means and said drive motor means for transmitting a driving force from said motor means to said centrifugal exciter means, and a skeletal support structure comprising first support means for carrying said centrifugal exciter means and said drive motor means, and second support means for supporting said transmission means, said centrifugal exciter means, motor means and transmission means each comprising modular units detachably mounted on said skeletal supporting structure and being individually replaceable independently of the other modular units and while the other modular units remain attached to said skeletal structure.

**3.** In combination with a vibratory power device, an assembly for producing directional oscillations, said assembly comprising skeletal supporting structure, a pair of centrifugal exciters having contrarotating unbalance weights, a pair of drive motors and transmission means all carried by said skeletal supporting structure, said transmission means operatively connecting said centrifugal exciters to said drive motors respectively for transmitting a driving force from said motors to said exciters, said transmission means also operatively connecting said centrifugal exciters to each other, said centrifugal exciters, said drive motors and said transmission means each being modular units detachably mounted on said skeletal supporting structure and being individually replaceable independently of the other modular units and while the other modular units remain atached to said skeletal structure.

**4.** In combination with a vibratory power device, an assembly for producing directional oscillations, said assembly comprising skeletal supporting structure, a pair of centrifugal exciters having contrarotating unbalance weights, a pair of drive motors and transmission means all carried by said skeletal supporting structure, said transmission means operatively connecting said centrifugal exciters to said drive motors respectively for transmitting a driving force from said motors to said exciters, said transmission means comprising a gear train operatively connecting said centrifugal exciters to each other, said centrifugal exciters, said drive motors and said transmission means each being modular units detachably mounted on said skeletal supporting structure and being individually replaceable independently of the other modular units and while the other modular units remain attached to said skeletal structure.

**5.** For use with a vibratory power device, the combination comprising centrifugal exciter means, drive motor

means and transmission means operatively interconnecting said centrifugal exciter means and said drive motor means for transmitting a driving force from said motor means to said centrifugal exciter means, a skeletal supporting structure including first support means comprising support components superimposed on one another for carrying said drive motor means and said centrifugal exciter means, and second support means located laterally to said first support means for supporting said transmission means, said centrifugal exciter means, motor means and transmission means each comprising modular units detachably mounted on said skeletal supporting structure and being individually replaceable independently of the other modular units and while the other modular units remain attached to said skeletal structure.

6. In a combination according to claim 5, the support components of said first support means comprising a plurality of spindles and a housing resiliently suspended from said spindles, and said second support means comprising a plurality of fasteners securing said transmission mean to said housing.

7. An assembly according to claim 4, wherein each of said drive motors is replaceable independently of the other and said drive motors are connected to one another only through said transmission means.

8. In a combination according to claim 1, clutch means provided respectively between said transmission means and said centrifugal exciter means and between said transmission means and said drive motor means.

9. Vibration exciting apparatus comprising a spring-mounted assembly including, in combination, skeletal support means and centrifugal exciter means, drive motor means and transmission means carried by said support means, said transmission means operatively interconnecting said centrifugal exciter means and said drive motor means for transmitting a driving force from said motor means to said centrifugal exciter means whereby oscillation of said spring-mounted assembly is excited by



said centrifugal exciter means, said exciter means, motor means and transmission means each comprising modular units detachably mounted on said skeletal supporting structure and being individually replaceable independently of the other modular units and while the other modular units remain attached to said skeletal structure.

10. For use with a vibratory power device, an assembly for producing directional oscillations, said assembly comprising a skeletal supporting structure, a pair of centrifugal exciters having contrarotating balance weights and a pair of drive motors carried by said skeletal supporting structure, and transmission means also carried by said skeletal supporting structure at one side thereof and operatively connecting said centrifugal exciters to said drive motors respectively for transmitting a driving force from said motors to said exciters, said transmission means also operatively connecting said centrifugal exciters to each other, said centrifugal exciters, said drive motors and said transmission means each being modular units detachably mounted on said skeletal supporting structure and being individually removable and replaceable at said one side of said skeletal supporting structure independently of the other modular units and while the other modular units remain attached to said skeletal structure.


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