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VIBRATORY ROLLER

Filed July 30, 1962 2 Sheets-Sheet 1

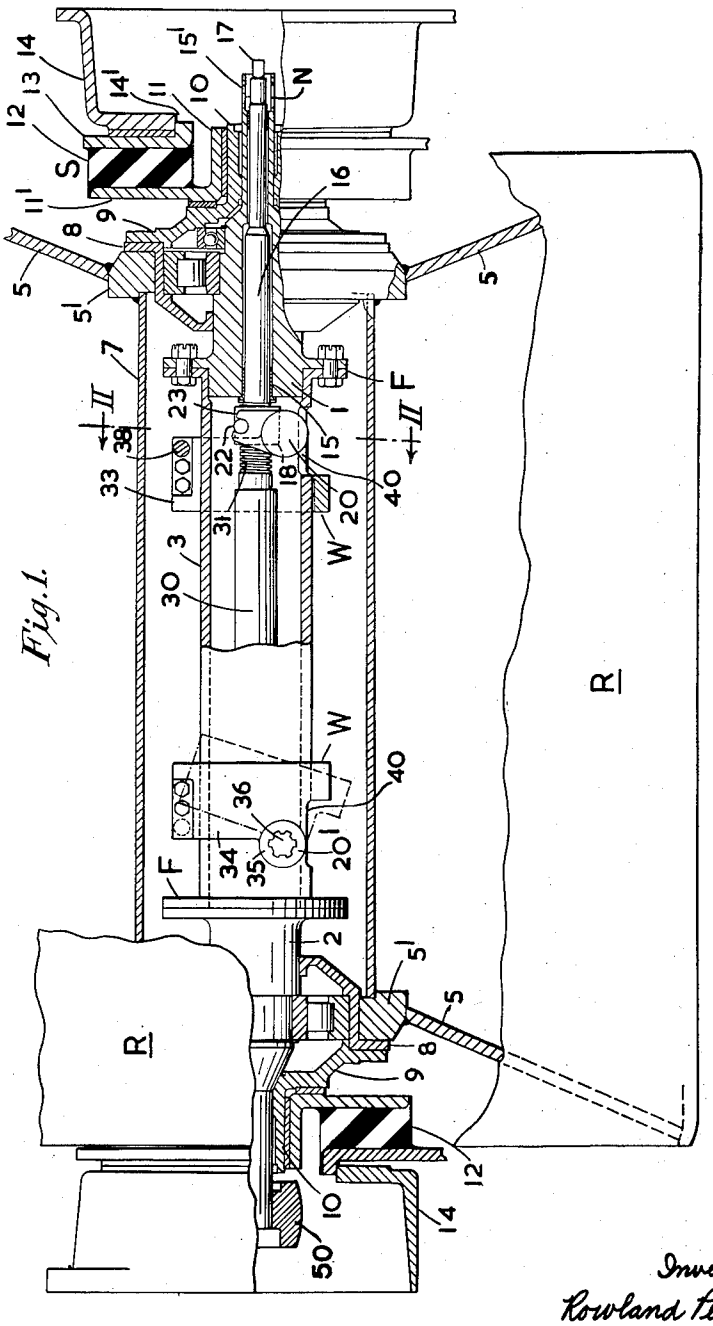

Fig. 1.

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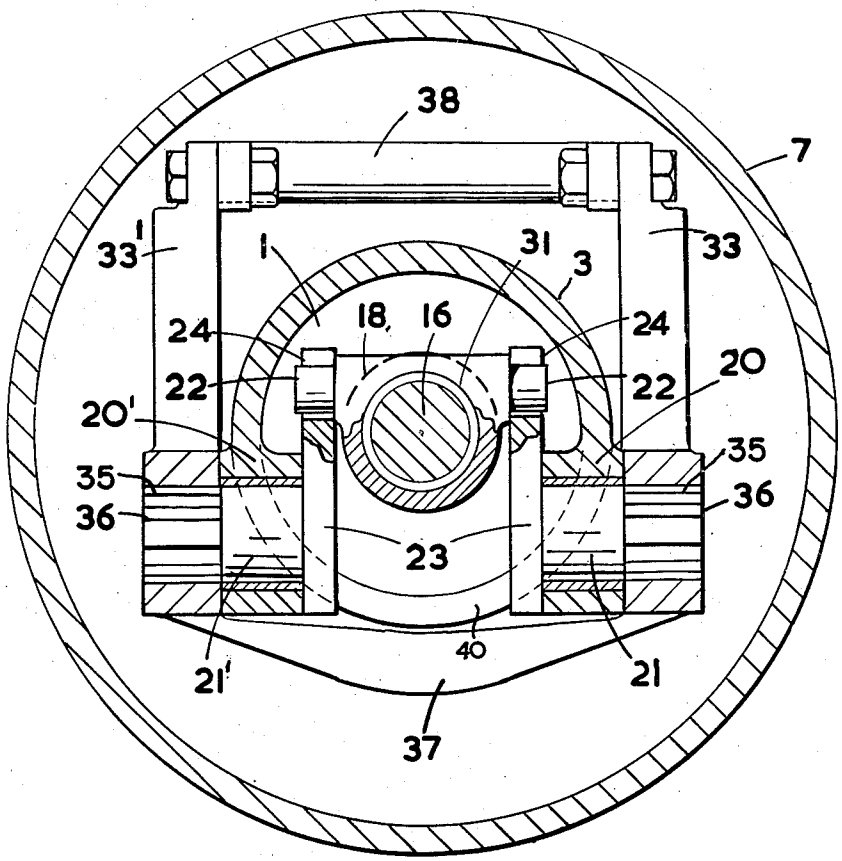
Filed July 30, 1962 2 Sheets-Sheet 2

Fig. 2.



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VIBRATORY ROLLER

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This invention relates to road rollers which vibrate.

The use on a road roller of an out-of-balance shaft as the vibrating unit has certain advantages and it is now recognised that under certain operating conditions it is desirable for the amplitude of the vibrating unit to be adjustable in order that it can be varied to suit the characteristics of the ground undergoing compaction.

The assignee of the present applicant has, for many years, made use, in vibratory concrete compacting and finishing machines, of a vibrating beam having a high frequency vibrating unit with adjustable eccentric disc weights.

In a vibratory roller, the problem, facing the designer of a suitable variable amplitude unit, is mainly one of limitations of space and the use of a number of eccentrically mounted discs carried by the roller spindle, owing to the space taken up by the discs, and the difficulty of adjustment by control means, accessible from outside the roller shell, renders them totally unsuitable for the purpose.

The present invention has for its object a construction which is robust and will withstand the wear and tear to which such machines are subjected when in use and which, at the same time, is simple and can be manufactured at comparatively low cost.

According to one embodiment of the present invention, a variable amplitude unit for a vibratory roller comprises a shaft mounted in a roll shell, the mounting having stub axes on which the roll is free to rotate. Provided on the shaft is a pair or pairs of eccentrically operating weights, which are capable of angular displacement about independent parallel axes transverse to the shaft and so arranged as to counterbalance each other axially in all positions of adjustment. Preferably two axially spaced pairs of weights are provided and adjustment of each pair of eccentric weights is by means of members supported by the shaft and connected through lever mechanisms to their respective pairs of weights, movements being imparted to said members from a control rod or shaft extending through a bore in the shaft and accessible at one end from outside the roll shell.

The roller spindle may be in the form of a composite shaft consisting of two outer axle elements connected by a central sleeve, each axle element having a central bore in which the control rod is free to revolve.

The central sleeve provides a housing for the members and lever mechanisms by which adjustment of the eccentric weights is effected, the weights, which are mounted outside the sleeve, being arranged with the weights of each pair on opposite sides of the shaft.

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

FIGURE 1 is a transverse section showing the roller shell and variable amplitude unit.

FIGURE 2 is a transverse sectional view on an enlarged scale on the lines II—II of FIGURE 1.

In the drawings the roll shell is indicated at R and the roller embodies shear suspension mountings indicated generally at S, each mounting, as hereinafter described in detail, comprising two components having faces arranged in vertical planes to which is bonded a rubber block or blocks.

In this invention the vibratory shaft is provided with

eccentrically operated weights, indicated generally at W, the weights being capable of angular adjustment in order to vary the amplitude of vibration of the unit.

The vibratory shaft is made up of two axle components **1**, **2** joined to one another by a central sleeve **3**, the sleeve and components **2** and **3** having radial flanges by which they are secured to one another by fixing bolts.

The roll shell R comprises end plates **5** each secured by welding to a central ring **5'**, the rings **5'** at each end being spaced apart by a cylindrical distance piece **7** welded thereto.

Secured within each end ring **5'** of the roll shell is a bearing housing made up of two parts, an outer part **9** having a spigot **10**, and an inner part cap piece **8**, in which is formed a shoulder to locate in the ring **5'**. The parts **8**, **9**, **10** are duplicated at the other end of the roller and it will be seen that the axle elements **1**, **2** are mounted to revolve in suitable bearings within each bearing housing **8–9**.

Each shear suspension S comprises a flanged bush part **11** which journals the associated spigot **10**, and an outer ring part **13**, the bush **11** having a flange **11'** between which and the ring **13** an annular block **12** of rubber is bonded, the ring **13** in turn being supported by an end cap **14** on the end frames of the main frame. Each end cap **14** is connected to and thus constitutes a part of the roller frame. In each cap **14** is an aperture **14'** through each of which apertures **14'** the respective axle elements **1**, **2** and spigot **10** are accessible. The shaft assembly **1**, **3**, **2** is rotatable by a pulley **50** fixed to the shaft component **2**.

Each of the axle elements **1**, **2** is provided with an axial bore **15** to receive the opposite (reduced) ends **16** of a control rod **30** by which adjustment of the weights W is effected, as hereafter explained.

Referring also now to FIGURE 2, the central section **3** of the axle is formed with two pairs of bearing housings indicated respectively at **20**, **20'** each pair being axially spaced apart from each other. The bearing housings of each pair extend transversely to the axis of the shaft and are in alignment with each other so as to provide mountings for spindles **21**, **21'**, each spindle having an integral crank arm **23**. The arms **23** are positioned centrally, i.e. within the hollow of axle **3**, and have forked or slotted ends **24** for engagement with laterally projecting trunnion studs **22** on nuts **18**. The nuts **18** engage threaded portions **31** on the control rod **30**. The threads of one nut **18** and the cooperating threaded portion **31** of the control rod **30** are of one hand, and the threads of the other nut **18** and the cooperating threaded portion **31** of the control rod **30** are of the opposite hand. Therefore, on rotation of the control rod **30**, the nuts will be moved axially inwards or outwards according to the direction of rotation of the rod. The control rod can be rotated by means of a crank handle that can be engaged with a squared end **17** on control rod end **16** that projects beyond the outer end of a tubular extension **15'** of the axle element **1**.

The two eccentric weights W are arranged in pairs and comprise rectangular plates **33**, **33'** and **34** which are keyed, as indicated at **35**, to splines **36** on the outer ends of spindles **21**, **21** so that the weights of each pair lie on opposite sides of the shaft **1–3–2**.

In order to limit the maximum angular displacement of the weights they are interconnected by U-shaped straps **37**, each having a cross bar **38** which acts as a stop.

It will be seen that the central sleeve **3** provides a housing for the members and lever mechanisms by which adjustment of the eccentric weights **33**, **33'**, **34** is effected, while the weights, which are mounted outside the sleeve, are arranged in pairs with the weights of each pair on opposite sides of the sleeve.

In operation the vibratory shaft **1–3–2** rotates with the weights W attached thereto in a fixed position as required and are adjusted through the control rod **30** by means of a handle (not shown) attached to the squared end **17**.

It will be obvious that rotation of the control rod **30** will cause the nuts **18** to move either towards or away from one another depending upon the adjustment required.

Movements of the nuts **18** in an axial direction cause the levers **23** to rotate about their fulcrums on the spindles **21**, **21** in such a manner that each pair of weights **33**, **33'**, **34—34** which are attached to the spindles **21**, **21** will also rotate about these fulcrums.

With the weights in the extreme position as indicated by the dotted outlined position, maximum amplitude will be produced in the unit for the reason that the centre of gravity of the eccentric weights is offset from the centreline of the shaft to the greatest extent possible, and therefore produces the maximum out-of-balance moment. It will be obvious from the description that the two pairs of weights **33**, **33'**, **34** will move in unison to produce greater or lesser out-of-balance moments as required.

The advantages gained from the vibrator unit of this invention are:

(1) Two sets of eccentric weights only are used as opposed to the more expensive and complex system of using heavy eccentric shafts.

(2) The arrangement of eccentric weights pivotally mounted on an axis at right angles to that of the shaft enables exceedingly light and simple weights to be used.

(3) The out-of-balance moments of the weights as arranged produce counterbalanced axial forces in the vibrating shaft such that no locking device is required and the clearances between the nuts **18** and the control rod **30** are taken up by the dynamic force present, resulting in the elimination of possible chatter and wear.

(4) Variation of the setting can be carried out simply and with little effort.

A simple visual setting indicator viewable through a slot such as shown at N, may be incorporated.

For the purpose of adjustment access slots **40** are provided in the central section **3** of the vibratory shaft opposite the threaded portions mounting the collars or nuts **18**.

What is claimed is:

1. In a vibratory roller having a roller frame, the combination of a shaft; means journalling said shaft to rotate with respect to the roller frame; a roll shell journalled to revolve on the shaft; pairs of eccentrically operating weights mounted on said shaft to set up an unbalance, the weights of each of said pairs being mounted respectively on opposite sides of the shaft for pivotal movements about an axis transverse to the axis of said shaft whereby to move in the axial direction of the shaft; means for effecting adjustment of said weights including a rotatable control rod extending through said shaft, said rod being provided with oppositely threaded portions proximate to each pair of weights; and means on each of said weights cooperating with the respective threaded portions of the control rod, whereby rotation of the said rod will angularly adjust the weights in equal and opposite directions.

2. Variable amplitude unit for a vibratory roller including a roll shell, said unit comprising a shaft having bearing surfaces at its ends for journalling the roll shell and including a central hollow section; pairs of eccentrically operating weights carried by the shaft for setting up an unbalance, the weights of each of said pairs being mounted respectively on opposite sides of the hollow section of said shaft for pivotal movements about an axis transverse to the axis of said shaft whereby to move in the axial direction of the shaft; control means for effecting adjustment of said weights including a rotatable rod extending through the hollow section of said shaft and having threaded portions proximate to each pair of weights, each end section of the shaft having an axial bore to receive said rod; threaded members mounted on the threaded portions of the control rod for movement axially with respect to said control rod; and means interconnecting said members respectively with each pair of weights for effecting angular adjustments of the weights in equal and opposite directions in response to rotation of said rod.

3. Variable amplitude unit as claimed in claim 2 in which the hollow section of said shaft is provided with bearing housings, and in which said interconnecting means comprises spindles mounted in said housings respectively; and means connecting said spindles respectively to said members and to said weights.

4. In a vibratory roller having a roller frame, the combination of a vibratory shaft; a roll journalled to revolve on said vibratory shaft, said roll including a shell having end plates, each end plate including a two-part housing, one part of said housing having a bearing by which the shell is journalled to revolve on the vibratory shaft, and the other part of said housing having a spigoted end by which the roll is journalled within the roller frame; pairs of eccentrically operating weights mounted on said shaft to set up an unbalance, the weights of each pair being mounted respectively on opposite sides of the shaft for pivotal movements about an axis transverse to the axis of said shaft whereby to move in the axial direction of said shaft; means for effecting adjustment of said weights including a rotatable control rod extending through the vibratory shaft, said rod being provided with threaded portions proximate to each pair of weights; and means operatively connecting the weights of said pairs respectively with the threaded portions of said control rod, whereby rotation of the control rod will effect angular adjustment of the weights in equal and opposite directions.

5. A vibratory roller as claimed in claim 4 having a resilient suspension comprising a bush member within which the spigoted end of the roller end plate housing is carried; a second member attached to the roller frame, each of said members having a vertical face; and a member of resilient material connecting said vertical faces.

6. In a vibratory roller having a roller frame, the combination of a shaft; means journalling said shaft to rotate with respect to the roller frame; a roll shell journalled to revolve on said shaft; pairs of eccentrically operating weights mounted on said shaft in spaced relation axially of said shaft to set up an unbalance, the weights of each of said pairs being mounted respectively on opposite sides of said shaft for pivotal movements about an axis transverse to the axis of said shaft whereby, upon pivotal movement, the weights will move also in the axial direction of the shaft; and means for effecting an axial adjustment of said weights including a movable control rod extending through said shaft; and means connecting said control rod respectively to said pairs of weights and being responsive to movement of said rod for rocking said pairs of weights about their respective transverse axes.

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