June 30, 1953 C. JACKSON 2,643,595

MACHINE FOR COMPACTING GRANULAR MASS MATERIAL

Filed Nov. 3, 1947

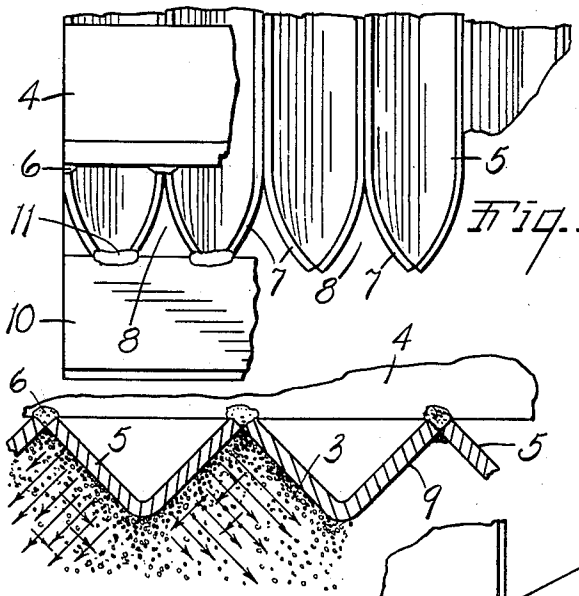


Fig. 3.

Fig. 4.

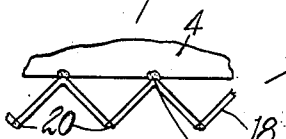


Fig. 6.

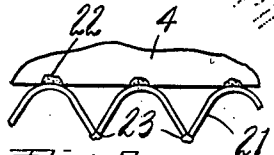


Fig. 7.

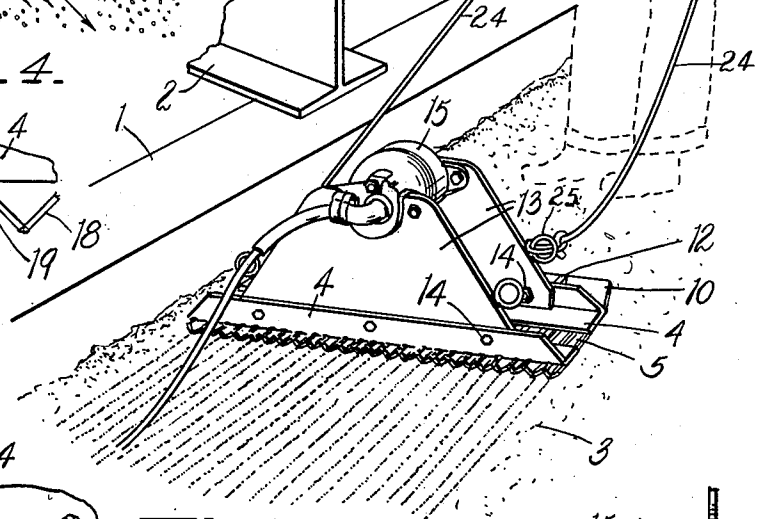


Fig. 1.

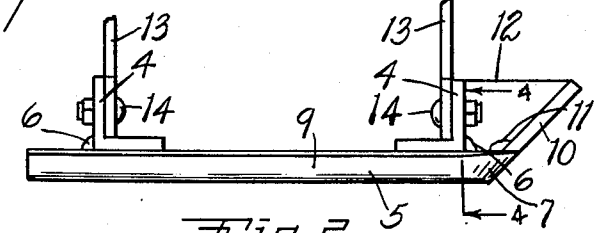


Fig. 2.

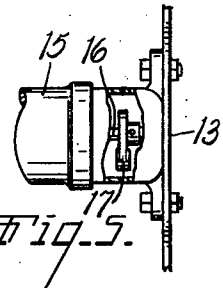


Fig. 5.

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MACHINE FOR COMPACTING GRANULAR MASS MATERIAL

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5 Claims. (Cl. 94—48)

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This invention relates to improvements in machine for compacting granular mass materials.

The main objects of this invention are:

First, to provide a machine for compacting granular mass materials such as gravel, sand or soil for fills in bridge abutments, pavement foundations and in other relations where it is desired to compact the mass and minimize sinking and other displacement when subjected to loads and vibrations incident to traffic.

Second, to provide a machine for this purpose which is highly efficient and at the same time light in weight and easily manipulated.

Third, to provide a machine of this character which is self-propelling in ordinary use at a speed desirable for the compacting of loose granular materials deposited as a mass.

Fourth, to provide a machine for compacting mass granular materials such as sand, gravel, earth and the like which results in the efficient compacting thereof with a minimum of manual labor.

Objects relating to details and economies of the invention will definitely appear from the description to follow. The invention is defined in the claims.

A structure embodying the features of the invention and the manner of carrying out the invention is clearly illustrated in the accompanying drawing, in which:

Fig. 1 a fragmentary perspective view of a machine embodying my invention in operative relation to a mass of material to be compacted as a fill in a bridge abutment, the bridge abutment and fragments of a bridge being indicated.

Fig. 2 is a fragmentary side elevation view.

Fig. 3 is an enlarged fragmentary plan view illustrating certain of the structural details.

Fig. 4 is an enlarged fragmentary view with the shoe bars in section on a line corresponding to line 4—4 of Fig. 2, the vibratory action on the mass compacted being indicated by arrows.

Fig. 5 is a fragmentary plan view illustrating the mounting of the vibration producing element.

Fig. 6 is a fragmentary view of a modified form or embodiment of my invention.

Fig. 7 is a fragmentary view of a further modification or embodiment of the invention.

In the accompanying drawing 1 represents a bridge abutment and 2 fragments of a bridge. 3 represents the fill material for the abutment which commonly is gravel or a gravelly mixture of sand and earth or soil. While I have illustrated the machine in connection with the filling of a bridge abutment, it will be understood that it is adapted for compacting foundations of various

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mass material for pavements and the like. It is also useful in placing concrete foundations, asphaltic binders for pavements and the like.

The embodiment of the invention illustrated comprises a pair of base bars 4 disposed with their angles facing upwardly and inwardly or toward each other. To the under side of these base bars or bed members I secure a plurality of shoe bars 5 of angle section arranged with their angles facing upwardly and in edge to edge relation as illustrated in the drawing. These shoe bars are fixedly secured to the base bars by welding as conventionally illustrated at 6.

The forward ends of the arms of the shoe bars are converged at 7 as best shown in Fig. 3 providing inclined nose portions for the individual bars and forwardly expanding throat portions 8 for the downwardly facing channels 9 between the bars or formed by the bars. These channels are open from front to rear.

To guide the material to the shoe bars I provide a forwardly inclined nose plate 10 disposed with its upper edges upon the upper ends of the shoe bars at their front ends and welded thereto as indicated at 11. The nose plate is further supported by the brace plates 12 extending from the forward base bar to the nose plate and welded thereto, the welds not being indicated. This arrangement provides a shoe having a plurality of downwardly facing channels open from end to end thereof.

The plate-like pedestals or uprights 13 are bolted to the vertical arms of the base bars as at 14. These pedestals or uprights provide a support for the vibrating unit which consists of an electric motor designated by the numeral 15 and having a rotor 16 provided with an unbalancing weight 17. It will be noted that the axis of the rotor is arranged centrally relative to the shoe and longitudinally of the shoe with its unbalancing weight forward of the transverse center of the shoe. I use the term longitudinal as applied to the direction of travel of the machine although the shoe of the machine illustrated is of greater length transversely than longitudinally.

With this arrangement of the unbalanced rotor the mass compacted is subjected to vibrations directed to a substantial extent as indicated by the arrows in Fig. 4 although it will be understood that as a matter of fact the vibrations imparted to the material by the walls of the shoe bars which are vibrated in a more or less orbital path are delivered to the material in various directions. The arrangement of the unbalanced rotor as described acts to propel the

machine forwardly, the commercial machine illustrated in the drawing being propelled across the mass treated at a rate of four or five feet per minute. The operator guides the machine preferably by means of flexible cables **24** which serve as vibration absorbers, these cables being connected to the eyes **25** on the ends of the front upright or pedestal **13** so that the machine may be guided by a pull on one or the other of the cables. If desired the cables may be used optionally for propulsion of the machine.

In the embodiment of the invention shown in Fig. 6 the angle shoe bars **18** are arranged to face downwardly and are welded to the base bars at **19**, the edges of the adjacent shoe bars being welded at **20**. The embodiment shown in Fig. 4 is preferred as the shoe bars may be effectively welded to the base bars, and it is not necessary to weld the edges as is desirable in the embodiment shown in Fig. 6.

The arrangement shown in Fig. 7 is the same as that shown in Fig. 6 with the exception that the shoe bars **21** are of curved section and they are welded to the base bars at **22**, adjacent shoe bars being welded at their meeting edges **23**. It will be noted that the bars are arranged so that the face of the shoe consists of a continuous series of parallel channels. The walls of the channels greatly increase the area of the shoe in contact with the material compacted. The engagement of the shoe with the material compacted tends to keep it in a straight path as it is advanced as the result of its own vibration.

The machine may be operated close to a wall or the like. The machine of this invention is especially desirable for use in compacting granular materials such as sand, cinders and gravel, and results in a compaction such that detrimental settlement does not occur under load, and relatively steep slopes may be employed without danger of slides.

Compaction by the use of the machine of this invention results in a certain amount of rearrangement and interlocking of the particles which cannot be accomplished by heavy loads or pressure compaction or pounding. Where a crushed mass is treated the tendency of the pieces to "arch" is largely overcome. I have used the term "high frequency" and have obtained satisfactory results at a frequency range of 2500 to 5000. It is desirable to vary the frequency with the material treated, but a frequency of 3500 to 4000 is satisfactory for most materials.

It is ordinarily desirable to take at least two passes of the machine over the material to be compacted, this insuring that the whole mass be subjected to the vibrations. In deep fills the machine is desirably used on successive layers of ten to fifteen inches in depth.

The machine illustrated is highly desirable for the practice of the invention.

Having thus described the invention what is claimed as new and desired to secure by Letters Patent:

1. In a machine of the class described, the combination of a vibratory shoe comprising base bars, a plurality of shoe bars of angle section welded in edge to edge relation on the under sides of said base bars with their angles facing upwardly, said shoe bars coacting to provide a plurality of downwardly facing channels open from front to rear of the shoe and having downwardly diverging walls, the arms of the shoe bars being converged towards each other at their front ends providing nose portions having side walls diverging from each other from the front ends of the nose portions rearwardly and providing forwardly expanding throats for the channels, a forwardly inclined nose plate secured at its lower edge to the upper edges of the shoe bars at their front ends, uprights mounted on said base bars, said base bars being disposed adjacent the front and rear ends of said shoe bars, means for vibrating said vibratory shoe at high frequency comprising an electric motor having a rotor provided with an unbalancing weight centrally mounted on said uprights in substantially spaced relation from the shoe bars and with the axis of the rotor disposed substantially parallel to said shoe bars and channels and with its unbalancing weight located forward a line disposed transversely of the shoe and centrally between the front and rear ends thereof, said shoe bars sloping upwardly at the forward ends thereof between said channels to facilitate forward movement of the shoe as the shoe is vibrated, said shoe bars terminating abruptly at the rear thereof for digging into the compacted material to prevent rearward movement of the shoe as the same is vibrated, said channels open from the front to the rear of the shoe facilitating forward travel of the shoe in a straight line as the shoe is vibrated, and flexible vibration absorbing cables connected in laterally spaced relation at the front of the machine for guiding and optionally for propulsion of the machine.

2. In a machine of the class described, the combination of a vibratory shoe comprising base bars, a plurality of shoe bars of angle section welded in edge to edge relation on the under sides of said base bars with their angles facing upwardly, said shoe bars coacting to provide a plurality of downwardly facing channels open from front to rear of the shoe and having downwardly diverging walls, uprights mounted on said base bars, said base bars being disposed adjacent the front and rear ends of said shoe bars, means for vibrating said vibratory shoe at high frequency comprising an electric motor having a rotor provided with an unbalancing weight centrally mounted on said uprights in substantially spaced relation from the shoe bars and with the axis of the rotor disposed substantially parallel to said shoe bars and channels and with its unbalancing weight located forward a line disposed transversely of the shoe and centrally between the front and rear ends thereof, said shoe bars sloping upwardly at the forward ends thereof between said channels to facilitate forward movement of the shoe as the shoe is vibrated, said shoe bars terminating abruptly at the rear thereof for digging into the compacted material to prevent rearward movement of the shoe as the same is vibrated, said channels open from the front to the rear of the shoe facilitating forward travel of the shoe in a straight line as the shoe is vibrated, and flexible vibration absorbing cables connected in laterally spaced relation at the front of the machine for guiding and optionally for propulsion of the machine.

3. In a machine of the class described, the combination of a vibratory shoe comprising base bars, a plurality of shoe bars of angle section fixedly mounted in edge to edge relation on the under sides of said base bars and coacting to provide a plurality of downwardly facing channels open from front to rear of the shoe, means for vibrating said vibratory shoe at high fre-

quency carried by said base bars and comprising a rotor provided with an unbalancing weight centrally disposed between the opposite sides of the shoe and with the axis of the rotor disposed substantially parallel to said shoe bars and channels and with the unbalancing weight located substantially nearer to the forward end of the shoe than to the rear end thereof, said shoe sloping upwardly at the forward end thereof between the channels thereof, said channels open from the front to the rear of the shoe engaging the compacted material facilitating forward travel of the shoe in a straight line as the shoe is vibrated, and vibration absorbing means connected in spaced relation at the front of the machines for guiding and optionally for propulsion of the machine.

4. In a machine of the class described, the combination of a shoe provided with a plurality of downwardly facing channels having downwardly diverging side walls and open from the front to rear of the shoe, and means for vibrating the shoe at a high frequency comprising a rotor having an unbalancing weight, the axis of said motor being disposed parallel to said channels, and means for supporting the rotor and unbalancing weight on the shoe in substantially vertically spaced relation from the shoe, said unbalancing weight being disposed closer to the forward end of the shoe than to the rear end thereof, said shoe at the forward ends of the channels thereof sloping upwardly to facilitate forward travel of the shoe as the shoe is vibrated, said channels open from the front to the rear of the shoe engaging the compacted material facilitating travel of the shoe forward in a straight line as the shoe is vibrated.

5. In a machine of the class described, the combination of a shoe provided with a plurality

of downwardly facing channels open from front to rear of the shoe, and means for vibrating the shoe at a high frequency comprising a rotor having an unbalancing weight, the axis of said motor being disposed parallel to said channels, and means for supporting the rotor and unbalancing weight on the shoe in substantially vertically spaced relation from the shoe, said unbalancing weight being disposed closer to the forward end of the shoe than to the rear end thereof, said shoe at the forward ends of the channels thereof sloping upwardly to facilitate forward travel of the shoe as the shoe is vibrated, said channels open from the front to the rear of the shoe engaging the compacted material facilitating travel of the shoe forward in a straight line as the shoe is vibrated.

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