

April 27, 1937.

F. P. SLOAN

2,078,290

COMPACTING APPARATUS

Filed March 14, 1934

3 Sheets-Sheet 1

Fig. 2.

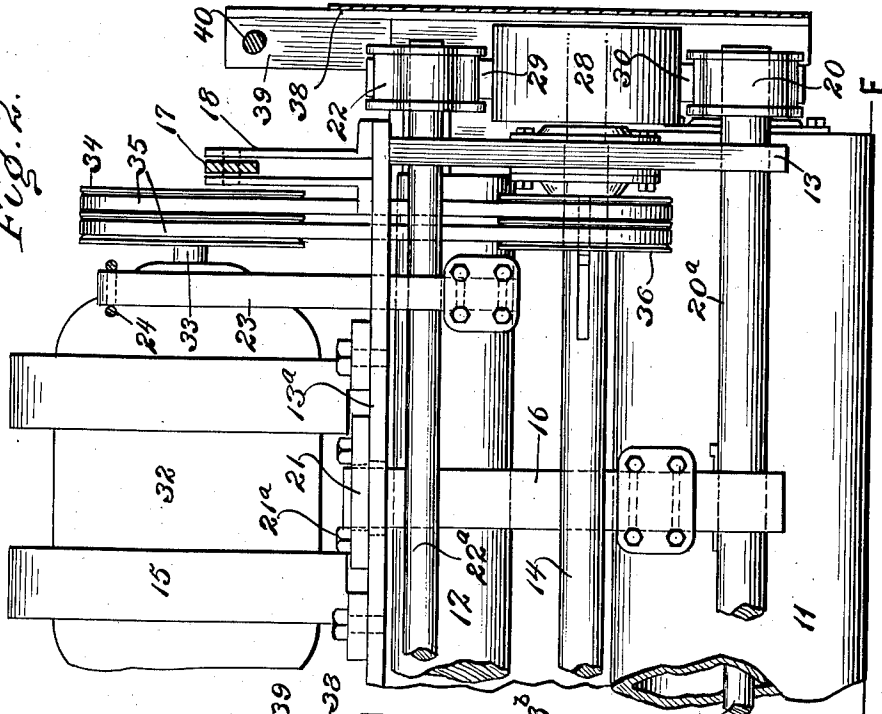
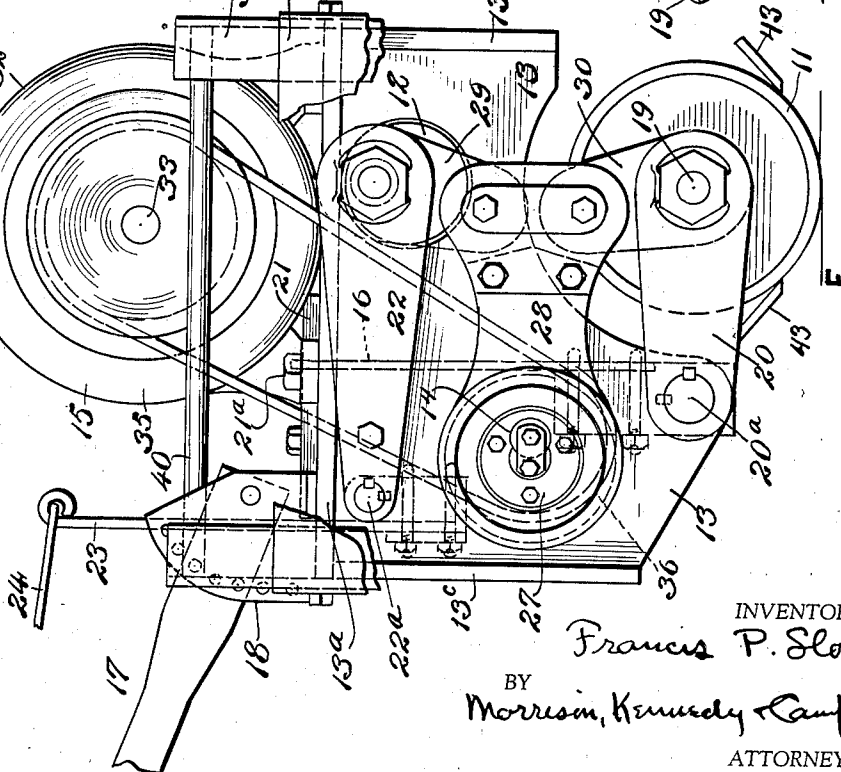


Fig. 1.



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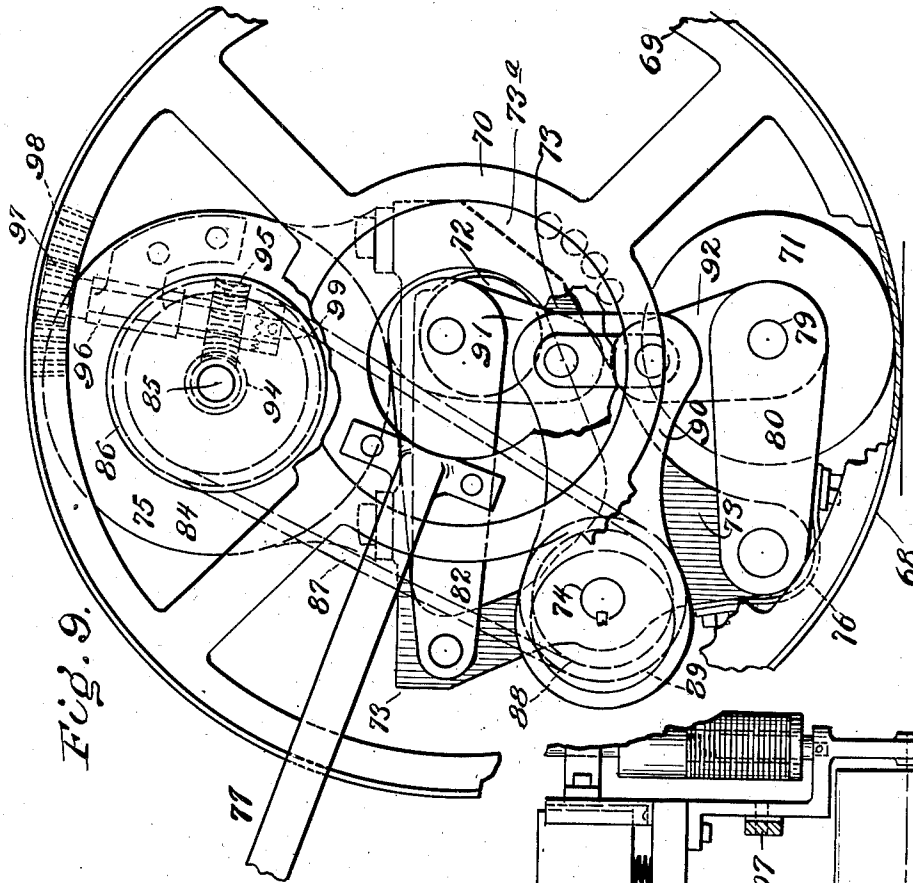
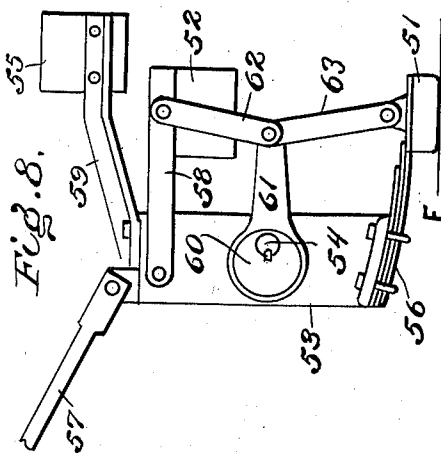
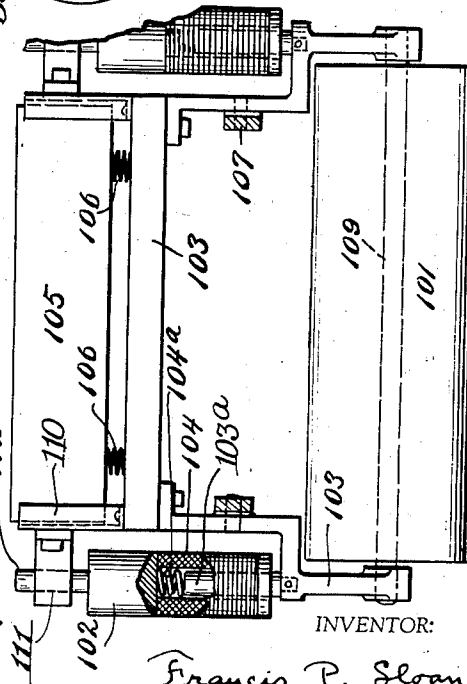


Fig. 10. 112



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## UNITED STATES PATENT OFFICE

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## COMPACTING APPARATUS

Francis P. Sloan, Scarsdale, N. Y.

Application March 14, 1934, Serial No. 715,417

14 Claims. (Cl. 94—48)

This invention is a novel compacting apparatus; having utility for example in the compacting of a concrete or similar surface upon which the base of the apparatus rests and over which it is advanced during the compacting operations, a typical case being the compacting of a floor surface in process of production such as a topping or layer of cement mortar, the word floor intending to include a pavement or other similar surface upon which the apparatus may rest and over which it may travel. An instance of the class of apparatus referred to is shown in my copending prior application Serial No. 603,834, filed April 7, 1932, patented April 17, 1934 No. 1,955,101 of which the present application is a part continuation as will be hereinbelow more fully set forth.

The general objects of the present invention are substantially as set forth in said prior application, but the present invention deals further with the special objects of increasing the effectiveness of the compacting action, improving the facility of advancing the apparatus across the floor surface, usually but not necessarily effected by man power, providing adjustment at will of the degree of compacting force and permitting adjustment of the angle at which the force is applied as an assistance to the travel of the apparatus. Other objects and advantages of the invention will be pointed out in the hereinafter following description of an illustrative embodiment of the features of the present invention or will be manifest to those conversant with the subject. To the attainment of such objects and advantages the present invention consists in the novel compacting apparatus and the novel features of combination, arrangement and construction herein illustrated or described.

In the accompanying drawings Figure 1 is a side elevation of a compacting apparatus embodying the principles of the present invention, with the near side frame plate or casing wall omitted to show the interior mechanism.

Fig. 2 is a partial rear elevation of the apparatus shown in Fig. 1, that is, looking from the left side of Fig. 1, being the point of view of the workman manipulating the apparatus.

Fig. 3 is an exterior side elevation on a reduced scale indicating the complete apparatus including the handle bar.

Fig. 4, in perspective on a still further reduced scale, shows a skeleton type of frame or casing which may be employed for maximum lightness.

Fig. 5 is a side elevation showing the principal mechanical elements of the apparatus in their

operative relation for explanation of the underlying principles of the improvement.

Fig. 6 is a diagram showing, much exaggerated, the effect of the action of this invention on the surface or floor, while Fig. 7 is a corresponding diagram showing in principle the compacting and advancing movements of the base.

Fig. 8 is a diagram of the same character as Fig. 5 showing certain modifications falling within the invention.

Fig. 9 is a side elevation of certain other modifications of structure and operation.

Fig. 10 is a similar side elevation of a modification wherein the actuating force is electromagnetic in character.

The principles may be preliminarily explained by reference to the apparatus diagram Fig. 5 and the action diagrams Figs. 6 and 7; whereon F is the floor line, F' the floor area before compacting and F<sup>2</sup> the floor area after compacting, the apparatus being assumed to travel to the right, although manifestly it may be caused to travel leftward, or preferably alternately right and left to cover a given floor area.

The essential elements of the apparatus comprise the following: A base 11 rests continuously and immediately upon the floor while traveling over it, the base here being shown as a roller or cylinder in preference to a sliding base as in said prior patent. The mortar or other concrete should have a relatively stiff consistency such as to support directly a rolling compactor without impairment. A mass 12 having substantial mass and inertia is movably arranged higher than and substantially above the base and will sometimes be described as the live load, serving as a reaction abutment for the compacting thrusts upon the base. Some sort of general support is desirable, resting wholly or partly upon the base, shown as a frame 13. On the frame is mounted a driver or operating member 14 in the form of a power shaft, from which the operating movements of the mass and therefore the base are taken, the shaft being suitably rotated at high speed from a motor or other power source not shown in this diagram.

Preferably there is provided a gravity weight 15 in the nature of a dead load, in accordance with said prior patent, this having a resilient relation to the base, and which may conveniently carry a motor as a part of the dead load, with connections from the motor to the shaft, as illustrated in other figures. Associated with the weight 15 is a resilient element between the weight and the base, in accordance with said

prior patent, so that the weight will not impede the compacting operations of the base, such resilient element being shown as a spring 16 interposed between the base and the frame, although the frame might be mounted without resilience on the base, if light, and resilience provided instead between the frame and the weight, or at both points. A damping means or snubber for this resilience may be used but is rendered unnecessary by designing the weights, speed and resilience to avoid resonance. A propelling means completes the essential elements, this being shown as a handle 17 extending to a convenient height for the manipulation by man power; but there may be a power means such as connections from the same power source already mentioned. To assist in upholding the weight at the handle a rear roller or wheel could be provided.

The diagram Fig. 5 shows further details which may be described as follows. The base 11 is shown as a rolling cylinder and its axle 19 is shown as connected to the frame by a swingable arm 20. The resilient spring 16 has one end connected to the arm and the other end mounted by a suitable anchor 21 to the frame; by this the base through the spring supports the frame and dead weight, at least partially. The live load or inertia mass 12 also is conveniently mounted on the frame for its up and down movements, in a floating position, by means of an arm 22; and to permit the workman to modify the inertia effect of the mass there is shown a resilient element or spring 23 connected to the arm 22, with a connection or chain 24 extending to the workman so that by pulling this chain he may relieve the full effect of the mass. The frame is shown as having a frontward extension 25 on which the dead weight 15 is mounted, thus bringing the weight approximately above or even somewhat forward of the base, thus reducing the effort of the workman in sustaining his end of the apparatus.

Various mechanical means may be employed to communicate the actuating force from the driver or shaft 14 to the base 11 and mass 12, such as cams, gears, eccentrics, etc., to cause rapid intermittent separating thrusts between mass and base; thus an eccentric or crank 27 is shown mounted on the drive shaft, communicating the power through a rod or pitman 28 to the connecting pivot of upper and lower toggle links 29 and 30, the far pivots of which are connected to the base and mass or to the arms carrying them. As the toggles are straightened alternately from one or both sides of alinement they thrust upward against the weight and downward against the base the latter thus receiving intermittent compacting impulses. In the aspect of an up-and-down reciprocation or lineal action the invention is believed to be novel irrespective of the rolling character of the base. The device comprising the links 29, 30, operating between the rolling base 11 and the inertia mass 12 may be described as a toggle joint, meaning a link assemblage like an elbow, operated by applying the power at the junction or hinge, thus both changing the direction of motion and giving great mechanical advantage.

The following features disclosed herein are disclosed but not specifically claimed in said prior patent, and to the extent of such features this application is a continuation, namely: the feature of a roller as a base rollable over the floor during compacting and giving support to the operating means; and the actuation of the inertia

mass relative to the base in an up-and-down manner without revolution, that is, a lineal reciprocation, as by a cam, eccentric or solenoid, giving a straight line reaction with the base.

Fig. 6 shows exaggerated the nature of the work performed with a cylindrical base or roller. A series of successive shallow grooves or depressions are shown, which are practically negligible and of no detriment to the produced surface. The speed of rightward travel may be considered as coordinated with the frequency of compacting operations as to space the depressions in the regular manner shown; after each action the roller advancing one space before the next action. Practically the compacting actions will overlap and the groove effect disappear. A base consisting of a transverse bar with its lowest portion flat would substantially avoid even these depressions. As the groove depressions are exaggerated in depth in Fig. 6 the roller cannot be illustrated without many times reducing its relative size.

Fig. 7, directly beneath Fig. 6, shows diagrammatically the corresponding movements of the base. Each separating thrust of the mechanism moves upwardly the live load to a substantial extent and thrusts downwardly on the base to an effective extent, indicated by the downwardly pointing arrows in the diagram. Following each such compacting thrust the base then travels forward and must roll or slide at a slight upward slant from out of the compacted area or depression and on to a new surface, for repetition of action.

The embodiment in Figs. 1, 2 and 3 is in substantial accord with the principles explained by the diagrams Figs. 5, 6 and 7. Above the rolling base 11 is the inertia mass 12, both connected with the supporting frame 13 shown as a box-like structure, the main or side walls 13 of which are connected by top wall 13<sup>a</sup>, front wall 13<sup>b</sup> and rear wall 13<sup>c</sup>. As this structure may be unduly heavy the frame in practice will be made on the principles shown in Fig. 4 where the side and top walls are of skeleton construction, and may be composed of light metal, and the front and rear walls omitted; if then it be desired to enclose the mechanism light sheet metal or non-metallic panels may be attached to the frame.

Continuing the description on Figs. 1, 2 and 3 the power shaft 14 has roller or other bearings in the frame. The dead weight in this embodiment comprises the frame, resiliently mounted on the base, and includes also the driving motor 15 mounted on the top wall of the frame for this purpose. The spring 16 provides the resilience between the base and the frame, so that the dead load does not impair the compacting operations. The propelling handle 17 is forked, having an extension attached to the frame at each side of the apparatus; and it is connected to the frame by an adjusting device 18 at each side permitting the slant of the handle relative to the frame to be altered, thus changing the angle of reaction between the base and inertia mass, which also can be momentarily altered by the workman lifting or lowering the handle bar at the rear end of the handle. The axle 19 of the cylinder is mounted on a pair of opposite arms 29 pivoted to the frame, the latter held in floating relation to the base by the spring 16, which may be of any type, but is shown as a plate spring extending upwardly from the arms, or rather from a collar on the pivot axle 20<sup>a</sup> of the arms, the upper end of the spring being fixed by an anchor de-

vice or clip 21 to the top wall of the frame, this anchor device for convenience shown as a plate adjustable longitudinally on the frame and secured by bolts 21<sup>a</sup> in such position as to insure that the frame will normally float at the proper elevation in relation to the base.

The inertia mass 12 is supported on a swinging arm 22, or an opposite pair of such arms fulcrumed on the frame by an axle 22<sup>a</sup>, and a spring 23 is secured by a collar to the axle, and extends upwardly to where it is connected by a chain 24 adapted to be pulled by the workman by a lever 24<sup>a</sup> mounted on the handle bar.

The driving shaft 14 carries an eccentric 27 operating through a pitman 28 extending to the toggle links 29 and 30, the latter in this embodiment being independently pivoted to the pitman to conserve space.

A motor 32 is shown, this being mounted on the frame top wall 13<sup>a</sup>, thus constituting part of the dead weight 15. Flexible drive from the motor to the shaft 14 may be as follows. The motor shaft 33 carries a sheave 34 over which travel belts 35 to a sheave 36 on the shaft 14.

Exterior to the frame 13 at each side may be provided a light outer wall or side plate 38 attached to the front and rear frame plates by upright angle irons 39 which are extended above the frame and carry at the opposite sides of the apparatus longitudinal bars 50 by which the apparatus may be lifted or transported.

To keep the rolling base clean there may be provided a pair of scrapers 43, as shown in Fig. 1, working in both directions, and as shown in Fig. 3 these scrapers may be mounted on a yoke 44 yieldingly supported preferably upon the arm 20 on which the roller itself is journaled.

As a specific instance the base may weigh 60 pounds, the inertia mass 60 pounds, and the dead weight 180 pounds. The rolling base may be 8 inches in diameter, and 20 inches long. The toggle may have a throw to cause  $\frac{1}{8}$  inch spread or separating action between base and mass. The shaft may turn 2400 R. P. M., giving 80 thrusts per second, and the travel may be 20 inches per second, or  $\frac{1}{4}$  inch per impacting thrust. As the mass reaches its low point at high velocity in each cycle and is suddenly reversed and raised, the reaction may depress the base say  $\frac{1}{8}$  inch into the surface. This causes contact and compacting over an area say 2 inches wide, which is repeated every  $\frac{1}{4}$  inch of travel, giving the result indicated in Fig. 6. The static pressure or gravity of the entire apparatus works with the intermittent compacting actions, and is adequate to hold down the base against lifting, the intermediate phase of the cycle serving for the next linear downward throw of the mass and the relaxing of the base while the latter advances and rides up upon the surface for the next compacting action. The straightening and bending of the toggle affords a simple and effective mode of applying the successive thrusts with mutual reaction between the base and mass, but an eccentric, cam, solenoid or the like can be caused to do the same. The spring 23 constitutes an adjusting means associated with the mass to modify its resistance to the power actuation, or to reduce its gravity pressure, thereby varying the compacting force of the successive thrusts against the base.

Fig. 8 shows certain features of modification. The base 51 is non-rolling and consists of a bar or plate of moderate length slidable over the surface, its under side substantially flat and obviat-

ing the formation of grooves as shown in Fig. 6. The base and the inertia mass 52 are both mounted on a frame 53 which also supports a drive shaft 54. A dead weight 55 in this case is shown mounted on an elongated frame extension 59 so as to overbalance somewhat the weight carried by the handle 57. Instead of mounting the base by a swinging arm on the frame, controlled by a spring, the base is mounted directly on a spring 56, which may be a leaf spring, attached to the frame. The inertia mass floats on a swingable arm 58. The shaft drives an eccentric 60 which operates through a pitman 61 to straighten and deflect the toggle links 62 and 63, thus causing relative up and down straightline thrusts as between the base and mass.

Fig. 9 shows an embodiment wherein the operating mechanism is mounted within instead of above the roller which constitutes the compacting base. The large external roller 68 is formed with an inward flange 69 and spokes terminating in a hub 70 which turns on a sleeve 73<sup>a</sup> to be described. Inside the hollow roller the compacting apparatus may be similar to that of Figs. 1 to 5. The interior thrusting roller 71 is opposed to an inertia mass 72, both connected with a skeleton frame 73 part of which is rigidly extended laterally as a sleeve 73<sup>a</sup> upon which the hub 70 of the outside roller turns. The drive shaft 74 is mounted on the frame and the dead weight 75 may include the frame and the motor thereon. A spring 76 is indicated between the arm 80 that carries the axle 79 of the interior roller 71 and the frame, the frame and supported parts thereby floating with resilient suspension upon the rollers 71 and 68. The propelling handle 77 may be rigidly fastened to the opposite ends of the sleeve 73<sup>a</sup>. The inertia mass 72 may be swung for up and down movement upon an arm 82.

The motor 84 operates through its shaft 85 and sheave 86 to drive a belt 87 applied to a sheave 88 on the shaft 74, which shaft carries an eccentric 89 operating through a strap 90 to actuate the toggles 91 and 92 as already described.

As a propelling means in lieu of, or supplemental to, the handle 77, there is shown a connection from the motor 84 to effect travel of the roller. This consists of a worm 94 on the motor shaft, driving at reduced speed a pinion 95 mounted on a shaft 96 which extends outwardly and carries a pinion 97 meshing with a crown gear 98 formed at the interior side of the flange 69 of the hollow roller. By this arrangement the motor tends to turn the rolling base clockwise, for rightward travel, and tends at the same time to rotate the frame and carried parts counterclockwise, thereby to press downwardly on the handle 77. Thereby the workman may modify the action by the position at which he holds the handle, and it is shown lowered sufficiently to cause the inside roller 71 to operate slightly forward of the lowest part of the outside roller. This tilts the line of compacting action from vertical to an incline which may afford assistance to the propulsion of the apparatus.

A slip clutch 99 may be introduced in the gear train 94-98 so that in case of obstruction the drive will release. When the motor is reversed and the roller is moving toward the workman the effect of the drive will be to lift and relieve the downward strain on the handle.

An electromagnetic embodiment of the principles hereof is indicated diagrammatically in Fig. 10 wherein the rolling base 101 and a pair of

inertia masses 102 cooperate substantially as already described, but with power supplied by an intermittent or alternating current. A support or frame element 103 is shown mounted on the axle 109 of the roller, and upstanding from this frame, at each end, is one of the two members of an electromagnetic actuator, namely the iron core 103<sup>a</sup>, which may or may not be polarized, and which is surrounded by a driving member or magnetic coil 104 attached below the inertia mass. To preserve the initial relation between the base and the mass a spring 104<sup>a</sup> may be interposed at any point, for example between each core and mass. A dead weight 105 is illustrated resting resiliently on the frame by means of springs 106; and a propelling handle 107 is indicated. The dead weight is shown guided for relative vertical movement by corner guide pieces or angles 110 upstanding from the top piece of the frame. From the guides 110 extend endwise a pair of guides 111, at each end, to guide the up and down movements of a rod 112 upstanding from the inertia mass. When an alternating current is passed through the coils 104 a series of impacting thrusts upon the rolling base is effected, giving substantially the operation and result already described.

Having described an illustrative embodiment of the invention and explained the much wider application of the principles involved, it is stated that it is not intended to limit the invention to disclose matters of construction and detail except to the extent set forth in the respective claims.

I claim:

1. A machine for compacting relatively stiff unset concrete flooring, comprising a rolling cylindrical base resting continuously upon the flooring in rolling contact with the concrete, a frame supported by said rolling base, an inertia mass located above the rolling base and having means movably mounting it on said frame for up and down movements, a mechanical device interposed between the inertia mass and rolling base and operable for causing up and down movements of the inertia mass with reaction against the rolling base, and power means carried by the frame and having connections to said device for operating said device at high speed; thereby causing rapid successive downward thrusts upon the rolling base during continuous contact of the base upon the flooring, and its rolling travel thereover.

2. A compacting machine as in claim 1 and wherein the frame is supported by resilient connections upon the rolling base, thereby not impeding the reactions between base and mass.

3. A compacting machine as in claim 1 and wherein the inertia mass is mounted on the frame in a floating manner for up and down guidance without substantial reaction upon the frame.

4. A machine as in claim 1 and wherein is a dead weight resiliently mounted and continuously applying its load to the base.

5. A machine as in claim 1 and wherein the inertia mass is mounted on the frame for substantially linear non-rotary up and down movements.

6. A machine for compacting relatively stiff unset concrete flooring, comprising a compacting base resting continuously upon the flooring in direct contact with the concrete, a frame supported resiliently upon said base, an inertia mass located above the base and mounted movably on said frame for up and down movements, a me-

chanical device interposed between the inertia mass and base and operable for causing up and down movements of the inertia mass with reaction against the base, and power means carried by the frame and arranged for operating said device at high speed; thereby causing rapid successive downward compacting thrusts upon the base during continuous contact of the base upon the flooring, and its travel thereover, the resilient support of the frame upon the base relieving the latter from substantial retarding by the former in its compacting actions; while the dead weight of the frame imposes a continuous gravity pressure upon the base supplemental to the compacting thrusts thereof.

7. Apparatus as in claim 6 and wherein the mechanical device consists of a toggle joint with its links connected respectively to the base and mass, and the power means operating at the hinge of the toggle joint whereby the mechanism acts with non-rotary reciprocation in each cycle to thrust upward the mass and downward the rolling base and then cause return of the mass and relaxation of the compacting thrust upon the rolling base.

8. Apparatus as in claim 6 and wherein the frame has a propelling handle for a walking operator, and means to adjust the angle of the handle with respect to the frame to tilt the frame and adjust the handle to the hands of the operator.

9. A compacting apparatus for operation upon relatively stiff unset concrete flooring, comprising a base in the form of a cylinder adapted to roll while resting continuously and immediately upon the surface of the floor to be compacted, a frame supported by the rolling cylinder base, an inertia mass above the base and having means movably mounting it on the frame to reciprocate up and down in a substantially straight path, without rotation, a mechanical device between the base and mass, and power mechanism mounted on the frame and operating through said device to reciprocate the mass at high speed with reaction against the rolling base thereby to cause intermittent downward thrusts upon the rolling base, whereby during rolling travel the base delivers successive compacting actions upon the floor surface.

10. A compacting apparatus for operation upon relatively stiff unset concrete flooring, comprising a base adapted to rest continuously and immediately upon and travel upon the surface of the floor to be compacted, an inertia mass floatingly mounted on the frame above the base for linear up-and-down movements without rotation, power means on the frame, and a toggle joint operated by said power means and having its lower and upper links connected with said base and mass to cause rapidly intermittent separating thrusts therebetween, whereby the base during travel delivers successive compacting actions upon the surface.

11. A compacting apparatus for operation upon relatively stiff unset concrete flooring, comprising a base adapted to travel while resting continuously and immediately upon the surface to be compacted, a frame supported by the base, an inertia mass above the base movably mounted on the frame to reciprocate up and down above the base without rotation, a power actuated device to actuate the mass at high speed with reaction against the base thereby to cause intermittent downward thrusts upon the base, and an adjusting means associated with said mass and continuously

adjustable during compacting operation to modify the resistance of the mass to power actuation and thereby at will of the operator to vary the compacting force of the thrusts upon the base.

5 12. Apparatus as in claim 11 and wherein the adjusting means comprises a resilient device or spring arranged to apply upward stress upon the mass thereby to modify the effect of gravity upon the mass, and a connection for adjusting  
10 such device.

13. A compacting apparatus for operation upon relatively stiff unset concrete flooring, comprising a base in the form of a large hollow enclosing cylinder adapted to roll while resting continuously  
15 and immediately upon the surface of the flooring to be compacted, a frame located inside and supported by the rolling cylinder base, an inertia mass movably mounted on the frame within the cylinder and having a device between it and the  
20 base to move the mass up and down relatively to the cylinder, and power mechanism to actuate said device and mass at high speed with reaction

against the cylinder base thereby to cause intermittent downward thrusts upon the cylinder base, whereby during rolling travel the cylinder delivers successive compacting actions upon the flooring surface.

14. A compacting apparatus for operation upon concrete flooring, comprising a base in the form of a hollow cylinder adapted to roll while resting continuously and immediately upon the surface of the flooring to be compacted, an axle to said cylinder, an inertia mass movably mounted inside the cylinder to move up and down relatively to the cylinder and axle, a device interposed between the mass and base for causing such movements, and power mechanism to actuate the device and  
10 mass at high speed with reaction against the cylinder thereby to cause intermittent downward thrusts upon the cylinder, whereby during rolling travel the cylinder delivers successive compacting actions upon the flooring surface.  
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