

Oct. 20, 1959

A. R. BERRANGÉ
IMPACT ROLLING OR TAMPING MACHINES FOR THE
COMPACTION OF LOOSE MATERIALS, SUCH
AS ROAD SURFACES

2,909,106

Filed Aug. 17, 1953

3 Sheets-Sheet 1

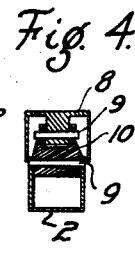
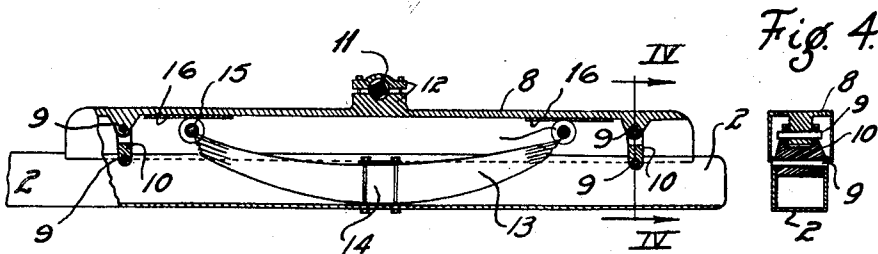
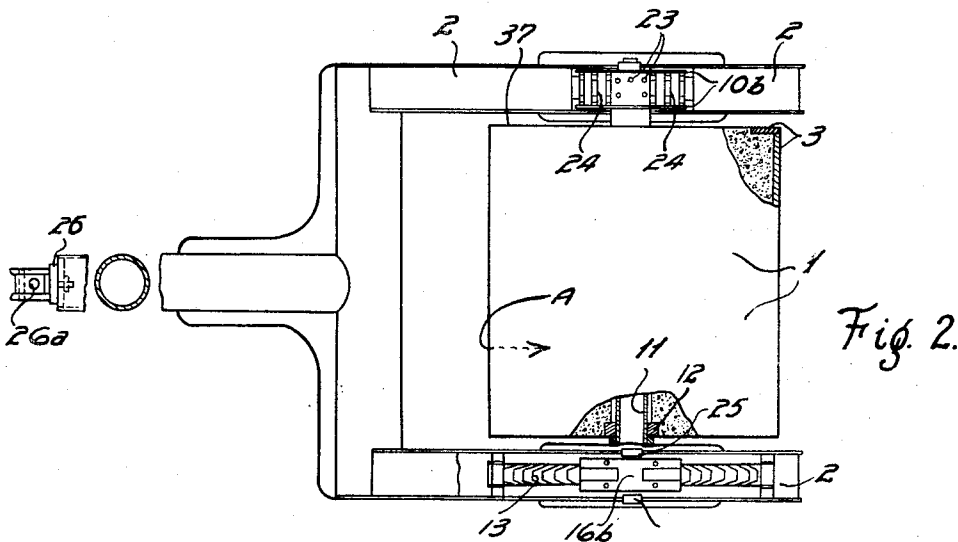
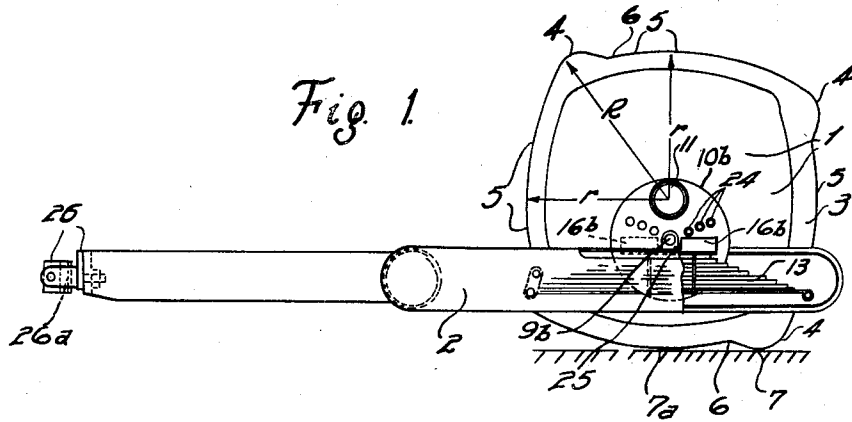


Fig. 3.

AUBREY R BERRANGE

INVENTOR

BY *Wendert, Lind
& Ponack*

ATTORNEYS

Oct. 20, 1959

A. R. BERRANGÉ
IMPACT ROLLING OR TAMPING MACHINES FOR THE
COMPACTION OF LOOSE MATERIALS, SUCH
AS ROAD SURFACES

2,909,106

Filed Aug. 17, 1953

3 Sheets-Sheet 2

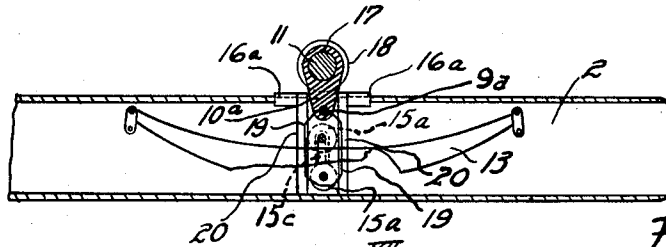


Fig. 5.

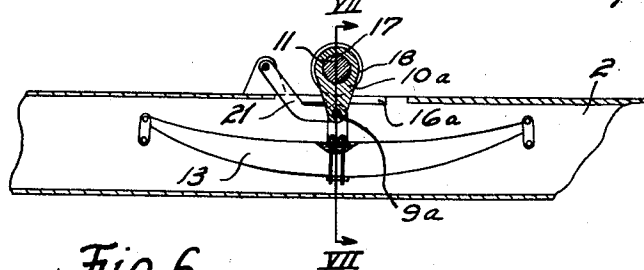


Fig. 6

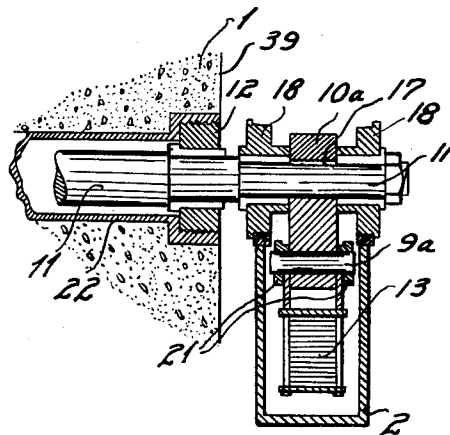


Fig. 7.

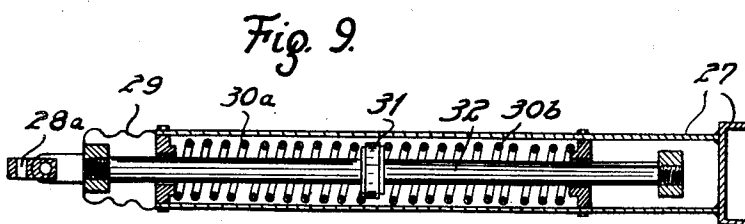


Fig. 9.

AUBREY R. BERRANGE
INVENTOR

BY *Wendert, Lind
& Porack*
ATTORNEYS

Oct. 20, 1959

A. R. BERRANGE
IMPACT ROLLING OR TAMPING MACHINES FOR THE
COMPACTION OF LOOSE MATERIALS, SUCH
AS ROAD SURFACES

2,909,106

Filed Aug. 17, 1953

3 Sheets-Sheet 3

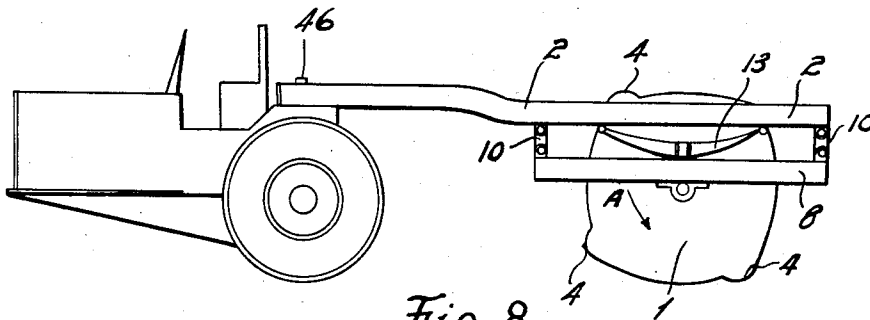


Fig. 8.

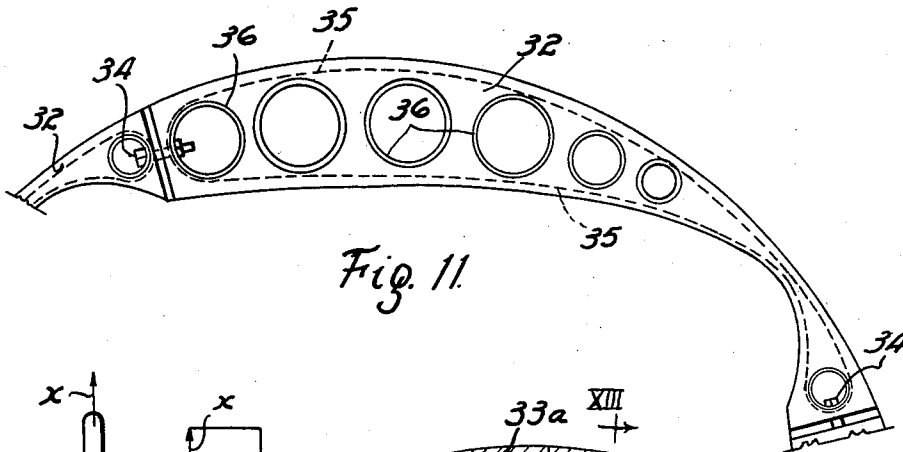


Fig. 11.

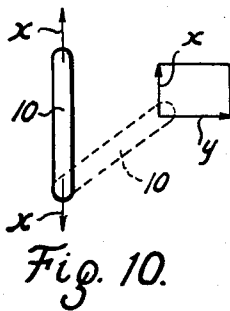


Fig. 10.

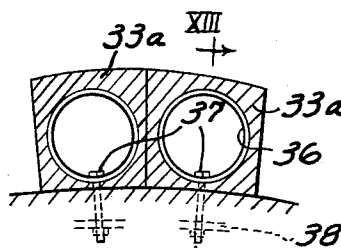


Fig. 12.

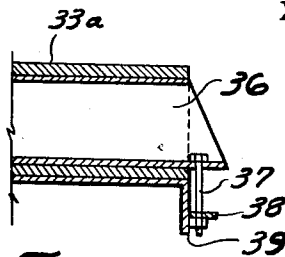


Fig. 13.

AUBREY R. BERRANGE

INVENTOR

BY *Wendert Lind*
4 Ponack

ATTORNEYS

1

2,909,106

IMPACT ROLLING OR TAMPING MACHINES FOR THE COMPACTION OF LOOSE MATERIALS, SUCH AS ROAD SURFACES

Aubrey Ralph Berrangé, Newlands, Cape Town,
Union of South Africa

Application August 17, 1953, Serial No. 374,475

9 Claims. (Cl. 94—48)

This invention relates to impact tamping machines suitable for the compaction of soils, gravels, or similar materials of which embankments are built, particularly where these materials are used for supporting road or airport surfacings, such machines consisting essentially of a roller of non-circular cross-section presenting salient corners about which, as the rolling takes place, the roller center is raised, gravitational return of the roller from its then unstable equilibrium as it continues its forward rolling movement creating impacts on the ground by the roller surfaces between the said corners.

It will be appreciated that it is impossible to work the impact roller on a loose surface. A high horizontal shear force is produced at the point of contact between the roller weight and the ground, in order to get the roller weight to rotate. Loose material is shoved up in front of the roller weight and no impact is produced. In practice, a loose surface first has to be compacted by conventional rolling to produce a reasonably hard surface on which the impact roller can operate. The conventional roller can, however, only compact the material to a depth of a few inches with the density satisfactory by modern standards. The impact roller operating on this thin compacted crust, compacts the material to greater depth, e.g. several feet below the surface.

For deep compaction to high densities, having due regard to the hardness and nature of the ground or the like, impact or tamping rollers operating generally as aforesaid but of adequately heavy construction and intended for use at reasonable speeds, e.g. of the order of 5 m.p.h. up to 8 m.p.h. or more are, according to the invention, constructed in a shape or shapes which while affording substantial lift of the roller to create heavy impacts obviate undesirable digging in of the corners. The invention also provides for the avoidance, when using heavy rollers weighing several tons, of the imposition, particularly during sudden starting, stopping and turning movements, of undesirable jerk loads between the roller shaft and the drawbar, hitch point, or other means by which the traction is applied to the roller. This is accomplished while not materially resisting the ability of the roller to override the drawbar or the like for its free forward accelerated lunging or toppling movements upon which, together with the weight of the roller, the force of the impact depends. Furthermore means may be provided by which the free forward accelerations of the roller under the actions of gravity and the rotational momentum of the roller are augmented from the haulage forces, in connection with the buffering of the drawbar or the like against sudden changes in the tractive forces applied to the roller.

Another desirable feature of such rollers is that they should be easily transportable without generation of impacts, as when being moved from one operating site to another or when required to be used as conventional rollers for compaction work.

According to the invention in an impact rolling or tamping machine comprising a roller of heavy construc-

2

tion operable at traversing speeds of the order above indicated, (a) the roller is of a cross-section in which each salient corner, contact of which with the ground or the like raises the centre of the roller for the purpose aforesaid, is rounded; (b) the perimetral surfaces extending between rounded corners as in (a) above are of slightly convex cam profile, the radial distance of said surfaces from the roller center increasing generally from a value less than the radial distance of one corner to merge into the rounded corner which next follows the first into engagement with the ground; (c) spring means is included between the roller shaft and the haulage or hitch point or the equivalent of a frame in which the roller is accommodated, e.g. within the drawbar system, which spring means serves as a buffer for starting, stopping and turning loads while not substantially interfering with the roller accelerations generating impacts of the perimetral surfaces with the ground; (d) spring means as in (c) above is devised to become stressed during each rise of the roller center above a salient corner to react on the drum to accelerate and augment its following fall and blow on the ground; (e) the frame of (c) above comprises two superimposed portions the upper one of which mounts the roller and the lower of which provides the drawbar or its equivalent, the two portions being linked in such a way as to admit of relative motion generally in the direction of the axis of traction, and spring means being included for resiliently resisting such relative movement, preferably to a small degree for small frame portion displacements and to a large degree for such displacements as arise from starting, stopping or like loads applied to the roller shaft.

The invention also consists in improvements relating to impact rolling or tamping machines hereinafter set forth.

In the accompanying drawings:

Figures 1 and 2 respectively are a side elevation and a plan view, each partly sectional, of one convenient construction of machine embodying the invention (Figure 2 being fragmentary to show some constructional detail);

Figure 3 is a fragmentary sectional elevation through one side member of an alternative construction of draw-frame according to the invention;

Figure 4 is a section on line IV—IV of Figure 3;

Figures 5 and 6 are views similar to Figure 3, but showing further alternatives;

Figure 7 is a section on line VII—VII of Figure 6; being drawn to a somewhat larger scale;

Figure 8 is a semi-diagrammatic side elevation of an application of the invention to traction by a two-wheeled tractor;

Figure 9 is a longitudinal sectional elevation of a spring system enabling any of the alternative systems of Figures 1 to 7 to be dispensed with in favour of a direct inter-connection between the roller mounting and side members of the draw frame;

Figure 10 is a diagram illustrating the geometrical principle upon which embodiments of the invention shown in Figures 3 to 8 are based;

Figure 11 is a side elevation illustrative of a convenient and preferred method of providing a roller weight with a cylindrical surface for converting to a cylindrical roller or to facilitate transportation;

Figure 12 is a side elevation of an alternative arrangement to that shown in Figure 11; and

Figure 13 is a section on line XIII—XIII of Figure 12.

Referring first to Figures 1 and 2, and also Figure 8, and ignoring all but the impact roller 1 and the fact that it is arranged between side members 2 of a draw frame, the general form of which is clear from the drawings, and in which the hitch point occurs at the left-hand end, the

said roller, conveniently cast in reinforced concrete and having the rolling surfaces and parts of the ends faced with steel plate or the like 3, may be any one of a variety of shapes in cross section, as hereinafter described, with dimensions giving a total weight of several tons. The shapes referred to are such as to provide one or more salient corners as 4 over which during operation the roller center (axis) is necessarily lifted through a height equal to the difference between the effective radius R of the corner and the minimum effective radius r of the perimetral surface 5 extending generally around the roller, e.g. to the next corner.

Whatever the cross section adopted, e.g. generally square as in the drawings, equilateral triangular, regular polygonal, the corners are rounded to a cylindrical form of relatively substantial radius, the intervening "flats" or tamping surfaces as 5, merging smoothly rearwardly from one corner towards the next in the direction the reverse of that (see arrow A) in which the roller turns in advancing over the ground.

The force of the impacts resulting from the forward fall of the "flats" on the ground ahead of each point where a rounded corner engages the ground is intensifiable and the shape of the depression resulting from each such impact may be varied by relieving the profile of the "flats," as specifically shown in the drawings, in the direction of roller rotation referred to above, and by providing a re-entrant portion as at 6 meeting the respective corner 4 at a radius from the roller shaft intermediately of the two radii whose difference determines the extent of lift of the roller centre.

Each "flat" or tamping surface 5 may thus be, as shown, of a smooth convexly curved or cam shape.

With a roller of such shape, the force of the impacts can be shown mathematically to increase, inter alia, proportionately with the distance between the point of engagement (as 7) of any corner with the ground and the point (as 7a) at which the adjacent tamping surface first contacts the ground ahead of it; and such distance is a function of the curvature of the said surface which is determinable according to particular requirements. However, as the force of impact is directly related to the jerk forces applied between the roller and the drawbar frame, or the like, it is preferred, at a sacrifice of intensity of the tamping forces, to shape the roller so that its first point of contact with the ground occurs behind the vertical plane then containing the roller axis.

The tamping surface curvature 5 is determinable mathematically so as to secure uniformity of downward force as the roller advances from the original impacting point to engage a following corner with the ground, by causing the centre of gravity of the roller to ascend with uniform acceleration. For this effect the locus of the centre of gravity should be parabolic, and such locus is determinable by the convexity adopted for the tamping surface effective immediately following the original impact point, up to the point where it merges into the curvature of the next corner.

Dealing now with the haulage of a roller designed according to the principles explained above and mounted within a suitable frame, there is embodied between the journal bearings of the roller and the haulage hitch point of the frame a means of buffering which necessarily influences the intensity of impact produced by the roller.

As illustrative of the principle involved in overcoming drawbar jerk at low speeds, it is convenient to refer to Figure 3, which shows a construction wherein at each end of the axle 11 there is provided an end member which has a roller support frame 8 as a part thereof. The roller support frame is operably pivotally connected to guide members in the form of links 10 pivotally mounted on frame 2. The links 10 guide the roller support frame 8 so that it is always parallel to the direction of the axis of haulage of the machine. The roller support frame 8 supports the roller axle 11 by its ends in suitable bearings 12

on the roller support frame 8, and the side members 2 of the frame section extend forwardly (to the left) into any form of drawbar or the like, such as is shown in Figures 1 and 2 affording a haulage hitch point for drawing the machine, as by means of a power-driven tractor.

Incorporated on the side members of the frame section are semi-elliptic leaf springs 13, centrally anchored at 14 to these members and with their free extremities extending outwardly and upwardly where they terminate in rollers 15 engageable with tracks 16 formed by the lower surfaces of the respective roller support frames.

The arrangement is such that with the machine at rest the links stand upright as shown and the springs are substantially or wholly unstressed. When the haulage force is applied to the frame 2 the inertia or other resistance of the roller to movement, more particularly to being raised over its corners, results in the application of compression to the springs. Such stressing of the springs is arranged to occur before the centre of gravity of the roller reaches its highest point in its lift so that they may thereafter contribute a propulsive force or reaction on the roller with respect to the frame section augmenting the gravitational toppling force of the compaction impacts.

With this arrangement of springs, during starting and stopping or turning, or when moving slowly, large frame displacements arise, the springs build up large resistances for the effective buffering of the machine parts and the avoidance of damage. When the machine works at or near its operating speed, however, only small relative frame displacements arise and there is no resistance to the lunging or toppling action of the roller and consequently no reduction of the impact on the ground surface.

The geometrical principle upon which the spring mounting in the embodiment of the invention just described (as also in embodiments later to be described with reference to Figures 4 to 8) is based may be clearer from Figure 10, wherein 10 represents a link with a vertical force x acting on it, representing the action of a spring. With link 10 in the vertical position, the applied force x gives rise to no horizontal force. However, when the link 10 is in the position shown by the dotted lines, the same force x gives rise to a horizontal force y , and the nearer the link approaches the horizontal position, the larger does this horizontal force become. Using this principle it is possible to build up to an infinite value of horizontal force for a moderate vertical force which can be produced by a spring, and therefore shock loads on the machine parts can be controlled.

Adverting to Figure 3, the length of the links 10 determines the total possible amount of fore and aft movement of the axle 11 relative to the frame 2. Consider now the tractor, attached to the draw frame 2, to be moving at a steady slow speed. As the tractor exerts a force to raise the roller weight onto its point, the axle 11 moves backwards relative to the frame 2. Then as the top-dead-center position is passed and the roller weight topples forwards under the action of gravity and the forces exerted by the springs through the links 10, the axle 11 moves past and forward of the central position.

If the links 10 are too long, the axle 11 attains a forward velocity considerably in excess of the velocity of the frame 2 before it passes the neutral position, and the springs and links have to arrest this excess velocity. Furthermore, the roller weight is enabled to strike the ground then continue to roll towards the next point, while the axle 11 comes almost to rest before the motion of frame 2 overtakes the axle 11, and the springs again have to accelerate the roller weight forward for its next cycle. Indeed, under certain conditions of slow forward speed of the tractor, and too long links 10, the roller weight, and thus the axle 11, may actually come to rest and then commence to topple backwards before the motion of the frame 2 can "catch up." In this event, heavy shock loads in the mechanism are induced when the frame

2, through the springs and links, suddenly has to reverse the direction of rotation of the roller weight.

By making the links 10 a length just sufficient to accommodate the range of motion of axle 11 relative to the frame 2, required at the operating speed of the machine, the shock loads can be reduced at slow speeds. With short links 10, at slow forward speeds, the axle 11 passes rapidly from the rear to the forward side of the central position, after the top-dead-center of the roller weight is reached, and prevents the roller weight from attaining forward velocity greatly in excess of the tractor, and after the impact face of the roller weight has struck the ground, the axle 11 moves rapidly to the rear of the central position again without the roller weight reducing its forward velocity appreciably or coming to rest. Thus heavy jerk loads on the mechanism are eliminated.

For details of construction it is convenient to refer again to Figures 3 and 4. Axle 11 is rigidly positioned with respect to the roller support frame 8. Roller support frame 8 is connected to the frame 2 through links 10 which pivot on pins 9. With links 10 designed to be rigid against sideways displacement and with the axle 11 rigidly clamped to roller support frames 8 these members 8 on either side of the roller weight are constrained to move forward or backward in unison thus ensuring that the roller weight cannot twist laterally in the frame and foul the sides during any working maneuver.

Rollers 15, mounted at the extremities of the spring 13, engage the hardened plates or guides 16. The upthrust of the springs tends to hold the axle 11 in the central position, and any displacement from this position is resisted by a rapidly increasing force.

This principle of spring mounting is followed in the varied constructions or modifications illustrated in Figures 5 to 7 (wherein functionally corresponding parts bear like references to those used in Figure 3). Thus, for example, in Figure 5 the axle 11 is rigidly connected at each end to an end member comprising a crank arm 10a, such connection being shown as a key 17, but any other method such as splines, bolts and the like may be used. As axle 11 is displaced from the central position the rollers 18, also forming part of the end member, roll on hardened plates or guides 16a, drawing upwards pin 9a passing through guide members comprising plates 19 which carry rollers 15a travelling in guides 20. An inverted U-bolt 15c connects the axle of upper roller 15a to springs 13. The pin 9a is therefore constrained to move vertically only, the springs resisting vertical force only and the horizontal forces being transmitted to frame 2.

In Figure 6 a guide member in the form of a link 21 pivotally connecting arm 10a to the frame 2 serves to guide pin 9a in a vertical (or nearly-vertical) direction. As the roller axle 11 moves away from the central position, pin 9a rises under vertical restraint from the spring 13, the link 21 resisting the horizontal forces and transmitting them to the frame 2.

In the cross-section Figure 7 the axle 11 can be seen to pass through a pipe 22 along the axis of the roller weight, and to have at its extremities the crank arms 10a to which it is keyed by means of keys as 17. The roller weight rotates on the axle 11, on journals 12, which are fixed into the roller weight. Rollers 18 also rotate on the axle 11. Bearing surfaces of plain bronze or steel sleeves are shown fitted over the axle 11, but other suitable bearings such as roller bearings could be used.

From the geometric properties of the arrangement as shown in Figure 6 it will be seen that as axle 11 moves to the rear of the central position, pin 9a also moves slightly in this direction, thus allowing axle 11 to move a horizontal distance greater than the radius of the crank arm. In the opposite direction, the horizontal movement of axle 11 is less than the radius of the crank arm.

In the arrangements shown in Figures 5 and 6 there

is no relative vertical movement between the roller axle and the draw frame as in the case of Figures 1 and 3.

Adverting now to the alternative construction shown in Figures 1 and 2, for a more detailed description thereof, the roller weight, here shown as having four compacting faces 5, consists of the steel shell 3 filled with concrete, and having a cylindrical hole passing through its axis. The axle 11, which is shown in this case as a hollow shaft, passes through the journals 12, enabling the roller weight to rotate on the axle 11. On the ends of the axle 11 end members 10b are rigidly fixed by means of bolts 23, or other suitable means. The end members 10b are each made up of a pair of circular parallel discs between which are located rollers 24. The circular form of the discs is of no importance other than for appearance. Discs 10b are pivoted on guide members in the form of pins 9b which pass through journals 25. Rollers 24 engage saddles 16b, mounted on semi-elliptical leaf springs 13, the latter being carried in the hollow box-section girders 2 which form the two main side members of the draw frame.

The reference 26 denotes a universal joint by means of which the tractor is hitched to the draw frame. The tractor pin passes through the hole 26a. Such a universal coupling is necessary to provide for motion in all directions. The provision of the usual method of a loosely fitting pin through an eye, would not be satisfactory because the pin and eye would soon be deformed by the hammering action when the machine is in operation.

The action of the spring mounting is as follows. When the draw frame is pulled (to the left) end members are guided in circular motion by pins 9b, allowing the roller weight axle 11 to lag and move backwards relative to the draw frame, and bringing the rollers 24 successively into contact with the spring saddle 16b, thus building up increasing force until the resistance of the roller weight is overcome. Similarly when the roller weight tends to over-run the neutral position, such as when travelling slowly, or during stopping or turning, the motion is arrested by rollers 24 bearing on the forward portion of the spring saddles 16b.

Although the fore and aft sections of the spring saddles 16b and rollers 24 are shown as being symmetrical, the rollers 24 could be arranged to occur, in the static state of the machine, nearer to the saddles so as to build up resistance more rapidly in either direction.

Referring now to Figure 8, which shows a form of impact roller attached to, for haulage by, a two-wheeled tractor, such as possesses the advantage of permitting tight turning circles, it has been found that such a combination possesses the particular advantage of avoiding the jerking which would otherwise accompany the slow forward motion during turning. With this system the tractor could come to a standstill while travelling in a straight line, then turn at right angles to the direction of the draw frame, and rotate the roller weight about a vertical axis without it tending to roll.

In Figure 8 the connection at 46 must be a stout trunnion or the like and pivot horizontally while being rigid in the vertical direction in order that the weight of the impact roller may counterbalance the weight of the tractor. When the roller weight rotates, the axle rises. By arranging the spring mounting as shown, and thus providing what may be termed an inverted version of the system shown in Figure 3, the links 10 draw the frame 2 downwards as the centre of the roller weight rises, and thus tend to compensate and reduce the amount of rise of the frame 2, consequently reducing the amount of tilting or pitching of the tractor when the machine is in motion.

With a sacrifice of the geometric and servicing advantages of the elliptical buffering spring arrangements included in the constructions above described, a simple frame may both directly mount the roller shaft and serve

as a drawbar or the like, there being provided in such case a spring connection between the frame and the actual haulage point or hitch eye or the like. Such an arrangement, which may employ a compressible telescopic connection suitably encased to exclude foreign matter from the device, may be adequate in its functioning to enable impact rolling to be satisfactorily accomplished in the manner explained above or according to functionally equivalent principles. Thus, Figure 9 shows such an alternative system of spring mounting which may be confined to the draw shaft 27 immediately behind the tractor, in which case the roller axle could be clamped rigidly to the side members of the draw frame. The reference 28a denotes the hole for the tractor pin and 29 is the accordion-type boot for preventing the ingress of dirt. The functioning of this mounting is obvious from the drawing. The coil springs 30a, 30b could both be inserted in the tube of the assembly while under compression, so that they will both remain in contact with the central stop 31 on the sliding shaft 32 for motion in either direction from the central position. In this way also the horizontal resistance of the springs also builds up more rapidly.

The characteristic of this direct type of mounting is that the horizontal force developed is proportional to the deflection of the spring, necessitating stiff springs in order to absorb heavy impact loads, unless a second set of very stiff buffer springs be fitted.

The spring mounting designed according to the principle illustrated in Figure 10 or as shown in Figures 1 and 2, need not be as stiff over the few inches of motion on which the mechanism operates during steady motion of the impact roller, because the horizontal resistance builds up rapidly at the extremes of permissible motion.

The machine in any of its embodiments, consistent however with the foregoing description, may embody its own towing motor or the like operatively connected, preferably through a suitable universal joint or the like, with the frame, e.g. the frame section 2 aforementioned, or with the haulage or hitch eye or the like in the alternative construction. Operation of the roller at uniform traversing speeds requires the employment of a relatively heavy traction vehicle or the like, e.g. one of at least the same weight as the roller itself.

In the matter of transportation of a machine according to the present invention, if no special provision were made for this, the usual method of transporting heavy machinery on a low-bed trailer, would have to be adopted, or alternatively a set of wheels could be fitted to the draw frame in such a way that they could be lowered into contact with the ground by means of screws, hydraulic jacks or the like, when it were desired to move the impact roller over any considerable distance. However, for easy transportation of the machine when impact action is not required, filling pieces of heavy construction may be provided for fitting into the profiled "flats" of the roller in such a manner as to bring the overall periphery of the whole roller or zones thereof to plain cylindrical roller form. Such pieces may be clamped together at their ends for securing firmly in place around the profiled roller; and in this condition the whole may serve as a conventional round compaction roller. In an alternative form the roller may be basically cylindrical in form and such pieces as above described may be removably fittable thereon, being externally shaped so as to impart the desired exterior profile to the whole for impact rolling according to the invention.

A convenient and preferred embodiment of such last-mentioned provisions is shown in Figure 11, and in a modified form in Figures 12 and 13. Figure 11 shows details of a method of fitting specially shaped sections 33 around the periphery of the roller weight in order to convert it into a cylindrical roller or to provide an easy method of transporting the machine. Figure 11 shows only one of four complete sections which may be

drawn up tightly around the roller weight by means of adjusting tie bolts 34. The sections are preferably constructed in narrow widths of about twelve inches, so that they may be sufficiently light to handle. They could be constructed of hard vulcanized rubber or other such non-metallic material reinforced with wire cables 35 and/or could be made lighter by the tubes 36 of steel, which form a series of holes.

Figure 12 shows a slightly different form of the same principle, in which the sections 33a are made segmentally combinable over the full width of the compacting face of the roller weight and are fixed by clamping bolts 37 fitting into lugs 38 on the vertical sides 39 of the roller weight. Each steel tube may be separately encased in a material such as rubber, but if ease of handling were no object, then several steel tubes could be formed into a single section. Figure 13, the cross-section of Figure 12, shows the method of allowing the steel tubes to project beyond the vertical sides of the roller weight to facilitate the fitting of the clamping bolts 37.

In a further modification, shock absorbers of suitable characteristics may be provided in association with the spring mounting to prevent undesirably large oscillations of the roller center relative to the draw frame, from occurring during slow speeds of the machine, thereby reducing the shock loads which would otherwise occur.

What I claim is:

1. An impact roller machine comprising a frame for attachment to hauling means for said machine, a ground engaging roller having a uniform cross section comprised of a plurality of salient rounded corners projecting from said roller and curved tamping surfaces therebetween, said tamping surfaces being joined to said salient rounded corners on one end by a reentrant portion and curving smoothly into the salient rounded corner on the other end, said machine further comprising means for axially rotatably mounting said roller, and resilient connecting means connecting said mounting means to said frame, whereby said roller may be rolled over said salient rounded corners and said tamping surfaces will strike the ground.

2. A machine as claimed in claim 1 in which the configuration of said curved tamping surfaces is such that the radial distance of said surfaces from the axis of said roller increases progressively from the point of impact of said surfaces to the smoothly curved junction with said salient rounded corners, said configuration being such that said point of impact is directly below the roller axis, whereby the center of gravity of said roller is accelerated uniformly upwardly between the impact and the salient corners.

3. A machine as claimed in claim 1 in which said mounting means comprise a shaft on which said roller is rotatably mounted and two end members on which said shaft is mounted and said resilient connecting means comprise a linkage pivotally connecting said end members to said frame for substantially horizontal movement of said mounting means relative to said frame, and spring means on said frame resisting movement of said mounting.

4. In an impact roller machine, a ground engaging roller having a uniform cross-section about the longitudinal axis of said roller, said rollers having a plurality of salient rounded projections extending the full length thereof and projecting therefrom, and convexly curved tamping surfaces between said projections, small radiused reentrant portions joining said tamping surfaces to said salient projections on one end of the tamping surfaces and the tamping surfaces curving smoothly into the salient projections on the other end thereof.

5. In an impact roller machine, the combination of a frame for attachment to haulage means, a ground-engaging roller having an irregular cross-sectional shape such that the center of gravity of the roller is caused to rise by the rolling action of said roller after having per-

9

formed an impact action, an axle on which said roller is axially rotatably mounted, connecting means between said axle and said frame and comprising end members on which said axle is mounted and guide members mounted on said frame and being operably pivotally connected to said end members, and spring means on said frame movably supporting one of the members of said connecting means and resisting movement of said members.

6. The combination as claimed in claim 5 in which said end members each comprise a roller support frame arranged over said frame, and said guide members comprise a plurality of links pivoted to each of said roller support frames and to said frame to form a parallel linkage, said spring means on said frame bearing on said roller support frames to resist movement thereof in the vertical direction.

7. The combination as claimed in claim 5 in which each end member comprises a roller and a crank arm rigidly attached to said roller, and each guide member comprises a pair of vertical guides on said frame and a plurality of wheels running in said guides, said crank arm being pivotally attached to said wheels, said spring means on said frame being attached to said wheels to resist movement thereof along said guides.

8. The combination as claimed in claim 5 in which

10

each end member comprises a roller and crank arm rigidly attached to said roller, and each guide member comprises a link pivoted to said crank arm and to said frame guiding the movement of the free end of said crank arm in a substantially vertical direction, said spring means on said frame being attached to the free end of said crank arm to resist movement thereof in the vertical direction.

9. The combination as claimed in claim 5 in which each end member comprises a pair of spaced parallel circular discs having a plurality of rollers therebetween arranged in spaced groups along slightly non-radial lines and being over said frame, and each guide member comprises a pin rotatably mounted on said frame and on which said discs are rotatably mounted, said spring means on said frame bearing successively on said rollers as said discs rotate on said pin to resist movement of said end member.

References Cited in the file of this patent

UNITED STATES PATENTS

1,454,575	Boyd	May 8, 1923
2,466,822	Pollitz	Apr. 12, 1949

FOREIGN PATENTS

441,375	Great Britain	Jan. 17, 1936
---------	---------------	---------------