O. ABELING.

ROAD RAMMER.

APPLICATION FILED SEPT. 9, 1911.

1,145,734. Patented July 6, 1915.

4 SHEETS—SHEET 1.

Fig 1

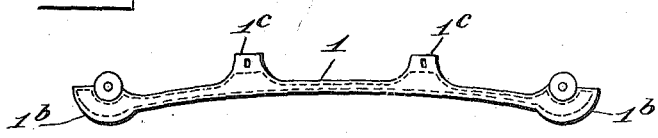

Fig 2

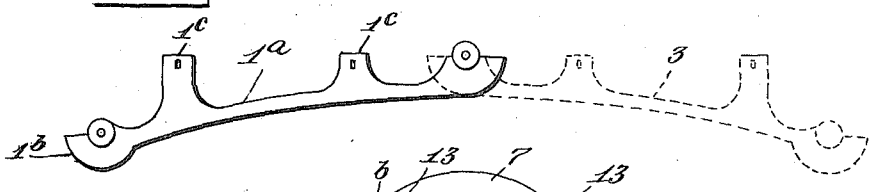

Fig 3

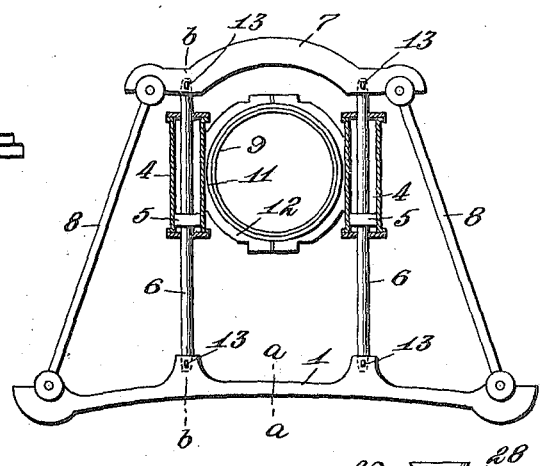

Fig 3a

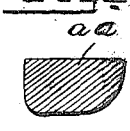

Fig 4

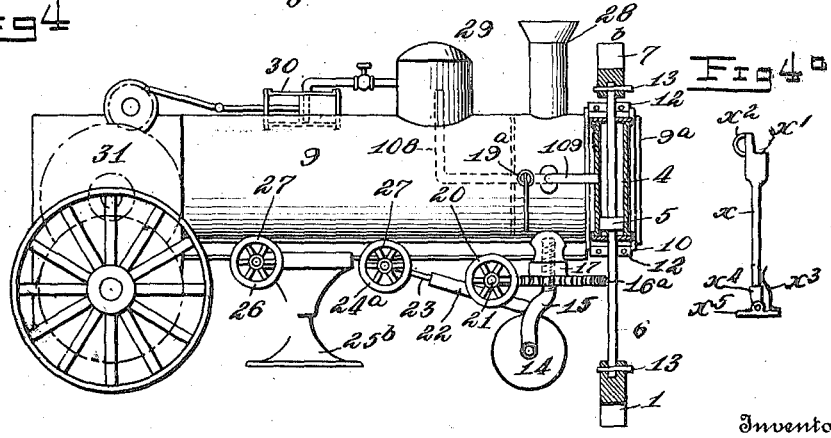

Fig 4a

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Witnesses

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4 SHEETS—SHEET 2.

Fig 5

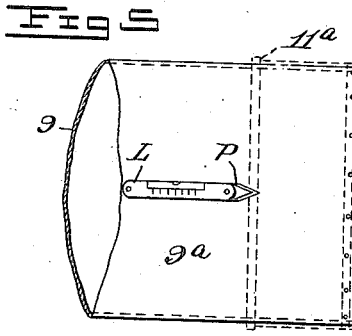

Fig 5b

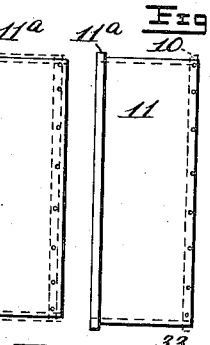

Fig 5c

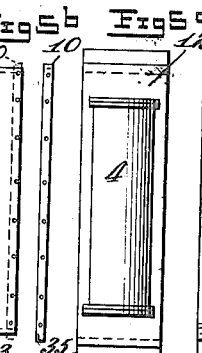

Fig 5d

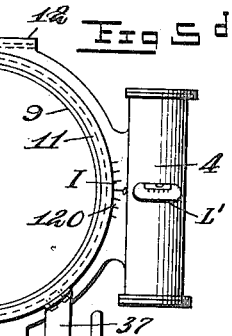

Fig 5a

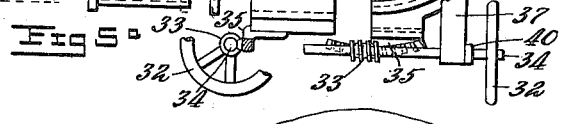

Fig 6

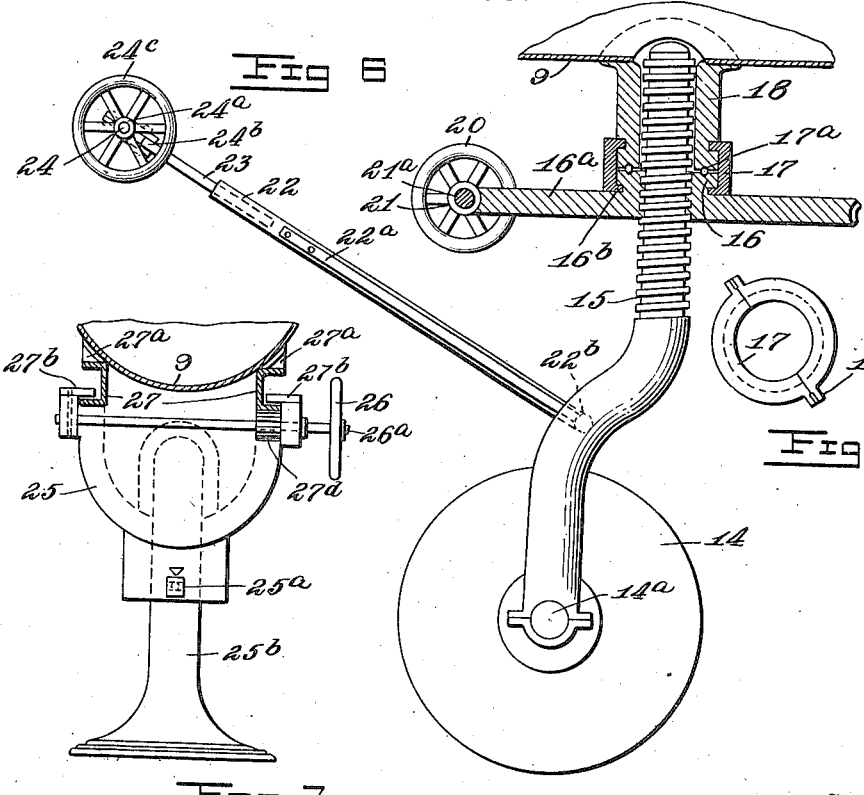

Fig 6a

Fig 7

Witnesses

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4 SHEETS—SHEET 3.

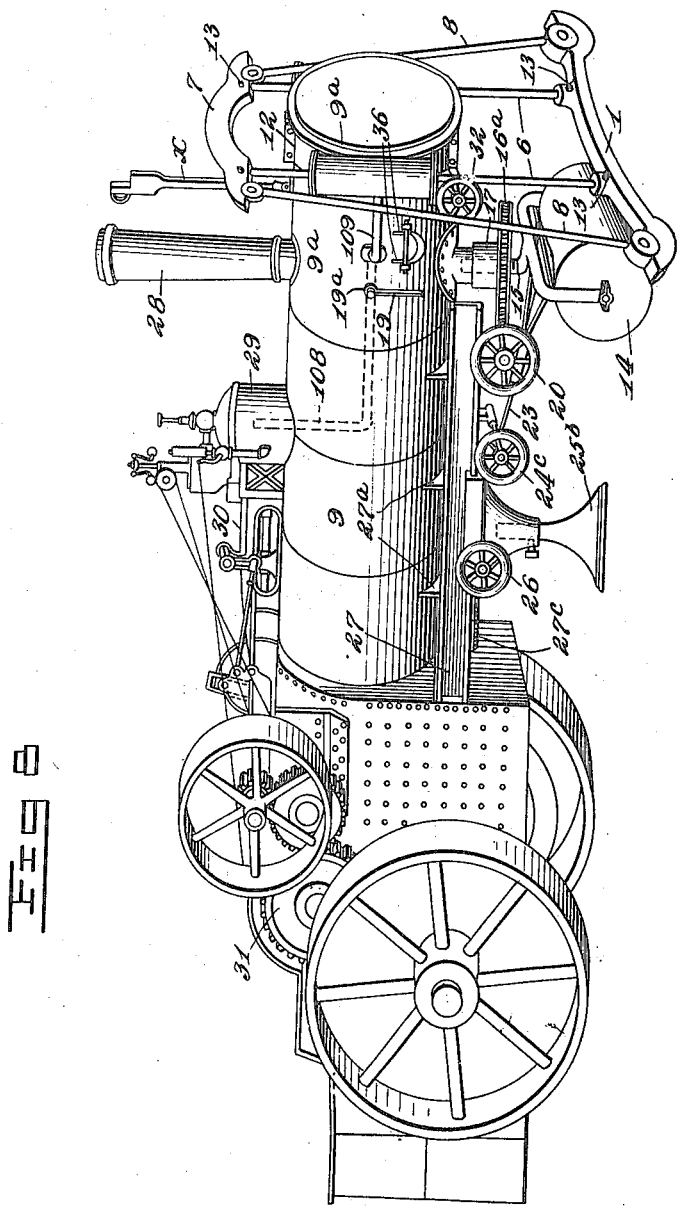

FIG 3

Witnesses

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APPLICATION FILED SEPT. 9, 1911.

1,145,734.

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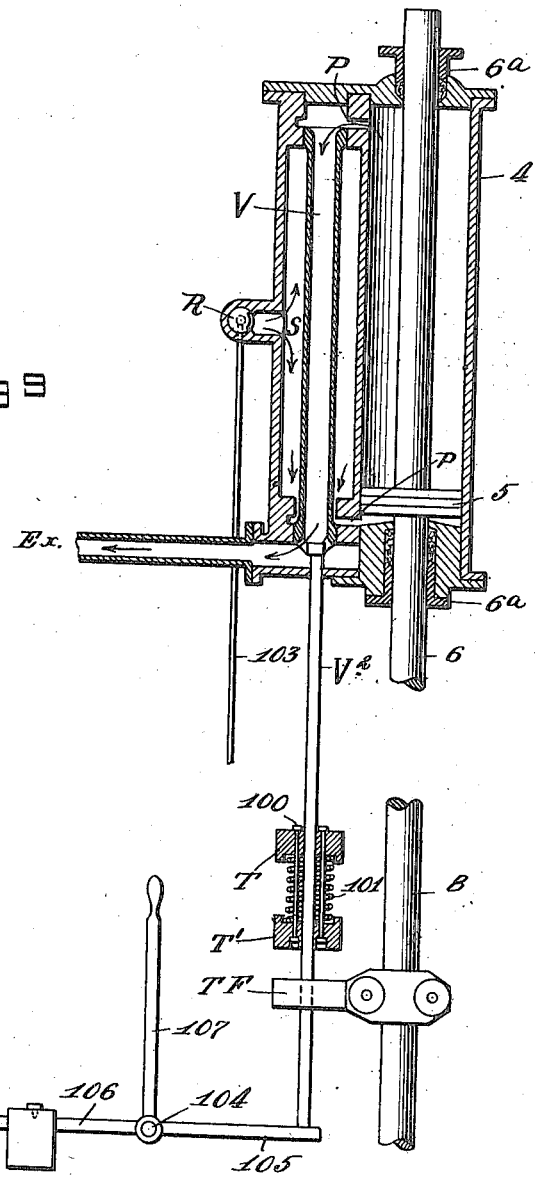
4 SHEETS—SHEET 4.

Fig 9



Witnesses

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UNITED STATES PATENT OFFICE.

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ROAD-RAMMER.

1,145,734. Specification of Letters Patent. Patented July 6, 1915.

Application filed September 9, 1911. Serial No. 648,486.

To all whom it may concern:

Be it known that I, OTTO ABELING, a citizen of the United States, residing at Washington, District of Columbia, have invented a Road-Rammer.

My invention relates to improvements in power road ramming devices.

While my invention in its preferred embodiment is particularly adapted for use in making roadways, it may also be arranged for ramming pavements and foundations therefor, for settling new railroad fills, reservoir bottoms, play grounds, race courses, public grounds, irrigation ditches or other places where it is desirable to compact the surface material.

Heretofore it has been customary to do such compacting by means of heavy rollers, but such rollers have theoretically only a mere line contact with the ground, and as the roller passes and repasses over the ground a billow rises in front of each roller. This shows that there is, besides the direct downward pressure, which is desired, a kneading action, which is not desired. As a consequence of this, the kneading action operates to leave the surface in waves, which are accentuated by the rolling action of vehicle wheels. In other words, with a heavy roller soft spots leave depressions and hard spots elevations, so instead of a road being brought to a uniform surface of the cross section crown line, only an approximately true line can be obtained.

The main object of my invention is to provide a power road ramming device of such a nature that it will compact the full width of a roadway, including the necessary ditches, at every stroke to such an extent in the direction of the roadway as to avoid any possibility of leaving the compacted surface with other than true lines of crown and grade.

With this broad object in view and some others which will be clear from the description hereinafter, my invention consists in the features, details of construction and combinations of parts which will first be described in connection with the accompanying drawings and then particularly pointed out in the claims.

In the drawings:—Figure 1 is an elevation of one form of rammer shoe embodying my invention; Fig. 2 is a similar view of another modification of the rammer shoe, arranged to ram one side of a roadway at a time; Fig. 3 a front elevation, partly in section, of a shoe and its operating mechanism; Fig. 3ª is a sectional view of the shoe on the line *a*—*a*, Fig. 3; Fig. 4 a diagrammatic side elevation, partly in section, of a complete ramming apparatus embodying the complete invention; Fig. 4ª is a detail view more particularly referred to hereinafter; Fig. 5 a side view of the front part of a boiler showing the manner of attaching the ramming mechanism thereto; Figs. 5ª, 5ᵇ, 5ᶜ and 5ᵈ detail views to be referred to hereinafter; Fig. 6 a side elevation, partly in section, of the means for supporting and adjusting the front end of the apparatus; Fig. 6ª is a detail view in plan; Fig. 7 a front elevation, partly in section, of a jack mechanism employed by me; Fig. 8 a perspective view of the complete apparatus in one form, and Fig. 9 a diagrammatic view, partly in section, of a cylinder and valve with valve controlling gear as employed by me.

Referring to the drawings, and in particular to Figs. 4 and 8, 9 is a boiler, for example, of a traction engine, having a stack 28, a steam drum 29, an engine indicated at 30 and a transmission gearing 31 between the engine and the driving wheels of the tractor.

The front end of the boiler shell is extended somewhat more than is usual, as indicated at 9ª, Fig. 4, to receive the ramming mechanism, as more fully explained hereinafter.

The front end of the apparatus is arranged to be suitably carried by a supporting and steering means which can be adjusted. In the present example this means comprises a front roller 14 mounted in bearings 14ª in a forked caster arm 15, whose upper end is threaded and extends through a sleeve 18 Fig. 6 secured to the bottom of the smoke box of the boiler, the said threaded end having a nut 16 and a worm wheel 16ª engaging worm 21 for a purpose hereinafter explained.

The nut 16 and the worm wheel 16ª are connected by an integral portion of smaller diameter than the exterior of the nut whereby an annular groove 16ᵇ is provided between said nut and said worm wheel. The downwardly extending sleeve 18 is also provided near its lower end with an annular groove. The upper face of the nut 16 and the lower face of the sleeve 18 are provided with raceways for a series of balls indicated at 17ª, these coacting parts form-

ing a ball bearing to carry the weight of the forward part of the traction engine. A split collar 17, having inwardly extending flanges serves to hold the nut 16 and the sleeve 18 together, the flanges of the split collar 17 entering the annular groove in the nut and in the sleeve respectively. The split collar 17 is provided with lugs 17^c Fig. 6^a arranged to be held together by bolts or machine screws in the usual manner. It will be seen that when the worm wheel 16^a is rotated the caster arm 15, owing to its screw-threaded connection with the nut, will be adjusted up or down as may be desired, thus enabling the front roller 14 to support the front end of the traction engine at the desired distance from the ground. For the purpose of rotating the nut, suitable means for driving the worm wheel may be provided. In the present instance, a worm 21 engages the worm wheel 16^a, said worm being mounted on a shaft 21^a extending transversely under the boiler and provided with a hand wheel 20 whereby the worm may be rotated to rotate the worm wheel 16^a and the nut 16. Suitable means is also provided for steering the front roller 14, this consisting in the present instance of a tiller 22 suitably connected to the forked portion of the caster arm 15 by means of a transverse rod 22^b (indicated in dotted line in Fig. 6), the said tiller being braced by braces 22^a. The rear end of the tiller is provided with the telescopic extension 23 having a box 24^a secured to it by bolts 24^b to permit angular movement of the tiller. The box 24^a is threaded and is engaged by a transverse screw 24 suitably mounted in hangers beneath the boiler and provided with a hand wheel 24^c. By rotating this hand wheel the box 24^a may be screwed backward or forward transversely of the apparatus thus swinging the tiller 22 and with it the front roller 14 so as to guide the apparatus in the desired direction. The telescopic connection between the tiller 22 and the extension 23 compensates for variations in the length of the tiller device when swung from one side to the other.

To the lower part of the boiler shell are attached two longitudinal girders 27, (Figs. 7 and 8) one at each side of the boiler, these girders in the present instance being shown as channel bars and being secured to the boiler by brackets 27^a. These channels 27 serve as a track for a suitable jack 25 which has ears 27^b extending over the lower flanges of the respective channel bars 27. In this jack 25 is mounted a transverse shaft 26^a provided with a gear pinion 27^d arranged to mesh with a rack 27^e secured on the under side of one of the channel bars 27. The shaft 26^a is provided with a handwheel 26 by means of which it may be rotated and thereby the jack may be traversed along the two channel bars 27 in the direction of the length of the boiler. The jack is provided with a vertically extending bore to receive the upper end of a hydraulic jack stem 25^b having a wide base as shown in the drawing and of any ordinary construction. By suitably adjusting the jack longitudinally of the apparatus by means of the hand wheel 26 it may be brought beneath the center of gravity of the apparatus and then the hydraulic jack may serve to lift the apparatus vertically so that it may be swung around on the head of the jack, thus permitting the engine to be turned at any part of the roadway in case this should become necessary.

The front of the boiler shell is extended somewhat more than usual in a traction engine in order to carry the ramming mechanism at a point in front of the supporting and steering mechanism. On this extension 9^a is secured a sleeve or thimble 11, Fig. 5^a, having a flanged or ribbed rear edge 11^a. A ring 10 is arranged to be detachably connected to the front edge of the said sleeve 11. This sleeve 11 serves as a hub for a rotatable carrying collar 12, formed in two halves arranged to be bolted together. When said collar is in place on the sleeve 11 it is held against displacement longitudinally rearward by the rib or flange 11^a, and against displacement in a forward direction by the ring 10, which is bolted to the sleeve 11.

Suitable means is provided for rotating the collar 12 to any desired position and then holding it or locking it in such position, for a purpose hereinafter explained. This means in the present example comprises an apparatus as follows: On the bottom of the collar 12 (Fig. 5^d) is arranged a worm segment 35 arranged to be engaged by a worm 33 mounted on a shaft 34 suitably journaled in bearings 37 carried by the boiler, said shaft having means for operating it, such for example, as a hand wheel 32. By rotating the hand wheel 32 the collar 12 can be rotated on the sleeve 11 and will be held by the worm and worm segment at any point. In attaching the worm segment 35 to the collar 12, one end is fixed to one half of the collar and the other end is either entirely unconnected from the other half of the collar or if connected thereto is so arranged as to allow for the adjustment of the two halves of the collar toward or from each other. The collar 12 is arranged to support suitable power actuated means for operating the ramming device. In the present embodiment of this invention this power actuated means comprises a plurality of cylinders and pistons, for example, two as shown in Fig. 3, one at each side of the apparatus. As these cylinders and pistons are alike the description of one will suffice.

Referring to Figs. 3 and 9, the cylinder is indicated at 4, within which is a piston 5 attached to a piston rod 6 which extends through both heads of the cylinder, as shown, suitable stuffing boxes 6^a (Fig. 9) being provided. The cylinder is provided with a port P at each end, these ports being controlled by suitable valve mechanism. In the present example, the valve mechanism is located at the rear of the cylinders, whereby the valve chest is kept closer to the source of steam supply and is alongside the smoke box of the boiler, so as to reduce losses of heat by radiation. The valve chest comprises a valve seat at each end, these seats having annular recesses in communication with the respective ports. The valve chest is also provided with an extension in which is mounted a rotary throttle valve as indicated at R, which may be of any desired construction, for example, the Corliss type valve shown in Fig. 9. The piston valve employed in the preferred embodiment of my invention and indicated at V is tubular and has an enlargement at each end, these enlargements acting in conjunction with the respective valve seats to control the ports P. The lower end of the valve chest is provided with an exhaust outlet as indicated at E^x. To the lower end of the valve is attached the valve rod V^2 which passes downward through the lower end of the valve chest and is arranged to be controlled by suitable valve operating means. This means comprises in the present case, a tappet mechanism for automatically operating the valve rod and manually controllable means for moving said valve rod.

The tappet mechanism comprises a tappet finger secured to a reciprocating part of the apparatus, as more fully explained hereinafter, and a tappet attached to the valve rod, this tappet comprising two heads T and T′, the upper one of which is fixed to the rod and the other of which is capable of limited movement on said rod, the movement being limited by bolts 100, which pass through both heads as shown in Fig. 9. Between the two heads is mounted a helical spring 101, which tends to force the movable head downward away from the fixed head.

When the tappet finger TF secured to a reciprocating part 8 of the rammer moves upward it strikes the lower head of the tappet T′ and moves the same upward against the force of the spring, which is compressed at first and then finally reacts upward to lift the valve rod and valve. As the tappet finger continues to move upward it moves the valve with it until the extreme upward position is reached. On the downward movement of the tappet finger, the valve moves downward owing to its own weight and the weight of the valve rod. By this means, the valve is given a longitudinal reciprocation.

When steam is admitted to the valve chest S, by opening the inlet valve R, such steam will flow through whichever port P is open at that time to the steam cylinder. In the position shown in Fig. 9 the piston is down and the valve also is down, so that the lower port is open to admit steam from the chest to the cylinder below the piston. The upper port is open to the upper end of the valve chest to permit a free exhaust from the upper side of the piston and owing to the fact that the valve is tubular the exhaust steam may pass through the valve to the exhaust E^x. In this way the piston is moved upward by the steam, lifting the rod 6 and the tappet finger TF. After the tappet finger strikes the tappet T′ it lifts the valve rod and with it the valve V, thus connecting the upper port P with the central portion of the valve chest and connecting the lower port with the exhaust. The steam will now enter the upper end of the cylinder, if the steam inlet valve, R, is open, and the exhaust steam at the lower end of the cylinder will freely escape through the exhaust steam outlet. In this way the piston and its rod will be driven downward, by the steam when the steam inlet valve is open, or will fall downward by its own weight and that of its attached parts when the steam inlet valve is closed.

In the particular embodiment of the invention shown in the drawings, the steam inlet valve is shown as provided with suitable means for operating it, for example, a rod arranged for manual operation. In this construction the operator, by moving the rod, 103, may move the steam inlet valve to cut off the steam either wholly or in part, so that the piston may be allowed to fall wholly by gravity or may be aided in its downward movement by steam pressure, acting during a part only of the stroke or during the entire stroke, as may be desired.

For the purpose of balancing the valve and its rod and at the same time providing a means for the manual control of the valve, suitable means is provided, consisting in the present instance, of a three-armed lever fulcrumed at 104, one arm 105 engaging the valve-rod, the opposite arm 106 being engaged by a suitable counterbalancing device, as for example, the weight, B, while the third arm 107 serves as a hand lever for manually lifting the valve rod and valve. As the valve rod is reciprocated by the tappet mechanism, the lever will swing and the counterbalancing device will act continuously on the rod to counterbalance the said rod and valve.

It is to be understood that the two steam inlet valves of the two cylinders are so connected that the operation of one also operates the other, this being done by connecting the axes of the two valves by a rod (not

shown) which extends through extension 9ª of the boiler shell from one side to the other.

To the upper ends of the piston-rods above the cylinders is connected a yoke 7, (see Fig. 3) the connections being made in the present example, by forming tapering holes in the lower face of the yoke, into which the upper corresponding tapered ends of the rods enter, suitable keys 13 being driven through the rods and yoke.

To the lower ends of the rods 6 is connected a rammer shoe, 1, which forms an important feature of my invention.

The apparatus thus far described by me may be used with several modified forms of shoes, such as, for example, the forms illustrated in Figs. 1 and 2, these two kinds of shoes being interchangeable. However, all shoes embodying this invention have the essential feature that each extends in the direction of the width of the road-bed to an extent greater than the width of a wagon-track, while each shoe also extends in the direction of the length of the road-bed sufficiently to give the shoe a good bearing area on the roadway so that the shoe will not act as a chopping device.

A further important feature of the preferred form of the invention is that the lower face of the shoe conforms to the desired shape of the upper surface of the roadway to be made, whereby with such a ramming device the roadway is brought to the desired configuration and compactness without the labor and delay which would otherwise be required. It is also important under some conditions of service to make the shoe hollow and provide means for the admission of steam to the interior of said shoe whereby the shoe may be heated when desired, for example, in cold weather, whereby any frost may be melted and the shoe dried so that the road materials will not adhere to it.

In the form of shoe illustrated in Fig. 1, the said shoe is arranged to extend the full width of the roadway so that as the road-bed is rammed its upper surface will be brought to the final configuration transversely which it is intended to have, and this can be done quickly, even with relatively unskilled labor.

The form of shoe illustrated in Fig. 2 is designed for use on a wide road-bed, such for example, as a road-bed of double the width of the road-bed for which the shoe shown in Fig. 1 would be used, and in this case also the preferred form of shoe would have means for forming a side ditch at one end, as indicated at 1ᵇ. The said shoe shown in Fig. 2 and designated at 1ª is arranged to ram from about the center of the roadway to one side, including the side ditch. With this shoe it is intended to run the ramming apparatus along the right hand side of the road-bed in one direction and then to run said ramming apparatus in the opposite direction along the other side of the road-bed, thus completing the road-bed, and in the preferred embodiment of the invention also completing the side ditches.

In order to make the various types of shoes interchangeable on the ramming apparatus, each shoe is provided with socket devices 1ᶜ to receive the ends of the piston rods, these socket devices being on a common level, as will be clear from Figs. 1 and 2. The ends of the piston-rods are connected to the socket devices in the same way as the upper ends of the rods are connected to the yoke. For the purpose of supporting the outer ends of the shoes, suitable brace rods 8 (Fig. 3) are provided, and as these rods are to transmit both compressive and tensile strains, the ends of each rod are formed as eye-bars and pin-connected to the yoke 7 and shoe 1 respectively, these parts 7 and 1 being provided with recesses whose bottoms conform closely to the shape of the eye-bar ends.

In order that shoes of different types, such as illustrated in Figs. 1 and 2 may be readily interchanged on the ramming device, the distance between the recess for the eye-bar connection and the nearest socket device may be different in the different shoes, thus allowing the same eye-bar to be used with the different shoes, as will be clear from an inspection of the left hand ends of Figs. 1 and 2, the latter view showing the recess for the eye-bar connection at the left of the figure much closer to its nearest socket device than is the case with the construction shown in Fig. 1. Also in Fig. 2 the socket device at the left is longer than the corresponding one in Fig. 1. Therefore, with this arrangement the shoes may be interchangeably used without necessitating the use of different eye-bars so far as the left end of the shoes are concerned. But an extension of eye-bars may be used with the different shoes, as would be necessary, for example, with the ends of the shoes at the right hand in Figs. 1 and 2.

The front face of each shoe is curved, for example, as indicated in Fig. 3ª in order to make a gradual slope between the rammed and the unrammed portions of the road-bed as the ramming apparatus travels along the road. This curved or sloped front face of the shoe results in a gradual or progressive ramming of the road-bed, thus gradually bringing it to the final shape.

The piping for conducting the steam from the boiler to the valve chests of the ramming apparatus may be arranged in any desired manner, but most advantageously, by having a pipe, 108, leading from the steam dome through the smoke box of the boiler, said pipe passing through the front flue

sheet. In the smoke box the pipe 108, connects with branch pipes, 109, leading laterally outside the boiler shell and thence forward to the valve chests. A suitable main throttle valve, 19^a, may be located in the smoke box in the pipe, 108, to control the supply of steam to the individual inlet valves of the valve chest. This main throttle valve 19^a is provided with a handle 19 outside the boiler shell as shown in Fig. 4.

For the purpose of holding the moving parts of the ramming apparatus in their raised position, when said ramming apparatus is not in use, as, for example, when traveling from one point to another, a suitable holding means is provided, and in the preferred form of the invention this holding means is arranged to release the moving parts automatically when steam is turned onto the ramming apparatus. In the present example the holding and releasing means (shown in Figs. 4^a and 8) comprises a strut x, which may be held in a socket x^4, hinged to the top of the boiler shell or to a base piece x^5 suitably secured to the boiler shell near its forward end, the upper end of the strut x being notched as at x' to enter beneath the yoke 7 when the same is just below its highest position, so that the descent of the yoke will be prevented. A spring device, such as the leaf-spring x^3 tends to push the strut to a vertical position. A handle x^2 is provided near the upper end of the strut for convenience in swinging it.

When the ramming apparatus is not in use, the strut is swung forward on its hinge, so that its notched end x' will come under the yoke 7 and the latter is then lowered slightly until it rests on the strut. The steam being shut off from the power cylinders of the ramming apparatus the whole weight of the moving parts will rest on the strut and be transmitted to the front end of the boiler shell at the upper side at a point substantially over the front supporting roller 14.

When steam is turned into the power cylinders of the ramming apparatus it finds its way to the lower side of the pistons. Owing to the fact that as the pistons are not in their highest position, the tappet fingers TF have not lifted the valves V sufficiently to close the lower ports to the live steam. Thus the steam lifts the pistons and yoke, freeing the latter from the strut x, which is thrown backward to a vertical position by its spring x^3 so that the yoke may descend freely as soon as the tappet fingers TF shift the valves.

The tappet fingers, which have been fully described heretofore as being mounted on a moving part of the apparatus may be advantageously clamped to the eye-bars 8, near the upper parts of said eye-bars, thus allowing short valve-rods to be used and keeping the valve-controlling mechanism well up from the ground and out of the dust and dirt as much as possible.

It will be clear from the description of the apparatus embodying the invention, that the traction engine may be propelled forward at any desired rate of speed, while the power ramming apparatus may be operated at different speeds according to the amount of steam supplied on the up-stroke of the shoe. Also, the downward blow of the shoe on the road may be varied according to whether or not any steam is used on the down-stroke, and, if used, according to the amount of steam supplied, which may be controlled by the operator.

Owing to the great flexibility of control of the apparatus, the number of blows delivered on any given surface as well as the force of said blows, allows the operator to compact the roadway so as to bring it all to the exact configuration for which the under surface of the shoe is designed without the use of any special feats of engineering such as are required by the means heretofore employed.

An important feature of a shoe striking a width of roadway equivalent to more than the width of a wagon track at one blow is the concave curving of its under face to conform to the usual convex surface of the finished road, because this results in a kind of focusing action, the materials of the roadbed being compressed toward a central axis of the road, and hence not tending to be displaced laterally into the ditches and to the side of the road. Moreover this tendency to force the materials toward a central axis of the road results in an equalizing of the density of the road materials and enables the ramming apparatus to bring the whole roadway to a solid, smooth condition, and of uniform density.

Roadways are always crowned, that is, the center is somewhat higher than the sides, and the lower face of the rammer shoe in the present invention is of a corresponding contour, having a hollow curvilinear face transversely of the road surface. As the shoe is of comparatively great length, in most cases covering the full width of the road, as a result of this curvilinear face it exerts a particular confining type of compaction upon the road surfacing materials, crowding the particles inwardly and centrally in lieu of tending to displace them outwardly of the rammer face as is the case with a plane-faced rammer, and particularly one of relatively small dimensions as compared with the cross section of the road. So to speak, the upwardly curving lower face of the rammer shoe incloses the road material particles and exerts a pressure on them tending to drive them not only downward, but somewhat centrally as well. This gives

a much better type of road. This type of shoe has the further advantage that all portions of the road on a transverse section are compacted substantially alike, thereby differing again from the action of a small hammer face compacting different transverse portions of the roadway at different times with more or less of what may be called a "joint" between such portions.

By this invention, it is only necessary to throw the road materials into an approximate shape in advance of the rammer which then rams said materials into the desired finished form, completing the roadway as the apparatus travels forward.

Since an apparatus of this kind can be constructed to strike a blow of great force and far in excess of what can be accomplished with even the heaviest rollers, the resultant roadway can be given a smoothness and density heretofore unobtainable, so that from ordinary earths roads can be made that will shed the rains rapidly and hence be reasonably durable. Thus by such apparatus, roads can be built of materials not heretofore considered satisfactory for such purposes. A roadway of clayey materials constructed in the manner described makes an excellent foundation for the use of waterproofing binders and dust-preventives.

Furthermore, with the apparatus described it is possible to maintain a road in good condition at a reasonable expense, since it is only necessary to use the apparatus to ram the road occasionally, no preliminary preparation being necessary in most cases, and all engineering expenses being avoided.

It is further to be noted that the arrangement of the power ramming apparatus on the front end of the boiler of the usual traction engine is an important feature, because in such a traction engine the rear wheels have their axles as far to the rear of the boiler as possible, thus causing the weight of the boiler, its attached parts, and of the water in the boiler to be carried largely by the front supporting and steering means. As a result, the front end of the engine can offer a great reactive resistance to the upward thrust of the rammer at the time it strikes the ground to which resistance is added the weight of the said supporting and steering apparatus, that is the roller 14 and its connected mechanism, because of the connection between the boiler and said roller 14 which includes the ring or collar 17.

Gas or any other power may be used for actuating the reciprocating elements upon which the rammer used is mounted.

The apparatus may be, and advantageously is, provided with means for leveling and for right line adjustment of the same. As shown in Fig. 5, a portion of the boiler may be provided with a leveling device L, P. Or, as shown in Fig. 5[a], the steam cylinder may be provided with a level L[1]. And, again, as shown in Fig. 8, swinging folding sights 36, pivotally mounted with a weighted lower section to maintain perpendicularity, may be used. Devices of these types are advantageous with such an apparatus as is here described and shown. In coöperation with the forward adjustable mounting on roller 14 of the front end of the apparatus, the leveling means permits adjustment of the apparatus to the grade and inclination of the road to be treated. Collar 12 may be, and advantageously is, graduated as at 120 (see Fig. 5[a]). When this collar is mounted in its proper place and horizontal adjustment of the apparatus is right, these graduations come in line with the pointer of L, P (Fig. 5). The device 36 permits the apparatus to be guided forward in a straight line irrespective of the irregularities of the vehicle or road bed.

In a roadway it is frequently desirable to have minor transverse depressions or elevations, or ridges and hollows extending across the road for drainage and other purposes. With the present device these may be effectively produced while still maintaining the character of the roadway as a whole. The vertical adjustment of the forward end of the apparatus permitted by the means actuated by 20 (see the embodiment of this apparatus shown in Fig. 8) and controllable according to the indications of L, P permits accurate control of the clearance between the rammer cylinders and the roadway and hence accurate control of the local elevation of the surface produced by the rammer shoe.

As the rammer shoe is of great lengthwise extension, the transverse channels or ridges produced by it are of uniform character transversely of the road.

Having thus fully described my invention, what I claim is:

1. In a road ramming apparatus, a rammer shoe whose length transversely of the roadway is greater than the width of the wagon track to be rammed, said shoe having its under surface concavely curved longitudinally.

2. In a road ramming apparatus, a rammer shoe having a length greater than the width of a standard wagon track, said shoe having its under surface concavely curved longitudinally, in combination with means for reciprocating said shoe in a substantially vertical plane.

3. In a road ramming apparatus, a rammer shoe extending the full width of the roadway, and having its under surface curved concavely transversely of the roadway, in combination with means for reciprocating said shoe.

4. In a road ramming apparatus, the com-

bination, with a rammer shoe extending more than the full width of a standard wagon track and having in addition a portion for ramming a side ditch, of means for reciprocating said shoe, and means for moving the ramming apparatus along the road.

5. In a road ramming apparatus, the combination, with a rammer shoe extending the full width of a roadway including the side ditches and having the end portions of its lower surface curved convexly and the portion of its lower surface intermediate its length curved concavely in the direction of the length of the shoe, of means for reciprocating said shoe.

6. In a road ramming apparatus, the combination, with a traction engine having a horizontal boiler, traction wheels near the rear end thereof, and a front supporting means near the front end of said boiler, of a ramming apparatus mounted on the front end of the boiler and comprising a steam cylinder and piston, the latter arranged to reciprocate in a vertical plane, and means for conducting steam to said cylinder from the boiler.

7. In a roadmaking apparatus, a vehicle and power ramming means carried by said vehicle, said means comprising a rammer shoe having a continuous concavely curved working face extending laterally beyond the sides of said vehicle.

8. In a roadmaking apparatus, a vehicle and power ramming means carried by said vehicle, said means comprising a rammer shoe having a continuous concavely curved working face extending laterally beyond the sides of said vehicle and comprising a plurality of piston-actuated means engaging said shoe at different points.

9. In a roadmaking apparatus a self-propelled vehicle having a boiler provided with a cylindrical forward extension, a circumferentially adjustable collar mounted on the extension, means for adjusting the same, a pair of engine cylinders having pistons and piston rods and mounted on opposite sides of the collar and a common rammer shoe carried and actuated by said rods.

10. In a roadmaking apparatus, a plurality of spaced power actuated devices provided with reciprocating stems and a rammer secured to said stems and having a curvilinear working face and a lateral extension beyond said devices on each side.

11. In a roadmaking ramming device a vehicle mounted on wheels at its rear extension, a roller mounted under its forward extension, means for steering through said roller and power-actuated ramming means forward of said roller, said ramming means comprising a continuous rammer shoe of greater length than the width of said vehicle and having a reëntrant curve in its working face.

12. In a roadmaking ramming device, a vehicle carrying a boiler, a circumferentially adjustable collar mounted on a cylindrical extension of said boiler, a pair of steam cylinders respectively mounted on each side of said collar and having pistons and piston rods, a common rammer shoe mounted on and actuated by said rods and having a length greater than the diameter of said collar and means for actuating said pistons in either direction.

13. In a roadmaking ramming device, a vehicle carrying a boiler, a circumferentially adjustable collar mounted on a cylindrical extension of said boiler, a pair of steam cylinders mounted respectively on each side of said collar and having pistons and piston rods, a common rammer shoe mounted on and actuated by said rods and having a length greater than the diameter of said collar, said shoe having a continuous working face with a reëntrant curve, and means for actuating said pistons in either direction.

14. In a roadmaking ramming device, a vehicle carrying a boiler, a circumferentially adjustable collar mounted on a cylindrical extension of said boiler, a pair of steam cylinders respectively mounted on each side of said collar and having pistons and piston rods, a common rammer shoe mounted on and actuated by said rods and having a length greater than the diameter of said collar, a yoke above the steam cylinders and upward extensions of the piston rods mounted in said yoke.

15. In a roadmaking ramming device, a vehicle carrying a boiler, a circumferentially adjustable collar mounted on a cylindrical extension of said boiler, a pair of steam cylinders respectively mounted on each side of said collar and having pistons and piston rods, a common rammer shoe mounted on and actuated by said rods and having a length greater than the diameter of said collar, a yoke above the steam cylinders, upward extensions of the piston rods mounted in said yoke and rods connecting the ends of the yoke with the ends of the rammer shoe.

16. In a roadmaking device, a vehicle, power actuated ramming means carried thereby and comprising a rammer shoe of greater length than the width of said vehicle and having a continuous working face and means for adjusting the level of said rammer shoe independent of the position of the vehicle.

17. In a vehicular roadmaking machine, a vehicle body, wheel means carrying the rear of said body, a roller carrying the front of said body, means for adjusting the vertical distance between said body and said roller and means for ramming the roadway ahead of said roller.

18. In a roadmaking ramming device, a

vehicle carrying a boiler, a circumferentially adjustable collar mounted on a cylindrical extension of said boiler, a pair of steam cylinders respectively mounted on each side of said collar and having pistons and piston rods, a common rammer shoe mounted on and actuated by said rods and having a length greater than the diameter of said collar, a yoke above the steam cylinders, upward extensions of the piston rods mounted in the yoke and detent means for securing the assemblage of yoke, rods and shoe in an elevated non-road engaging position.

19. In a roadmaking apparatus, a vehicle provided with supporting wheel means at its rear end, a rolling support for the vehicle near its forward end, vertically adjustable means connecting the rolling support and the vehicle, power actuated ramming means carried by the vehicle forward of the rolling support, said ramming means comprising a ramming shoe of greater length than the width of the vehicle and sighting means on the vehicle for controlling the adjustment of the vertically adjustable means.

20. In a roadmaking apparatus, a vehicle provided with supporting wheel means at its rear end, a rolling support for the vehicle near its forward end, vertically adjustable means connecting the rolling support and the vehicle, power actuated ramming means carried by the vehicle forward of the rolling support, said ramming means comprising a ramming shoe of greater length than the width of the vehicle and sighting means on the vehicle controlling the line of direction of said vehicle, said means comprising automatic folding sights mounted on and parallel to the vehicle body and comprising a weighted lower portion to maintain the sights in a perpendicular position automatically to enable guidance of the vehicle in a straight forward line.

In testimony whereof, I affix my signature, in the presence of two witnesses.

OTTO ABELING.

Witnesses:
CHAS. F. STACK,
AL. B. GRIFFITH.