Feb. 28, 1933. M. H. LEMAIRE 1,899,874

SYSTEM FOR CONTINUOUSLY CLEANING THE BALLAST OF RAILWAY TRACKS

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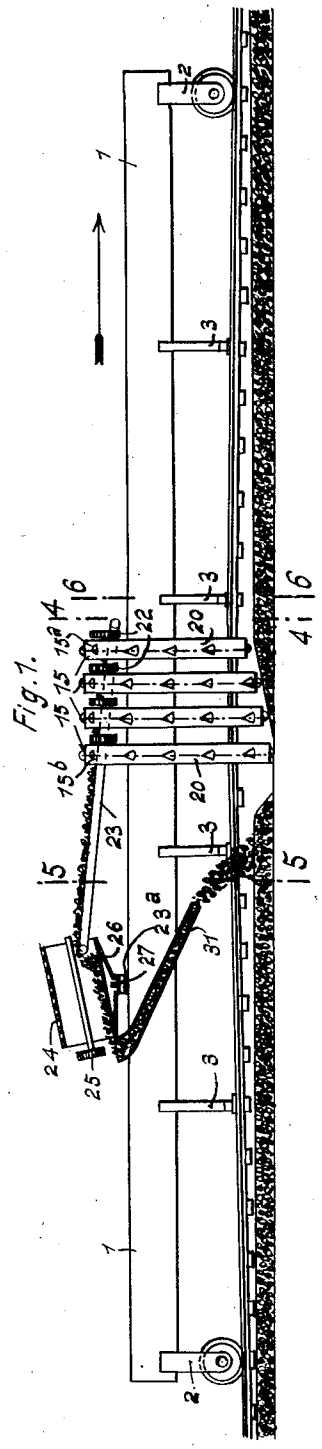


Fig. 1.

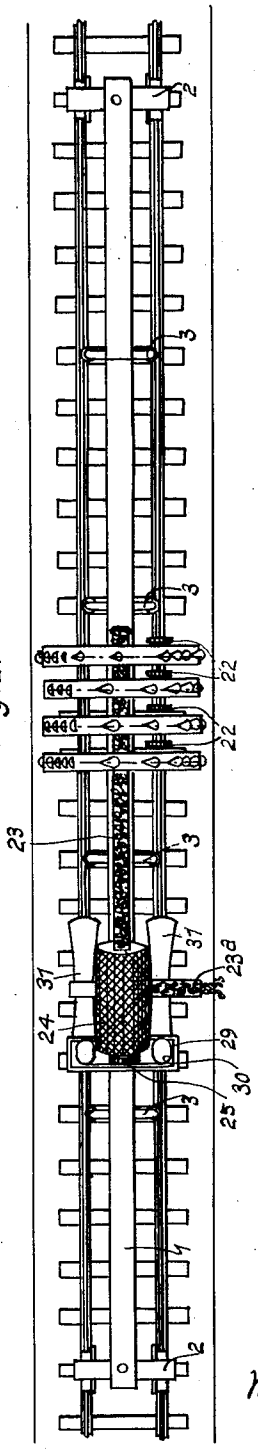


Fig. 2.

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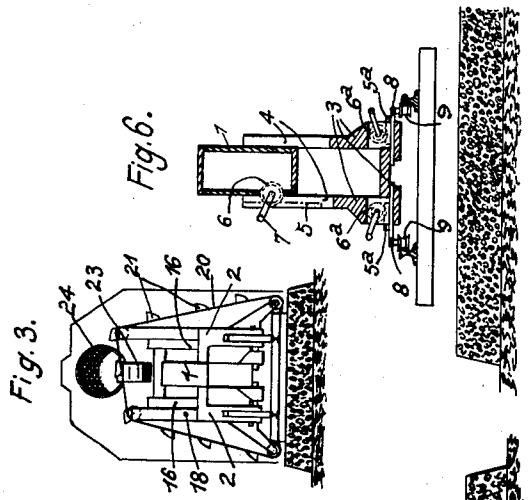


Fig. 6.



Fig. 3.



Fig. 5

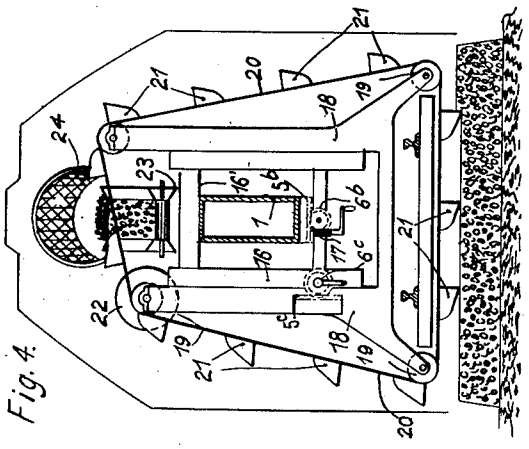


Fig. 4.

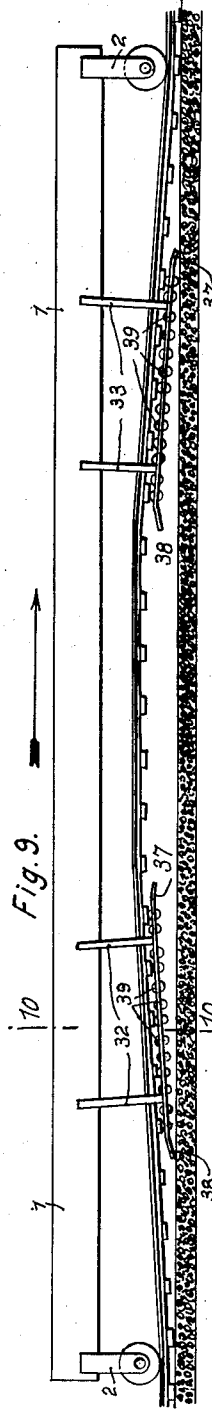


Fig. 9.

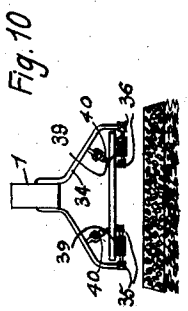


Fig. 10

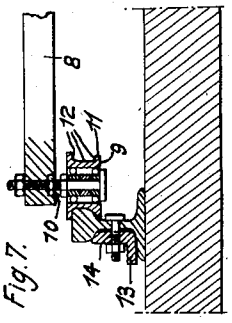


Fig. 7.

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Fig. 11.

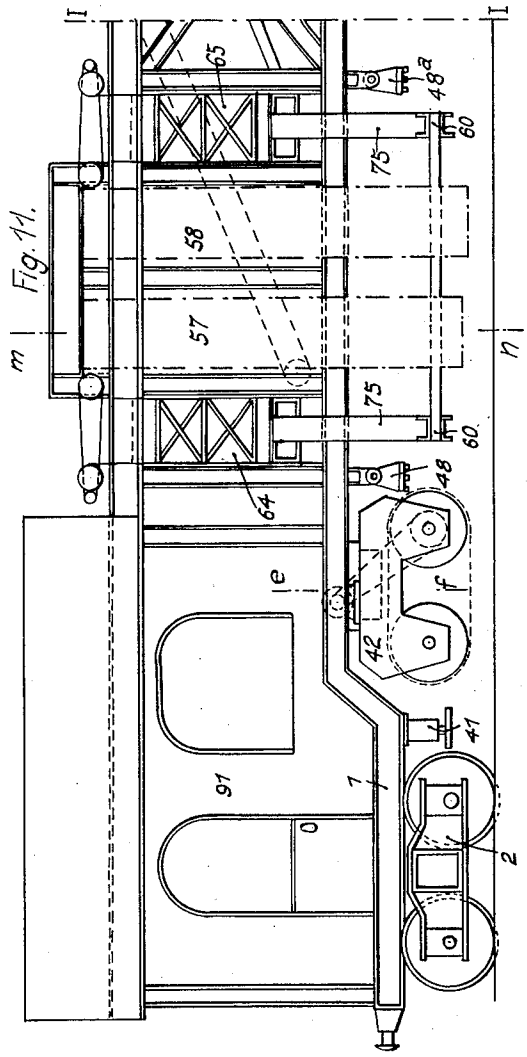



Fig. 11a.

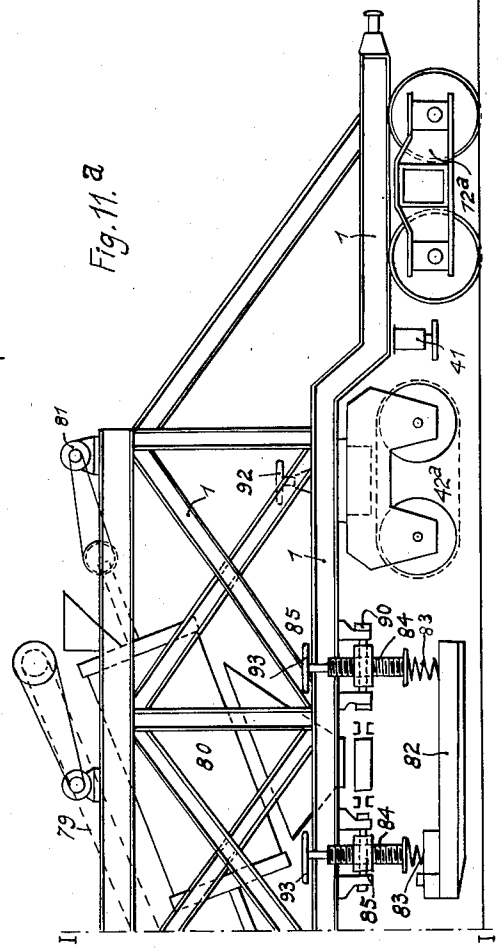
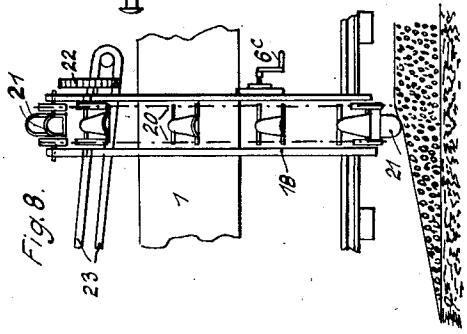



Fig. 8.




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Fig. 13

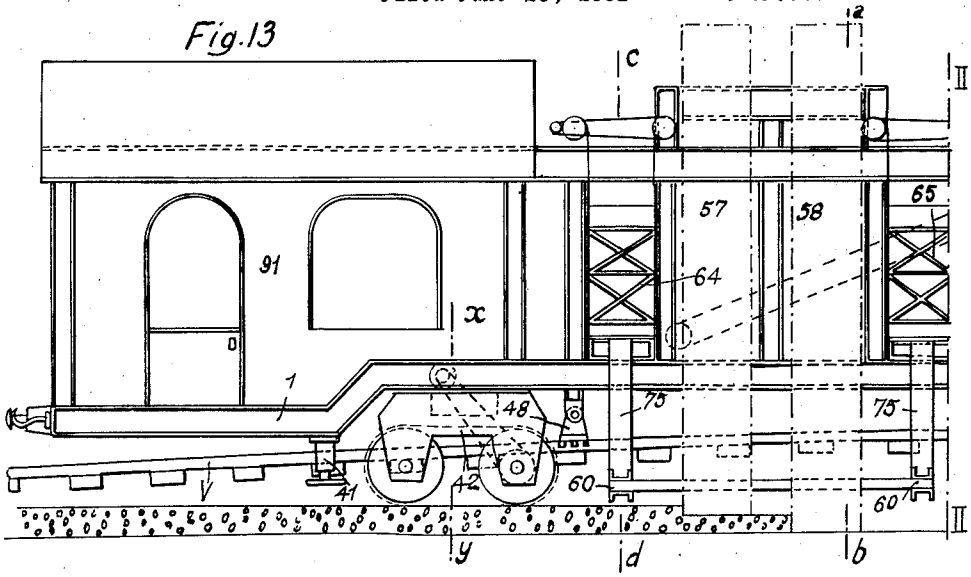



Fig. 13a

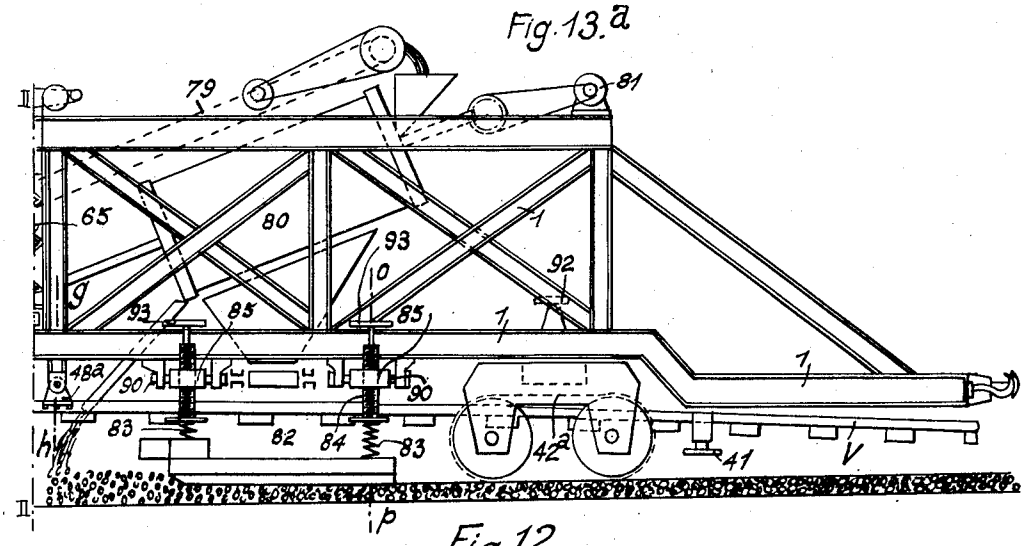
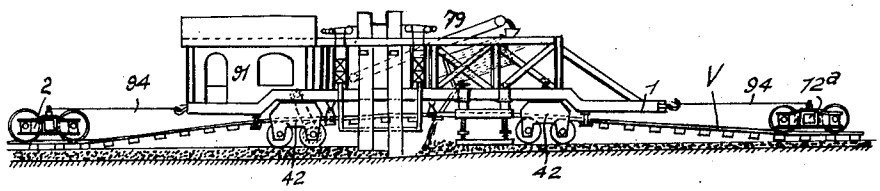



Fig. 12.




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SYSTEM FOR CONTINUOUSLY CLEANING THE BALLAST OF RAILWAY TRACKS

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Fig. 14.

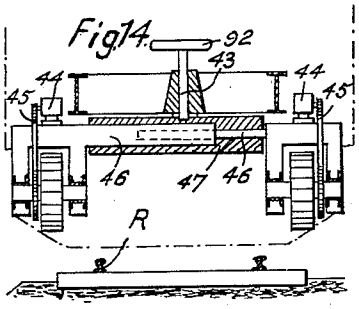



Fig. 15.

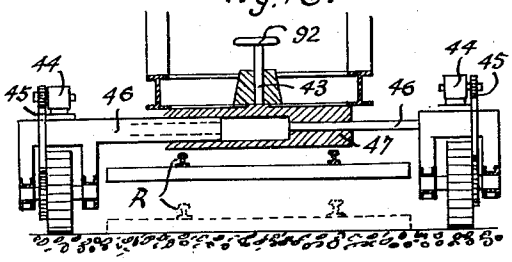



Fig. 16.

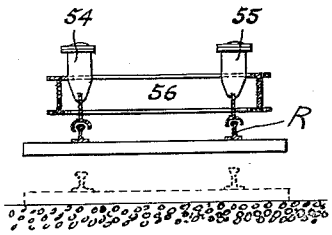



Fig. 17.

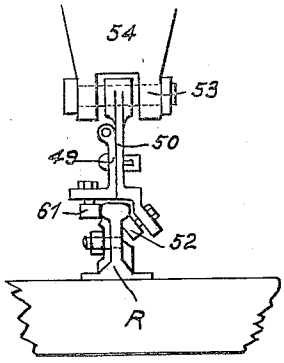



Fig. 18.

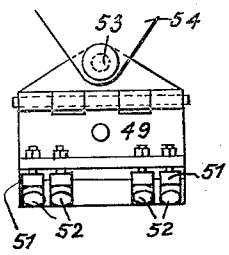
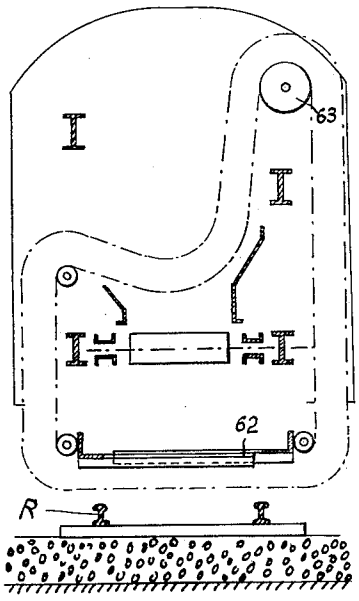
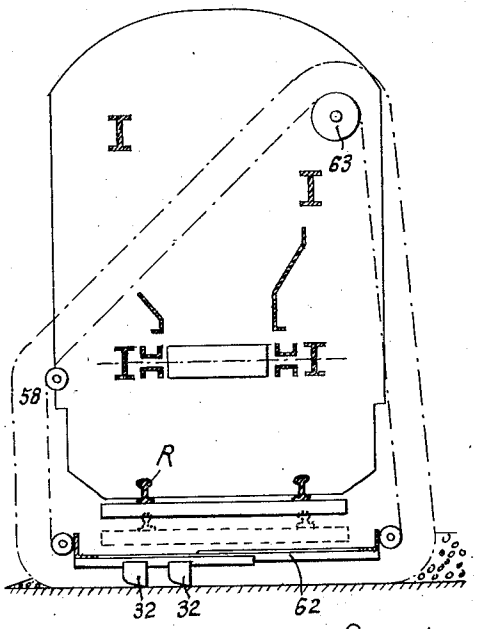



Fig. 19.

Fig. 20.




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Fig. 21.

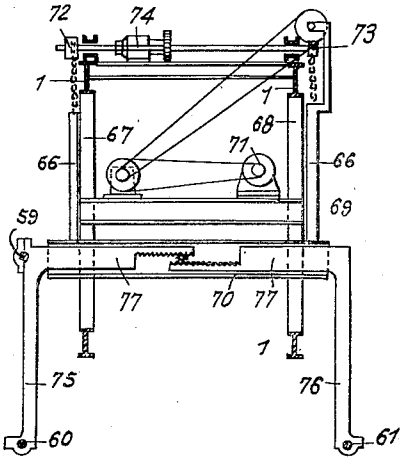



Fig. 22.

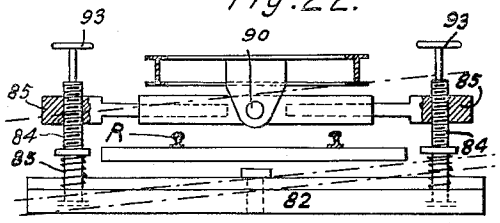
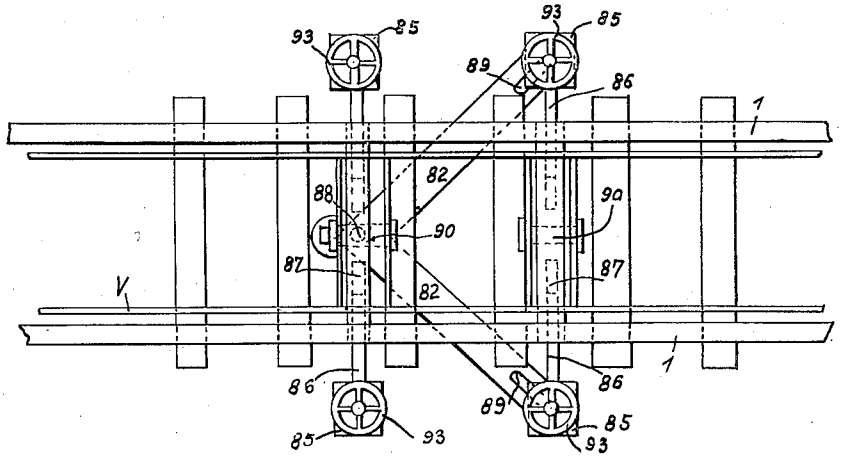



Fig. 23.




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Patented Feb. 28, 1933 1,899,874

# UNITED STATES PATENT OFFICE

MAURICE HENRI LEMAIRE, OF VALENCIENNES, FRANCE

## SYSTEM FOR CONTINUOUSLY CLEANING THE BALLAST OF RAILWAY TRACKS

Application filed June 26, 1931, Serial No. 547,157, and in France July 28, 1930.

According to present methods the work of cleaning the ballast requires considerable time and labour. It is necessary to remove the ballast to be cleaned by pick and shovel, to pass it to the screen, to take it out again and reballast the track, all of which are long, onerous operations. There are also used various mechanical systems mounted on rolling stock but the latter are comparatively slow in output or cannot be used except on a double track, which involves the inconvenience of holding up the traffic on two tracks and above all of being useless in the case of a single line.

The present invention has for its object a method of continuously cleaning the ballast capable of yielding a large output and particularly remarkable in that it consists in using a screen wagon running on the track itself which is to be cleaned and capable consequently of being used on a single track, the said wagon running on two bogies on which is mounted a rigid beam carrying track raising devices and in the central part a mechanical excavating and screening system.

The raising devices are arranged at both ends of the excavating system so that the track may be raised in the form of an arc under one part of the length of the beam to make possible the passage of the excavators under the track and their continuous rotation round the beam and the track during the forward movement of the whole system.

The ballast to be cleaned is removed by the excavators and taken to the screening device on the beam and is tipped out on to the road in a continuous manner after cleaning.

In one form of execution, the raising devices comprise a frame movable vertically by means of racks or like members, cross pieces movable transversely independently of each other, and rollers mounted at the end of these cross pieces the said rollers being intended to grasp and retain the track by the rails during the action of raising.

According to another characteristic, the system comprises a series of excavating arrangements located at the central part of the beam, the various heights of these devices being regulated by means of suitable members so that the bed of ballast is progressively removed during the forward movement of the system, the first excavator removing the top layer and the last excavator levelling the formation.

A modified way of carrying out the same method of cleaning, which is particularly advantageous, is characterized principally in that:

(1) On passage from the running position to the working position the arrangements for ordinary running on rails are taken away or raised; the screen wagon then travelling on the ballast itself during the cleaning operation by means of caterpillar tracks embracing the sleepers.

In this new form of execution, for setting the excavators into operation, the track is also suspended by raising devices in such a manner that the forward movement of the machine has the effect of progressively raising the track and making possible the passage of the excavators under it, as also their continuous rotation around the metallic framework of the wagon and around the track itself during the forward movement of the system.

This new construction of the screen wagon makes it possible to give it a considerably smaller length, the track being completely free under the beam, so that the length of the latter is not determined by the length of the arc of deformation of the track.

(2) The excavators are mounted on extensible sliding frames which can be folded back to come within the loading gauge when travelling.

(3) The screen wagon is completed by a device for distributing, levelling and compressing the ballast operating by uniformly distributing, levelling and compressing the cleaned ballast on the road before the descent of the track in such a way that the latter is subjected to an immediate trimming under the sleepers with the cleaned ballast.

The invention also comprises improvements relating to the track raising devices.

In the attached diagrammatic drawings given by way of example,

Fig. 1 is an elevation of the cleaning system in operation.

Fig. 2 is a plan of Fig. 1.

Fig. 3 is an end elevation of Fig. 1.

Fig. 4 is a transverse section on a larger scale on the line 4—4 of Fig. 1.

Fig. 5 is a section on a larger scale on the line 5—5 of Fig. 1.

Fig. 6 is a transverse section on the line 6—6 of Fig. 1 showing one of the devices for raising the track by direct action on the rails.

Fig. 7 is a part section on a larger scale corresponding to Fig. 6 and showing in detail one of the raising pulleys.

Fig. 8 is an elevation showing one of the excavating devices on a larger scale.

Fig. 9 shows diagrammatically in elevation a modification of the track raising device.

Fig. 10 is a section on the line 10—10 of Fig. 9.

Figs. 11 to 23 relate to the modified way of carrying out the invention.

Figs. 11 and 11*a* are elevations of the arrangement in position for travelling.

Fig. 12 shows the same in working position.

Figs. 13 and 13*a* are views corresponding to the preceding but on a larger scale.

Figs. 14 and 15 are transverse sections of the caterpillar tracks on the planes *e*—*f* of Fig. 11 and *x*—*y* of Fig. 13 respectively.

Fig. 16 is a diagrammatic view of an arrangement for grasping and raising the track, in section on the plane *g*—*h* of Fig. 13.

Fig. 17 is a detail view on a larger scale than the preceding figure.

Fig. 18 is a front view of a raising device.

Figs. 19 and 20 are transverse sections of excavating devices on the planes *m*—*n* of Fig. 11 and *a*—*b* of Fig. 12 respectively.

Fig. 21 is a diagrammatic elevation of one of the extensible sliding frames carrying the excavators. It is taken in section on the plane *c*—*d* of Fig. 13.

Figs. 22 and 23 show the device for equalizing, levelling and compressing the ballast, the first in section on the plane *o*—*p* of Fig. 13, the second in plan.

In the system shown in Figures 1 to 8, the cleaning arrangement comprises a rigid beam 1, mounted for example on two bogies 2 provided with axles and wheels enabling them to run on the track. On the beam 1 are fixed a certain number of track raising devices 3 (four in the example of the drawings). In Figures 6 and 7 the devices 3 are shown on a larger scale. They comprise, for example, a frame 3 slidably mounted on the beam 1; this frame is moved vertically by means of a rack 5 forming a jack, in engagement with a pinion 6, the rack 5 is fast with the frame 4 and the pinion 6 is mounted in a suitable manner on the beam 1. A handle 7 or any other driving means ensures the rotation of the pinion 6.

At the base of the frame, two cross pieces 8 are mounted and are arranged for movement independently of each other on the right and left respectively of the frame 4 by means for example of racks $5^a$ and pinions $6^a$ or any other driving arrangement. At the end of each cross piece 8 are fixed two rollers 9 (see Fig. 7). These rollers are for example journalled on a vertical axle 10 and provided with ball or roller bearings 11. The rollers 9, in addition, are provided on their periphery with a groove 12 having a profile corresponding to the head of the rail to be raised.

To enable the roller 9 to run on the inside of the rail the inner fish-plate is removed and the outer fish-plate 13 is temporarily held in place by means of flat-headed bolts 14.

At the central part of the beam 1, four or another number of excavators 15 are arranged. In Figures 4 and 8 one of these excavators is shown on a larger scale.

These excavators 15 will be of any suitable type constituted in principle by a frame 16 resting on the beam 1; this frame is capable of lateral displacement by means of any mechanical arrangement. The arrangement shown comprises a rack $5^b$, fixed to the beam, in engagement with a pinion $6^b$ driven for example by a worm gear and handle 17. On this frame 16 a fitting 18 is mounted so as to be capable of vertical movement and of being regulated in height by means of a rack $5^c$ in engagement with a pinion with handle $6^c$ fixed on the frame or by means of any other device. On the fitting 18 two driving pulleys 19 are mounted in a suitable way for driving an endless chain 20 fitted with buckets 21. A pulley 22 or other member is provided for driving the bucket chain 20. This pulley is for example keyed on the end of the shaft carrying the pulleys 19.

A conveyor belt 23 mounted on the beam 1 is driven by any motive system and receives the ballast discharged by the buckets 21. The belt 23 of any type is placed below the excavators 15 at their upper part and is extended so as to discharge the ballast to be screened into a rotary or other screen 24 mounted on the beam 1. The screen 24 is driven by a pulley 25 by means of any motive system.

Below the screen a hopper 26 receives the tailings, earth or impurities from the ballast. This hopper of suitable form has at its bottom an opening 27 for excavation of the materials extracted in the screening. The opening 27 is opposite a second conveyor $23^a$ transverse to the track and driven at high speed by any motive system. The conveyor $23^a$ is extended on the outside to 28.

At the end of the screen 24 a container 29 fixed to the beam 1 and placed transversely

receives the ballast. This container, as shown in Figures 1 and 5, comprises an upper compartment 30 in which two chutes 31 end. The latter are inclined and placed substantially vertical above each rail.

The operation of the cleaning system is as follows.

The screen wagon is drawn along the track to be reballasted to the place desired.

By means of the rack 5 and pinion 6 the raising devices 3 are brought to the height of the rail. The rollers 9 are put into contact with the heads of the rails by actuating the racks $5^a$ and pinions $6^a$. The height of the devices 3 is then regulated so that the centre ones are higher than the end ones; the track is thus raised in an arc of a certain length.

By actuating the racks $5^c$—$6^c$ the supports of the excavators 18 are lowered and the bucket chains are set into the operating position having been previously raised on either side of the frame 18 in the travelling position.

The excavator 15, the conveyors 23 and $23^a$, as also the screen 24, are then set into motion, the wagon is drawn in the direction of the arrow and the excavators are gradually lowered so that the first takes the top layer and the last levels the formation of the road.

As the wagon moves forward the devices 3 raise the track by means of the rollers 9 in engagement with the rails, the ballast to be cleaned, demoved by the excavators, is discharged on to the conveyor 23 which in turn takes it to the screen 24. The dirty bal'ast and tailings passing from the screen into the hopper 26 fall on to the conveyor $23^a$.

In consequence of its transverse position and its high speed of drive the conveyor $23^a$ throws the dirt beyond the track.

The screened ballast emerges from the screen 24 and falls into the compartment 30 from which it flows by the chutes 31.

In consequence of the arrangement of the chutes 31 the ballast falls on the rails and is thus divided and distributed uniformly between the rails. It is sufficient then after the wagon has passed to level the bal'ast, pack it and replace the inner fish-plates which had previously been removed for permitting the passage of the rollers of the raising devices. On curves the track is kept in its place under the wagon by means of the lateral displacement of the raising devices 3 effected in a suitable manner.

The use of this cleaning system is extremely simple and very effective; further it makes it possible to achieve a considerable economy in labour and a substantial gain in time for carrying out the cleaning of the ballast. The speed of movement of the system may easily reach 150 metres per hour.

In Figures 9 and 10 a modification of the elevating system is shown in which the device is constituted by two elements 32 and 33 fixed to the beam 1; these elements comprise a fitting 34 capable of vertical and lateral regulation by any suitable means. At the base of this fitting two longitudinal frames 35 and 36 are fitted which are curved at their extremities 37 and 38.

On these frames a certain number of rollers 39 are mounted freely, the gap between two rollers being less than the width of a sleeper.

In this case the track is raised as a preliminary by means of jacks, the frames are inserted below the sleepers and the arrangement is regulated and locked in height and in inclination.

As the screen wagon is moved forward the track will be raised by the front element 33, the sleepers resting in succession on the rollers. The track then rests on the rear element before replacing itself on the screened ballast. The excavators and the screen operate as described above. On curves the track retains its curvature under the wagon in consequence of the presence of the rollers 40 engaging the rails.

It will be noted further that the whole arrangement remains within the normal loading gauge of the rolling stock and can therefore be moved without inconvenience over the whole network of the system.

In the modified way shown to Figs. 11 to 23, the cleaning system consists of a rigid beam 1, for example, of metallic lattice. In the travelling position this beam is supported and runs on the track V by two bogies 2 and $12^a$.

On this beam are mounted groups of jacks 41, electric, hydraulic or pneumatic, which make possible the raising of the beam for changing from the travelling position to the working position.

For this conversion the beam wagon is provided with caterpillar tracks 42—$42^a$, two in number in the example of the drawing. Each of them is mounted on the beam in the manner of a bogie, the working pin 43 of which should be capable of adjustment.

The front bogie 42 is the only driving one. The drive is carried out by motors 44, the motion of which is transmitted by chains 45 to the caterpillar wheels.

The caterpillars are made fast with the bogies by means of sliding journals 46, entering a sleeve 47. This arrangement is adopted so as to clear the loading gauge in the travelling position as shown in Fig. 15. The motors 44 are of variable speed so as to make it possible to make one caterpillar rotate more rapidly than the other at curves in the track.

The track raising devices as shown in Figs. 16 to 18 will be provided in general to the number of two pairs 48, $48^a$ suitably spaced on the beam. Each of these devices constitutes a kind of travelling grip confining the head of the rail R. These travelling grips

are constructed as hinged tongs formed of two elements 49 and 50 assembled together. The rails are engaged by rollers 51, 52 arranged on one side and the other of the tongs. The latter are capable of pivoting on axles 53 allowing a certain lateral play which makes it possible for the travelling grips to adapt themselves to various distances between the rails and to the different inclinations of the same. The travelling grips are raised and held up by hydraulic or pneumatic jacks 54, 55, arranged on a cross piece 56.

The excavating systems rotating around the track in paths 57 and 58, are supported by pulleys rotating on axles 59, 60, 61. They slide on a sliding structure 62 and are driven by gear wheels 63. These excavators are supported by mechanisms 64, 65 which embrace them. Each of these mechanisms comprises in essence a frame 66 capable of sliding in grooves carried in uprights 67 and 68 of the beam 1 (Fig. 21). Cross pieces 69, 70 brace the frame 66.

The driving motor 71 is carried by the cross piece 69.

The raising and lowering of the sliding frame are accomplished by a double winch 72, 73, driven by a motor 74. Of course the motors 74 turn in synchronism during the raising or lowering of the frame 66.

In order that the excavating devices should be extensible transversely of the track the axles 59, 60, 61 of the excavator pulleys rotate in fittings 75, 76 which are capable of sliding, for example by means of rollers, inside the cross piece 70. The frames 75—76 are caused to move together (travelling position, Fig. 19) or apart, (working position, Fig. 20) by the action of a suitable device such as a rack and pinion system 77, or pneumatic or hydraulic jacks, etc.

The ballast discharged by the excavating buckets 78 is received by a conveyor belt 79 which takes it into a rotatable or other screen 80 mounted on the beam 1, and driven by a motive system 81; the actual principle of this arrangement had already been indicated in the form of execution shown in Figures 1 to 10.

The system for equalizing, levelling and compressing the ballast is constituted in essence by a casting 82 in the form of a V somewhat similar to that of a snow-plough. This piece is supported at its ends by strong spiral springs 83, regulatable as regards height by means of screws 84 turning in supports 85. The lower part of this equalizer is chamfered so as easily to distribute, equalize and compress the ballast. This system must be capable of being folded back in the travelling position to clear the loading gauge. For this purpose the supports 85 are caused to approach the axis of the track, by sliding on the arms 86 which carry them, inside a sleeve 87. To make this deformation possible the branches 82—82 of the V can each be turned about a front axis 88 and in addition slots 89 are provided at the rear end of the said branches.

The equalizing device can rotate about axles 90, parallel to the direction of the beam, so as to be slightly inclined when it is desired to give a suitable super-elevation to the ballast to one side.

On the screen wagon there is installed a cabin 91 occupied by the mechanic. The control of the front caterpillars is effected from this cabin. The rear caterpillars are guided by a workman by means of a wheel 92. The same workman can also operate the wheels 93 accomplishing the lowering of the equalizer.

The energy necessary for actuating the various mechanisms will be supplied for example by a Diesel engine coupled to a generator supplying electric current. The same engine can actuate, in addition, the air or water pumps required for the jacks.

The operation of this cleaning system is carried out as follows.

The screen wagon in travelling position is taken on the track to be reballasted to the commencing point of the work.

To change over from the travelling position to the working position the wagon is raised by the jacks 41—41. The bogies 2 and $2^a$ are taken off and attached respectively to the front and rear of the vehicle by cables 94 at one end and the other of the hog back which will be formed by the raising of the track.

The caterpillar tracks are drawn outwards into the working position to embrace the ends of the sleepers (Fig. 15). They are then lowered down to the road by operating the jacks 41.

For setting the excavators into action the track is unfished at a rail joint and is raised at the front by the front travelling grips 48. The beam is then caused to advance on the caterpillars so that the raised end of the track enters the belts formed by the excavators previously moved apart by the extension of the fittings 75—76 and slightly lowered by the frame 66. When the excavators are completely engaged below the track their setting into the working position is completed by commencing the cleaning, the excavators being set into movement at the same time by means of the motors 71.

The ballast levelling equalizer is introduced under the track after having been opened to the working position. Its lowering is effected progressively.

Finally, the track can be refished behind the machine and the rear raising devices $48^a$ may similarly be put into action.

As in the form of execution shown in Figures 1 to 10, in order to make possible the circulation of the gripping rollers 52 on the

inside of the rails, the inner fishplates are taken away and the outer fishplates are held in place temporarily by any suitable means, for example by flat-headed bolts.

The reverse operations to the foregoing are carried out on the cessation of work.

Of course, the invention is not limited to the manner of execution described above, nor to the examples shown. Inclined rollers can be used for example for the elevating device shown in figures 1 to 10, or instead of a frame with rollers a simple shoe of which the upper surface would be made convex, the sleepers then sliding on the shoe, or again a system of rollers and electromagnets could be used. Again, any other arrangement of excavator, conveyor or screen could be used. The devices for lateral and vertical displacement by rack and pinion could similarly be replaced by a system of nuts and screws, hydraulic or pneumatic jacks or other arrangements.

Also, the apparatus described in the second form of execution may be used specially for raising the track, that is to say, for the operation which consists in laying new ballast and then raising the track and introducing this ballast under the sleepers. For this purpose and without departing from the spirit of the invention the beam may comprise no excavators, or if it has them they may remain out of use. Such an application may be envisaged just as well in the method of progression on caterpillars as in that of progression on the track itself with a wagon of long wheel base of the type shown to Figures 1 to 10.

In addition, instead of running on either bogies or on caterpillars the screen wagon may move on an auxiliary running track embracing the track itself and laid temporarily for carrying out the work of cleaning.

I claim:

1. A device for cleaning railway track ballast comprising a beam movable along the track, a plurality of lifting devices carried by the beam and having rail engaging members connected therewith and operable to lift the rails from the ballast, a plurality of endless conveyors surrounding the beam and rails, a screen supported by the beam, and means for conducting the ballast elevated by the conveyors to the screen, as and for the purpose set forth.

2. A device for cleaning railway track ballast comprising a beam, a set of wheels at each end of the beam movable along the track rails, lifting devices carried by the beam and engageable with the rails to lift the rails into arc formation between the sets of wheels, endless conveyors surrounding the beam and rails, means for imparting movement to the conveyors, a screen, and means for conducting the ballast from the conveyors to the screen, as and for the purpose set forth.

3. A device for cleaning railway track ballast comprising a beam, wheels on the beam engageable with the rails of the track, rail lifting devices on the beam, a frame associated with the beam, endless conveyors surrounding the frame, beam and rails, means for moving the frame laterally and vertically with respect to the beam, a screen, and means for conducting ballast from the conveyors to the screen.

4. A device for cleaning railway track ballast comprising a beam movable along the track rails, lifting devices carried by the beam, grooved rollers carried by the lifting devices, means for adjusting the rollers to cause the grooves therein to engage the heads of the rails to lift the same, endless conveyors surrounding the beam and rails, a screen associated with the beam, and means for conducting ballast from the conveyors to the screen.

5. A device for cleaning railway track ballast comprising a beam movable along the track, lifting devices carried by the beam and engageable with the rails to lift the same from the roadbed, endless conveyors surrounding the rails and beam, a screen mounted on the beam, means for conducting ballast from the conveyors to the screen, a chute below the screen for receiving the ballast from the same, and means for discharging tailings from the ballast laterally of the roadbed.

6. A device for cleaning ballast of railway tracks comprising a beam having track engaging wheels upon its ends for supporting the beam, trucks carried by the beam and having endless tracks thereon for travel along the ballast of the roadbed when the tracks are elevated, said wheels being detachably engaged with the beam and movable to positions spaced from the ends of the beam whereby the beam is supported on the ballast by the trucks.

7. A device as claimed in claim 6, wherein the trucks are adjustable laterally of the beam.

The foregoing specification of my "System" for continuously cleaning the ballast of railway tracks" signed by me this 16th day of June, 1931.

MAURICE HENRI LEMAIRE.