S. R. W. M. BAGER.

EQUALIZING SYSTEM FOR STEAM SHOVELS AND THE LIKE.

APPLICATION FILED FEB. 17, 1913.

1,075,081.

Patented Oct. 7, 1913.

5 SHEETS—SHEET 1.

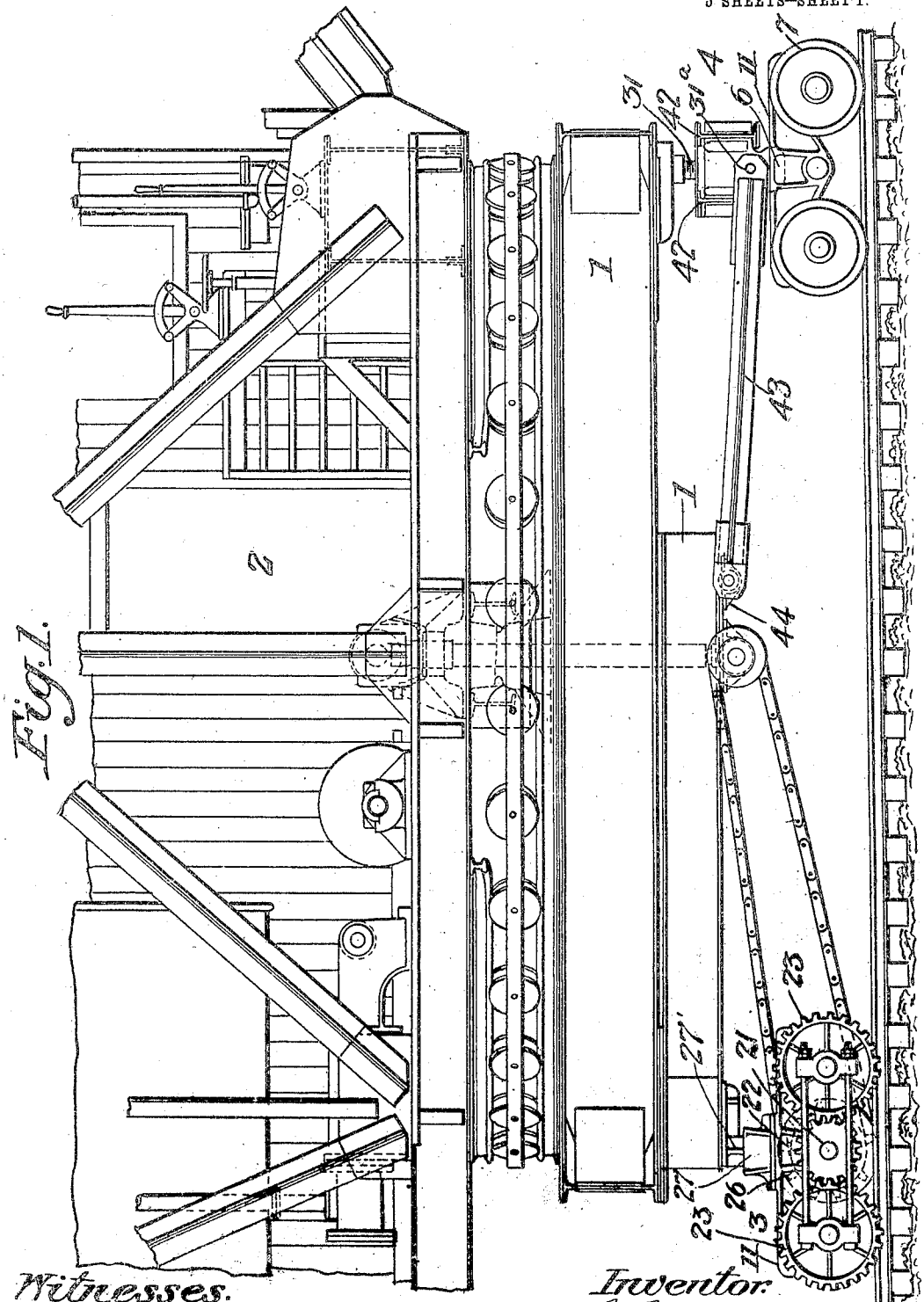



Fig. 1.

Witnesses.
O. C. Eglin.
V. T. Houghton.

Inventor:
S. R. W. M. Bager
by Edwin Goldsborough & O'Neill
Attys.

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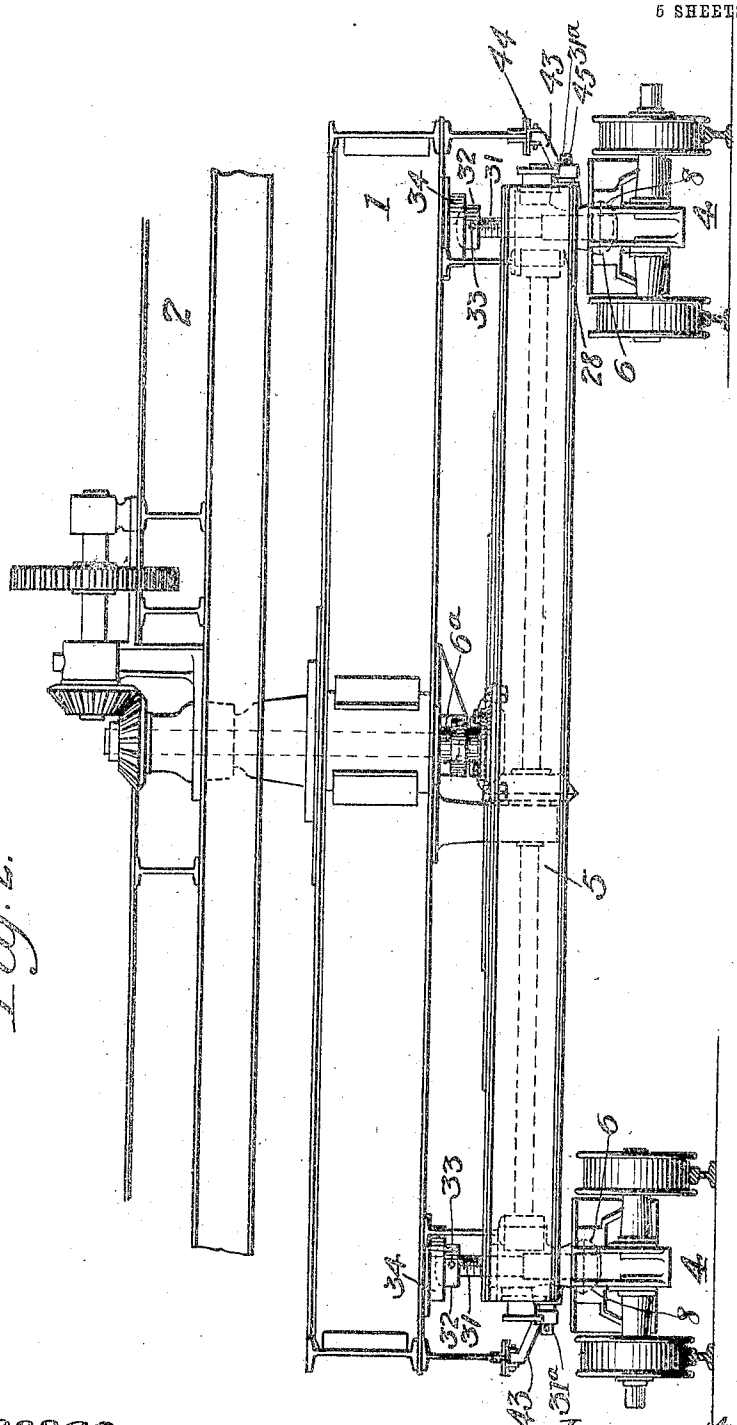



Fig. 2.

Witnesses.

D. C. Edelin

V. J. Houghton

Inventor.

S. R. W. M. Bager

by Howson Sheldon Brigham & Reid

Attys.

S. R. W. M. BAGER.

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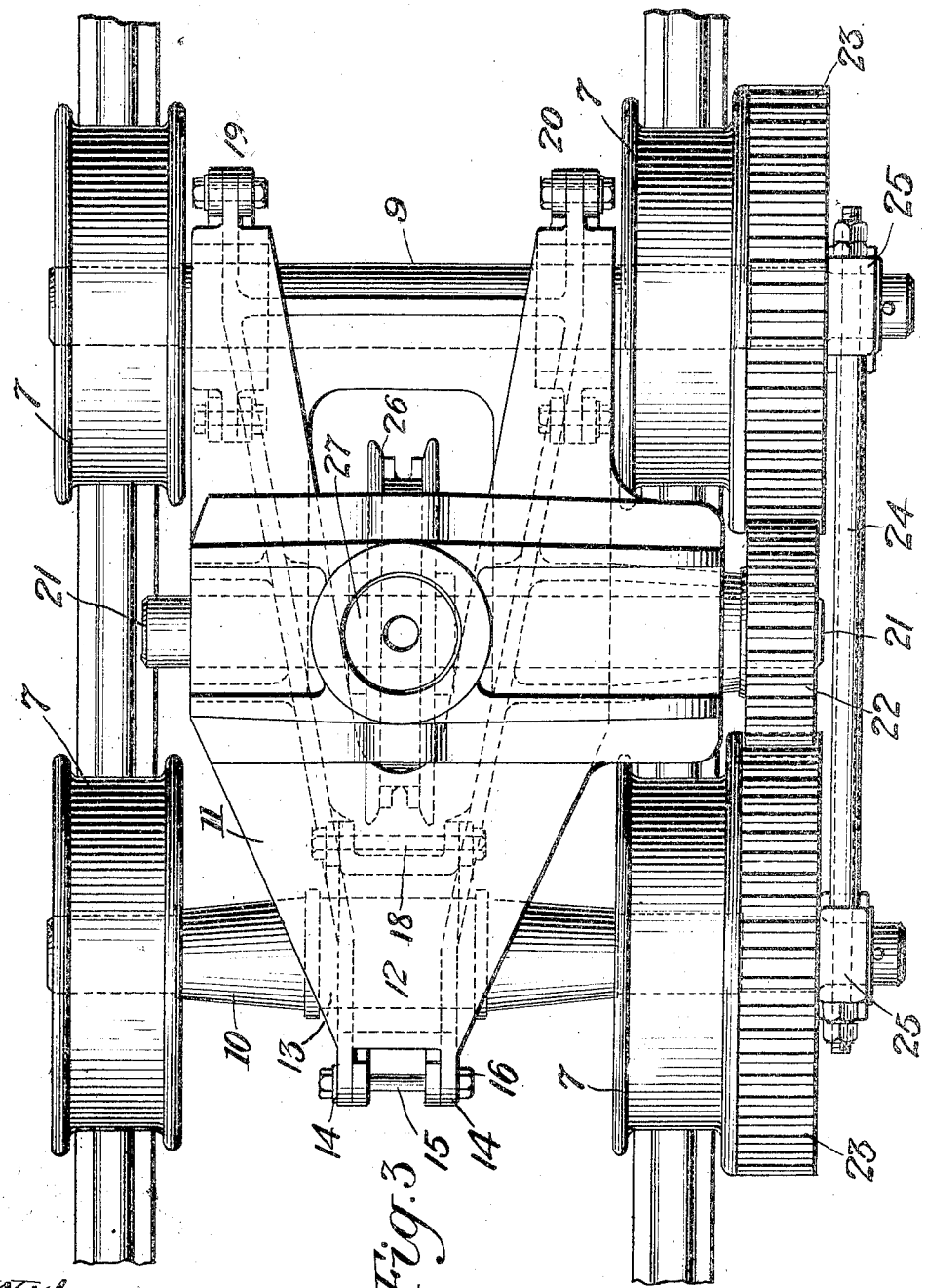



Fig. 3

Witnesses
W. W. Edelin.
V. T. Haugaton

Inventor
S. R. W. M. Bager
by Lemuel Goldschmidt & Veit
Attys.

S. R. W. M. BAGER.

EQUALIZING SYSTEM FOR STEAM SHOVELS AND THE LIKE.

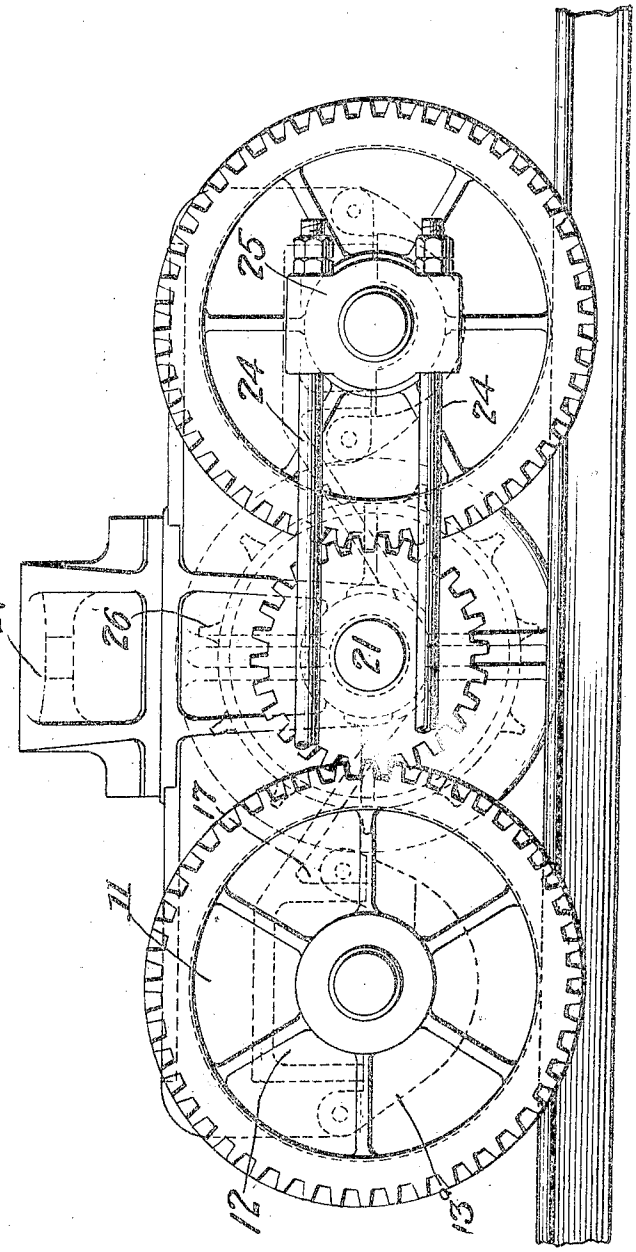
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5 SHEETS—SHEET 4.

Fig. 4.




Witnesses.
D. C. Edelin.
T. T. Scruggs

Inventor:
S. R. W. M. Bager
by Fisher, Goldsborough & O'Neill
Attys.

S. R. W. M. BAGER.

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5 SHEETS—SHEET 5.

Fig. 5.

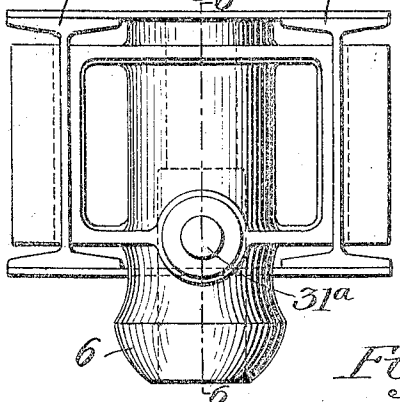



Fig. 6.

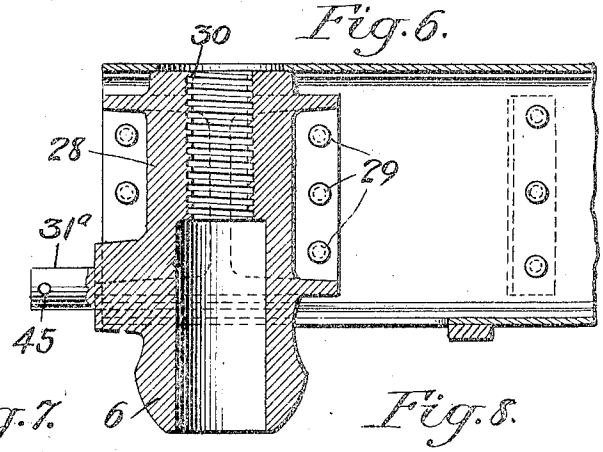



Fig. 7.

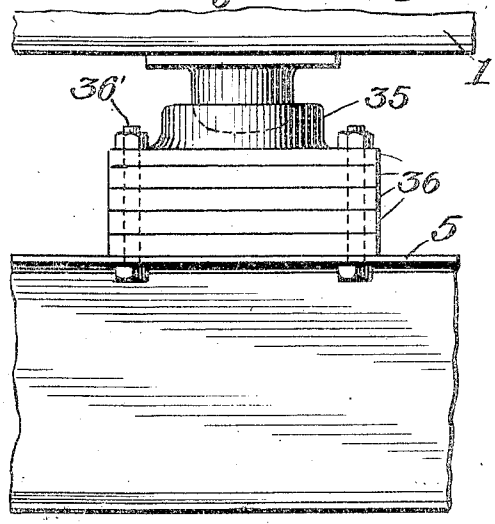
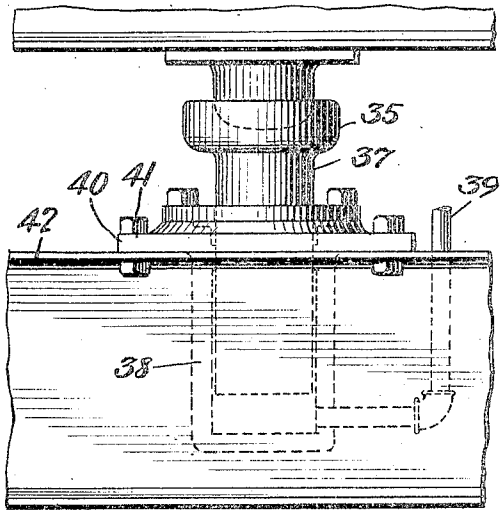



Fig. 8.




Witnesses

O. W. Edelin.

V. J. Houghtaling.

Inventor

S. R. W. M. Bager

by Munn Goldsborough & Mann

Attys

# UNITED STATES PATENT OFFICE.

SVANTE ROBERT WILLIAM MATTSSON BAGER, OF MILWAUKEE, WISCONSIN.

## EQUALIZING SYSTEM FOR STEAM-SHOVELS AND THE LIKE.

1,075,081. Specification of Letters Patent. Patented Oct. 7, 1913.

Application filed February 17, 1913. Serial No. 748,936.

*To all whom it may concern:*

Be it known that I, SVANTE R. W. M. BAGER, a subject of the King of Sweden, and a resident of Milwaukee, county of Milwaukee, and State of Wisconsin, have invented certain new and useful Improvements in Equalizing Systems for Steam-Shovels and the like; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to equalizing and compensating means used in conjunction with large portable pieces of machinery such as steam shovels, pile drivers, derricks and the like which are usually provided with four or more supporting trucks that are in most instances propelled along temporary tracks. Due to such temporariness of the trackway, it usually presents many irregularities, and in large pieces of machinery having no equalizing means, these irregularities produce an objectionable, improper and irregular distribution of the load on the four trucks, due to the tendency for them to all remain in the same horizontal plane. Furthermore, when the machine has been temporarily positioned where it is to perform its work, an irregularity in the track is likely to throw the entire machine out of vertical alinement and in the case of pile drivers especially, this has to be overcome by some suitable truing, adjusting or compensating means. Heretofore, either hydraulic or pneumatic means have been employed to act as absorbers for the irregularities and in most cases additional means for truing and adjusting the machine when positioned have been necessary. The latter means is often used for stabilizing the construction as well as adjusting the same. It is obvious that many advantages would lie in the use of mechanical means for accomplishing the above results instead of relying on air or water pressure, the objections arising from the use of which are well known to those familiar with the art.

The main object therefore of this invention is to provide such direct mechanical means which will compensate for the irregularities in the trackway, and at the same time, provide for a rigid support for the body of the machine when the same is in working position. Other objects will appear as the specification proceeds. In furtherance of this object, an equalizer beam is employed and interposed between a suitable sub-base of the machine and the two front trucks, so that said trucks will support the beam at its extremities and the equalizer beam will in turn support, at a point intermediate its ends, the front portion of the sub-base, the three supporting points allowing for relative angular changes between the respective parts. The rear of the sub-base is mounted directly on the two rear trucks in such a way to allow the trucks to adapt themselves to local irregularities without imparting the motion to the sub-base. It will therefore be seen that the sub-base, when the machine is being propelled, will be supported at three points, and consequently, it is not necessary for the four trucks to run in a horizontal plane, as would be the case if the machine were supported at four points. To insure rigidity and stability however, when the machine has been positioned, means are provided to establish a supporting relation between the extremities of the equalizer beam and the corresponding portions of the sub-base, which will then be supported at four points.

In describing the invention in detail, reference is made to the accompanying drawings, in which the invention is shown as being applied to a steam shovel supported for movement along a four rail trackway, by means of four trucks. It will be understood, of course, that the invention is applicable to all propelled machines having four traction members, whether said members be trucks or other devices which will accomplish the same results. Various changes and modifications may therefore be made without departing from the spirit or scope of the invention.

In the aforesaid drawings:—Figure 1 is a side elevation of the lower portion of a steam shovel provided with a sub-base mounted on the supporting trucks in accordance with the invention. Fig. 2 is a front elevation showing the manner of mounting the sub-base on the equalizer beam and the manner of mounting the latter on the supporting trucks. Fig. 3 is a top plan view of the preferred form of rear truck used. Fig. 4 is a side elevation of the truck shown in Fig. 3. Fig. 5 is a detail view of a combined jack nut and center bearing for the trucks. Fig. 6 is a sectional view taken on the line 6—6 of Fig. 5. Fig. 7 shows one form of an adjustable center bearing used between the sub-base and the equalizer beam.

Fig. 8 is a modification showing another form of adjustable center bearing.

In these various views, like reference characters refer throughout to corresponding parts.

Referring particularly to Figs. 1 and 2, a sub-base is shown, but the character of the mechanism mounted thereon is immaterial to the invention. To illustrate the function of such a sub-base, however, a portion of a rotating steam shovel deck is shown mounted on the sub-base which is designated generally by the character 2. The remaining description deals only with the manner of supporting the sub-base to accomplish the results hereinbefore enumerated. Preferably, four trucks are used which are adapted to support the sub-base 1 at its four corners. The two rear trucks, one of which is denoted generally by character 3 in Fig. 1, directly support the rear portion of the sub-base. Although the support is direct, preferably some means is provided for allowing each truck to adapt itself to local inequalities without imparting motion to the sub-base. As each truck is preferably provided with four wheels, the above result is accomplished by supporting the sub-base on a suitable supporting member by means of a center bearing, and supporting the said supporting members on the axles of the four wheels at only three points, as will be clearly apprehended from the more detailed description of this construction, which is to follow.

The two front trucks 4—4 instead of supporting the sub-base directly, support an equalizer beam 5 by means of the center bearings 6—6 which will hereinafter be more fully described. Intermediate the ends of the equalizer beam 5 is a center bearing denoted generally by the reference character $6^a$. Said bearing $6^a$ supports the forward portion of the sub-base 1 intermediate the lateral edges of said sub-base. By this construction, it is seen, therefore, that the sub-base is normally supported at three points, to wit, by the two rear trucks and the center bearing $6^a$. The equalizer beam 5 may consequently change its angular relation with the ground without affecting the sub-base and conversely any angular change of the sub-base due to the rear trucks running on tracks of unequal elevation will not be transmitted to the front trucks. The load is therefore distributed on the four trucks so that each truck will support its share of the load irrespective of the unevenness of the tracks. As each truck is provided with four wheels that run on two tracks it is desirable to construct the trucks so that the load will be distributed to the four wheels of each truck in a manner similar to the distribution of the load to the four trucks. In other words, it is desired to mount the truck on the four wheels so that they will not be compelled to remain in the same horizontal plane.

Figs. 3 and 4 illustrate the construction of the rear trucks which are identical with the front ones with the exception that the latter have no driving gearing and are provided with a different type of center bearing, such as will be described hereinafter.

The four wheels 7 of each truck are flanged to guide them on the rails constituting the trackway. They are preferably keyed or otherwise made fast to the front and rear axles 9 and 10 respectively. A bearing frame or supporting member 11 is mounted on the two axles and carries at the rear end the single bearing 12 which engages the journal 13 of the rear axle 10. The portion of the bearing 12 which engages the axle 10 is slightly curved or convexed longitudinally to allow the axle to tilt transversely of the truck. It is seen therefore that said bearing frame 11 is supported on the rear axle only at a point intermediate the ends of the axle. To secure the bearing in place and to hold the journal of the axle against the bearing 12, a bearing cap $13^a$ (Fig. 4) is used which encircles the under side of the axle and is secured to the bearing frame 11 in any suitable manner. Preferably ribs or projections 14 are cast integrally with the bearing frame 11 and one end of the bearing cap secured to these by suitable bolts 15 and nuts 16. The other end of the cap is secured to a web portion 17 (Fig. 4) of the frame by similar bolts $1^c$. The frame is supported on the front axle at 19 and 20 as clearly shown in Fig. 3. The bearings and caps used at these two points being similar to those just described, it is deemed unnecessary to explain them in further detail. By this construction, it will be obvious that the rear axle of each truck is at liberty to tilt out of the horizontal plane of the four wheels. Conversely, the forward wheels can tilt or change their plane without disturbing the position of the rear axle. Irregularities of the rails will consequently not tend to throw the load on only two wheels of the truck, as would be the case if the three point contact system were not used.

Preferably the rear trucks only are provided with driving means comprising a shaft 21 journaled in the bearing frame 11 intermediate the two axles. A pinion 22 is made integral with the shaft 21 and meshes with the toothed flanges 23 of one of the front and rear wheels. The shaft 21 is driven preferably by a sprocket 26 located under the truck center so that the pull of the sprocket chain which drives the sprocket from any suitable source of power does not tend to prevent the truck from swiveling when the entire machine curves.

In the center of the bearing frame 11 of

each front truck is provided a bearing socket 8 engaged by the center bearings 6 at the ends of the equalizer beam 5. Preferably, the center bearings 6 are formed on a separate casting 28 as shown in Figs. 5 and 6. The rear trucks are provided with center bearing castings 27, each of which is secured to its corresponding frame 11 and each casting 27 is engaged by a coöperating center bearing 27′ carried by the sub-base of the machine, see Fig. 1.

The two front center bearing castings 28 are secured to the equalizer beam in any suitable manner, but preferably riveted thereto as shown at 29 in Fig. 6. Running longitudinally and interiorly of the casting 28 are the threads 30 adapted to be engaged by similar threads on a jack screw 31, Fig. 2. The lower end of the casting is rounded to form the spherical bearing portion 6 which engages the bearing socket 27 of each truck as hereinbefore explained. Cast integrally with the combined center bearing castings and jack nuts 28 are suitable gudgeons $31^a$ whose function will be described.

The jack screw 31 which coöperates with the jack nut casting 28 is provided with a suitable cap or head 32 having therein a hole or recess 33 for the insertion of the bar or lever whereby the jack screw is actuated. The tops of said heads 32 are rounded as clearly shown in Fig. 2 and are adapted to engage with corresponding recesses in the bearing plates 34, said bearing plates 34 being rigidly secured to the sub-base 1 by any suitable means. By inserting a bar in the holes 33 of the heads 32 and actuating the jack screws, it is obvious that the latter can be raised or lowered at will and thereby be made to engage or disengage the bearing plates 34 carried by the sub-base 1.

It is often desirable to adjust the front of the sub-base to thereby level the construction when the machine is positioned for working. The center bearing $6^a$ is therefore preferably made adjustable in order to raise or lower the front of the machine through the intermediary of the equalizer beam 5. Two forms of such a center bearing are shown in Figs. 7 and 8. In Fig. 7 the center bearing socket 35 is mounted indirectly on the equalizer beam 5 and raised to the desired height by the interposition of suitable shims or filling blocks 36 which together with said socket are secured to beam 5 by bolts 36′. By this construction, it is obvious that the height of the center bearing socket 35 can be regulated by removing or supplying the required number of filling blocks 36. The sub-base 1 which is supported directly by the center bearing 35 is consequently raised or lowered a corresponding amount and the front of the entire machine can be adjusted to suit requirements. A modification of such an adjustable center bearing is shown in Fig. 8. The adjusting means in this construction takes the form of a hydraulic cylinder in which an extension 37 on the center bearing socket 35 operates as a piston. The hydraulic cylinder is shown at 38 and is supplied with a liquid under pressure from any suitable source by means of the supply pipe 39. The cylinder 38 is secured to the I-beams 42, (Figs. 1 and 8), of the equalizer beam, by means of the flange 40 preferably cast integrally with said cylinder 38. The said flange rests on the top edges of the two I-beams 42 and is secured to them by means of suitable bolts 41, so that cylinder 38 depends between the two I-beams 42. Of course, the exact placing or construction of the hydraulic cylinder is immaterial to the invention, but the preferred construction has been described to make the operation of all the parts clear and obvious. It will be manifest that as fluid under pressure is admitted to the cylinder 38, the center bearing socket 35 will be raised, thereby lifting the equalizer beam. Conversely discharging the fluid from the cylinder 38 will permit the center bearing and the equalizer beam which it supports to fall. The front of the entire construction can thereby be adjusted to a nicety.

In order to prevent the equalizer beam 5 from turning in a horizontal plane, on each side of the machine a reach-rod 43 is provided which is pivoted at one end to the bracket 44 carried by the sub-base 1. The other end of said reach-rod is indirectly pivoted to the equalizer beam by being slipped over the gudgeon $31^a$, on the casting 28, as clearly shown in Figs. 2 and 6. The extremity of the rod can be held on said gudgeon by any means such as a cotter pin inserted in a hole 45 drilled through the end of the gudgeon $31^a$. By applying such a reach-rod at each end of the equalizer beam, it is obvious that said reach-rods will permit the equalizer beam to tilt in a vertical plane, but will prevent the same from swinging in a horizontal plane.

When the machine is being propelled along the track-way, the jack screws 31 are lowered into their jack nuts 28. The equalizer beam is then free to tilt in a vertical plane, since there is no obstruction to prevent the extremities of the equalizer beam from moving relatively to the sub-base 1. Such tilting will not, however, be transmitted to the sub-base 1, since the latter is supported only at the mid-point of the equalizer beam by means of a ball and socket engagement, as described. When the machine is positioned for working, a rigid construction is necessary and such rigid construction is obtained by merely running up the jack screws 31 into engagement with the jack screw bearing plates 34. By this means, a four-point support is substituted for a three-

point support and it will be seen that the sub-base will then be supported at its four corners. If the two rails on one side of the trackway happen to be at a greater elevation than the remaining two rails, the equalizer beam will be tilted to compensate for such difference in elevation, but as the sub-base 1 retains its normal position, it is obvious that the weight will be properly distributed to the four trucks. If, however, the four rails are substantially in the same horizontal plane, but one rail of one side of the trackway is elevated slightly above its adjacent rail, the truck engaging the said two rails of unequal elevation, will be tilted, but, due to the ball and socket shaped center bearing 6, such tilting will not be transmitted to the equalizer beam 5. It is obvious that such inequalities of two of the adjacent rails would tend to throw the entire weight, which each truck normally supports, on two of the wheels of such truck. This however, is prevented by supporting the machine at only three points on each truck, as already described, so that local inequalities will not cause the four wheels of each truck to be tilted in unison in the same horizontal plane. One axle of each truck is permitted to tilt in a vertical plane and when such axle is caused to tilt by local inequalities of the rails, such tilting will be effective to properly distribute the load carried by each truck to each of the wheels thereof.

By the foregoing construction, it is seen that all inequalities of the trackway, whether such inequalities are relative to both sides of the track, or relative to the two rails constituting one side of the track, are thoroughly compensated for. Such compensation prevents the weight of the machine from being thrown on two trucks in cases where the irregularities are relative to the two sides of the trackway, and prevents the weight from being thrown on two wheels of each truck in cases where the irregularities are relative to the two rails of one side of the trackway. When the jack screws are elevated to engage the jack screw bearing plates 34, an absolutely rigid construction is obtained by a simple and speedy operation. The said jack screws always being carried by the jack nut castings, which in turn are always carried by the equalizer beam, are always in readiness to be actuated to substitute the four-point support for the three-point support. The carrying of the jack screws by the same castings which serve as center bearings for the trucks, insures a compact construction and a great reduction in the number of parts heretofore used to accomplish the stabilizing in cases where hydraulic or pneumatic equalizing means have heretofore been resorted to. In most of such cases the stabilizing was accomplished by supplying additional jacks which were interposed between a suitable part of the machine and the ground, or else by using suitable filling blocks to support portions of the sub-base directly on the ground. It will be noted that a slight adjustment of the jack screws is sufficient to prevent any rocking whatsoever of the sub-base.

It is obvious that the invention is not limited to the specific construction shown, for numerous changes can be made in many parts of the construction without departing from the scope of the invention as defined by the claims.

What I claim is:—

1. The combination with a machine of the class described mounted directly on two rear four-wheeled trucks, of two front four-wheeled trucks, an equalizer beam supported by said front trucks, the forward portion of the machine being supported by the beam intermediate the ends thereof.

2. The combination with a machine of the class described mounted directly on two rear four-wheeled trucks, of two front four-wheeled trucks, an equalizer beam supported by said front trucks, a center bearing intermediate the ends of said beam adapted to support the forward portion of the machine.

3. The combination with a machine of the class described, of four four-wheeled supporting trucks two of which directly support one part of the machine, an equalizer beam supported by the two other trucks, the remaining part of the machine being supported on said equalizer beam.

4. A support for machines of the class described, comprising four four-wheeled trucks, an equalizer beam supported by two of the same, the machine being supported directly on the other two trucks and on the said equalizer beam.

5. In a machine of the class described, provided with four four-wheeled supporting trucks, the combination with two of the trucks, of an equalizer beam supported thereby, one portion of the machine being supported by the intermediate portion of the beam.

6. In a machine of the class described provided with a sub-base and four supporting trucks, the combination with two of the trucks, of an equalizer beam supported thereby, one portion of the sub-base being supported at one point on said beam, and means associated with said beam whereby the sub-base of the machine can be supported at two points on said beam.

7. In a machine of the class described provided with a sub-base and four supporting trucks, the combination with two of the trucks, of an equalizer beam supported thereby, one portion of the sub-base being supported intermediate the ends of the beam, and means associated with the beam where-

by the sub-base of the machine can be supported at the ends of said beam.

8. In a machine of the class described provided with a sub-base and four supporting trucks, the combination with two of the trucks, of an equalizer beam supported thereby, one portion of the sub-base being normally supported intermediate the ends of the beam, and jack screws associated with the ends of the beam adapted to support the sub-base of the machine at the ends of the beam.

9. In a machine of the class described provided with a sub-base and four supporting trucks, the combination with two of the trucks, of an equalizer beam supported thereby, one portion of the sub-base being normally supported intermediate the ends of the beam, center bearing castings supporting the ends of the beam on the two trucks, means associated with said castings adapted to support the sub-base of the machine directly over said center bearings.

10. In a machine of the class described provided with a sub-base and four supporting trucks, the combination with two of the trucks, of an equalizer beam supported thereby, one portion of the sub-base being normally supported intermediate the ends of the beam, center bearing castings supporting the ends of the beam on the two trucks, jack screws in said castings adapted to support the ends of the beam directly over said center bearings.

11. In a machine of the character described, a load equalizing supporting system comprising two rear trucks which directly support the rear portion of the machine, two front trucks, an equalizer beam supported on said front trucks, the forward portion of the machine being supported at one point intermediate the ends of said beam, means to prevent said beam from turning in a horizontal plane, and means adapted to support the forward portion of the machine on the ends of said beam and directly over said front trucks.

12. In a machine of the kind described, a load equalizing supporting system comprising two rear trucks which directly support the rear portion of the machine, two front trucks, an equalizer beam supported by said front trucks, the forward portion of the machine being supported intermediate the ends of the beam, thereby permitting the four trucks to move out of their horizontal plane, the load on each truck being supported at three points thereon to allow the four wheels of each truck to move out of their horizontal planes, substantially as described.

13. In a machine of the class described provided with a suitable sub-base, four four-wheeled supporting trucks therefor, two of which support the sub-base directly, an equalizer beam supported by the other two trucks, center bearings associated with the trucks and beam to support the latter, and a center bearing intermediate the ends of the beam to support the sub-base.

14. In a machine of the class described provided with a suitable sub base, four supporting trucks therefor, two of which support the sub-base directly, an equalizer beam supported by the other two trucks, center bearing castings carried by the ends of said beam, center bearing sockets on said trucks adapted to support said castings, said castings also serving for jack nuts, a jack screw in said casting, adapted to engage the sub-base to steady the same, and a center bearing intermediate the ends of said beam on which the forward part of the sub-base is normally supported.

15. A support for machines of the kind described, comprising four four-wheeled load supporting trucks, an equalizer beam supported on two of said trucks by means of center bearings, the body of the machine being supported at three points by means of center bearings, to wit, on the two remaining trucks and on the equalizer beam.

16. A support for machines of the kind described, comprising four load supporting trucks, an equalizer beam supported on two of said trucks by means of center bearings, the body of the machine being supported at three points by means of center bearings, to wit, on the two remaining trucks and on the equalizer beam, and means on said equalizer beam adapted to engage the machine body to constitute a four point support for said machine body.

17. The combination with a machine of the class described, of two front trucks, an equalizer beam, jack nut castings carried by the ends of said beam, said castings provided with a rounded portion to serve as a center bearing to support the equalizer beam on said trucks, a center bearing intermediate the ends of said beam to support the front end of the machine, jack screws in said castings adapted to be elevated to constitute a support for the machine at each end of the equalizer beam, and means to prevent the beam from turning in a horizontal plane.

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

SVANTE ROBERT WILLIAM MATTSSON BAGER.

Witnesses:
EUGENE RANDOLPH WEBER,
O. M. WITTIG.