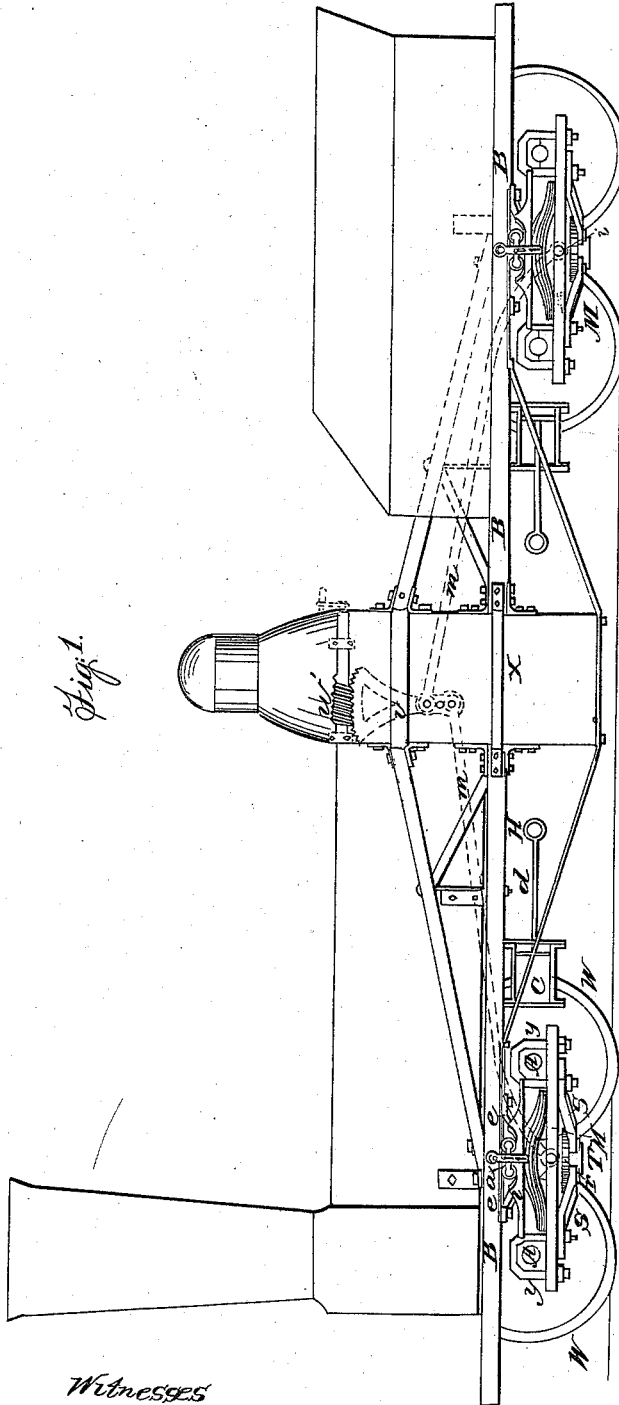


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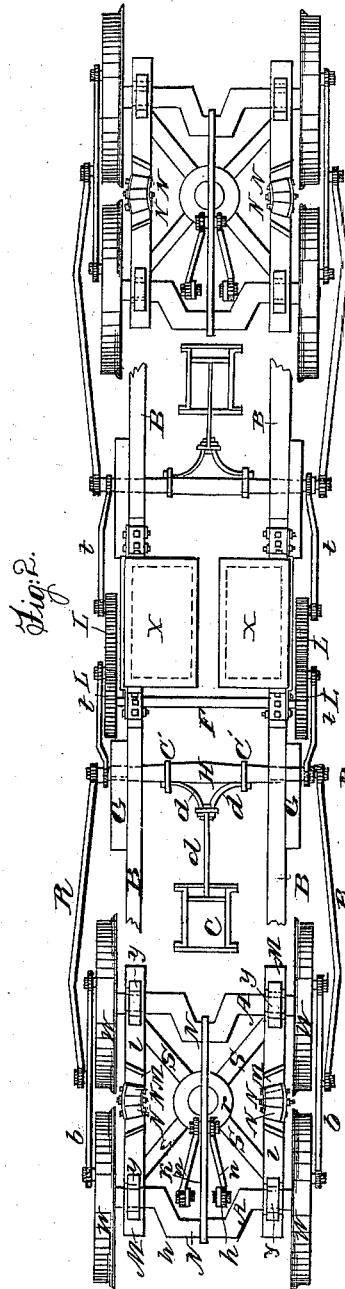
No. 3,866.

Patented Dec. 31, 1844



Witnesses

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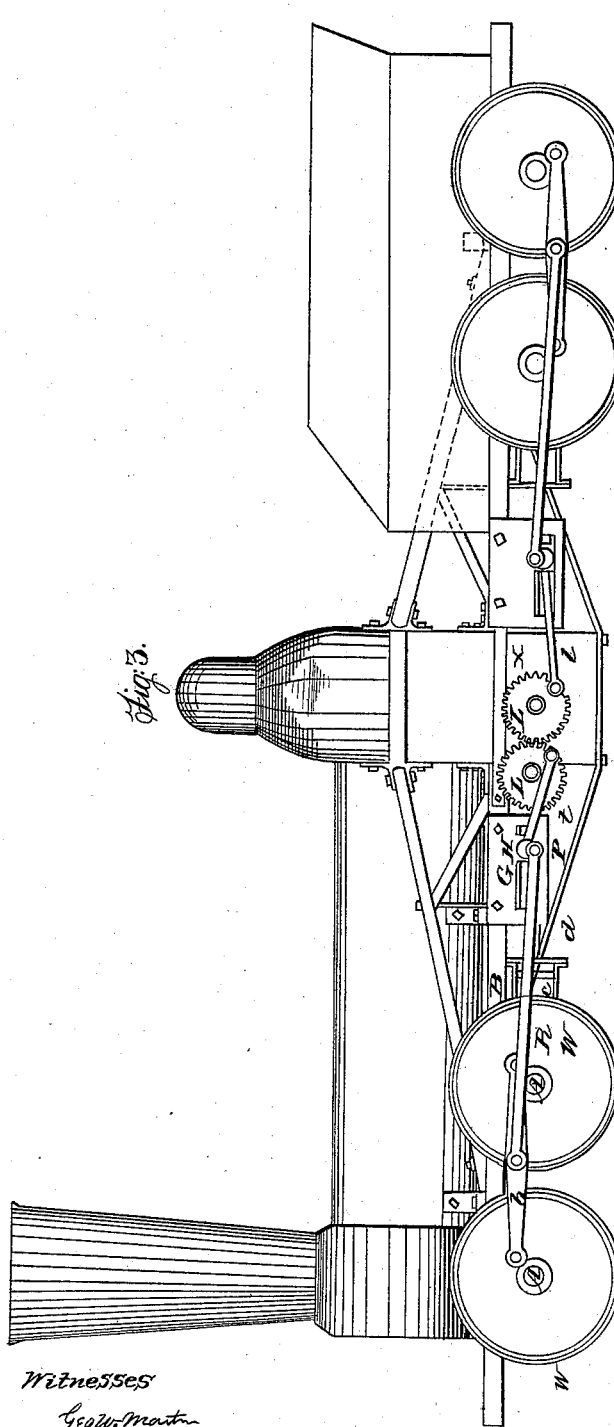
E. F. JOHNSON.

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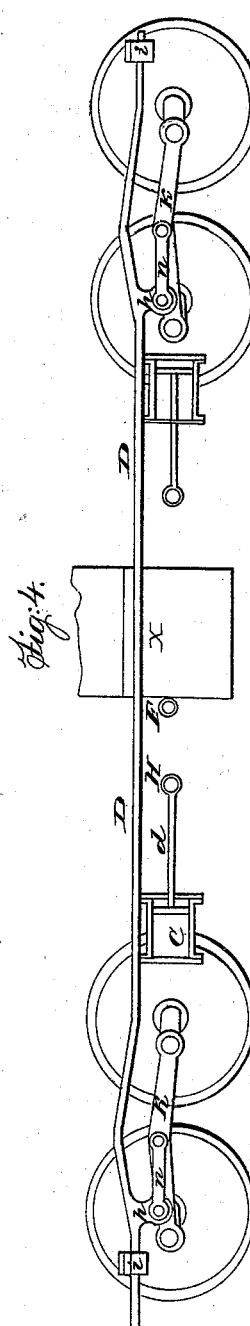
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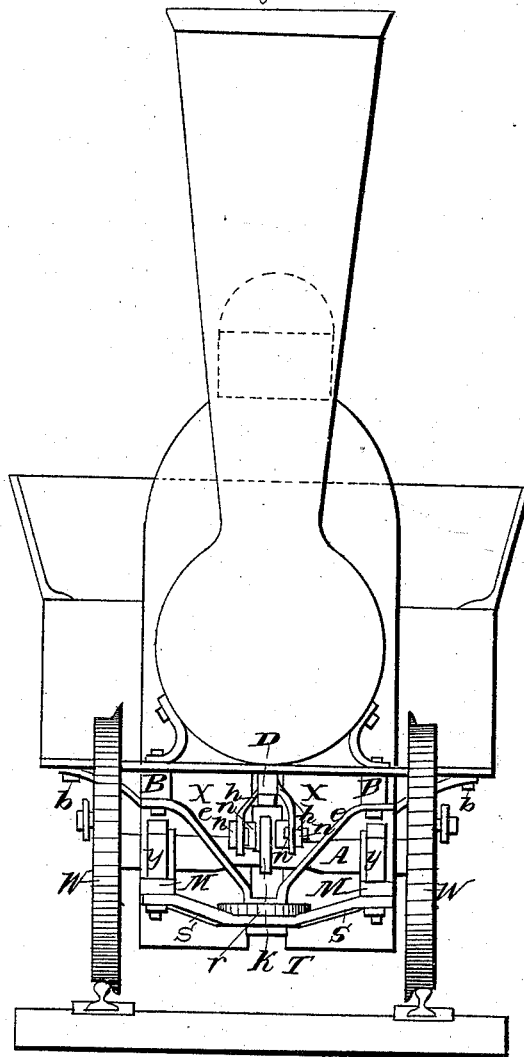
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7 Sheets--Sheet 3.

No. 3,866.

Patented Dec. 31, 1844.

Fig. 5.



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7 Sheets—Sheet 4

Locomotive.

No. 3,866.

Patented Dec. 31, 1844.

Fig: 10.

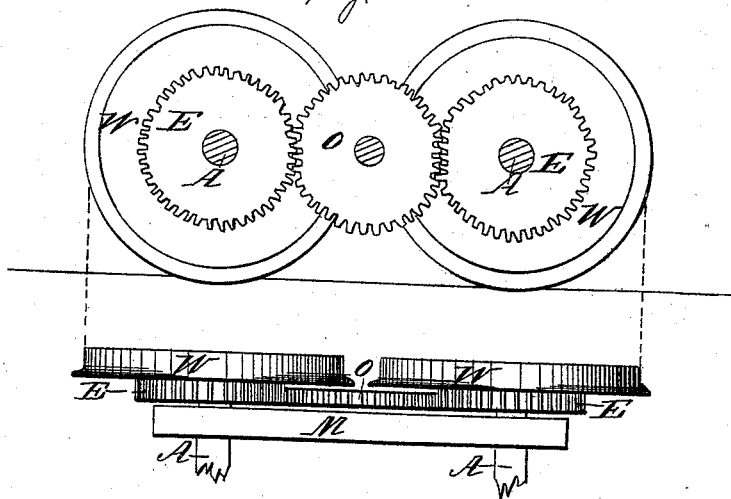


Fig: 7.

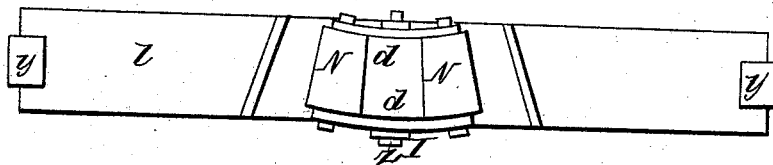
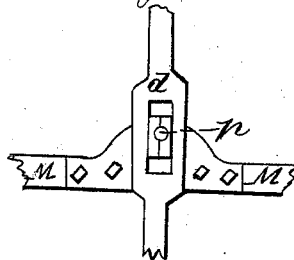


Fig: 6.



Fig: 14.



Witnesses

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Locomotive.

No. 3,866

Patented Dec. 31, 1844.

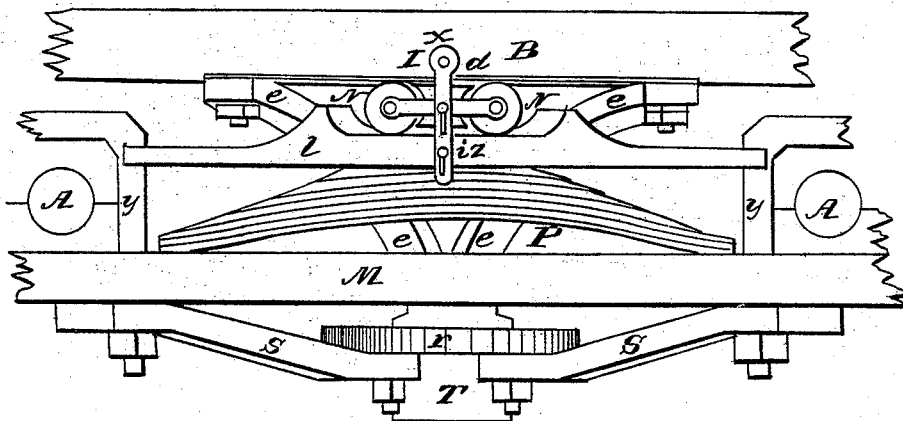


Fig. 8.

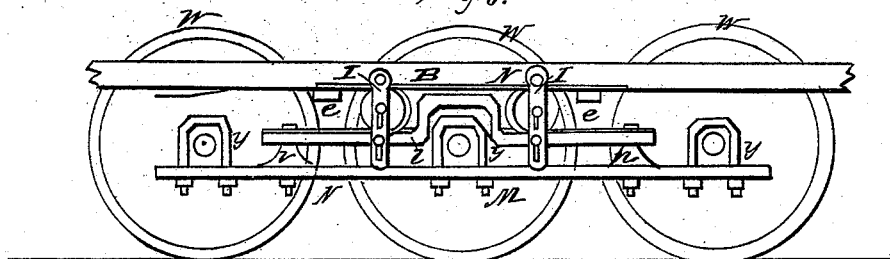
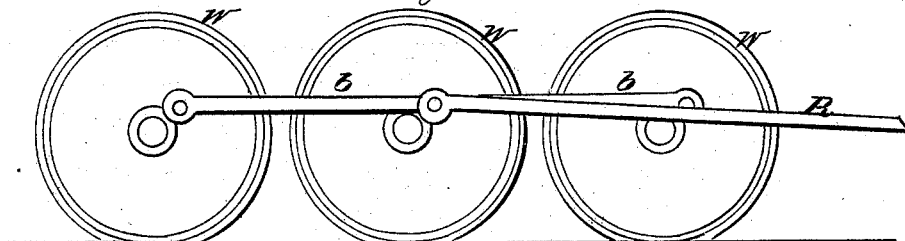


Fig. 9.



Witnesses

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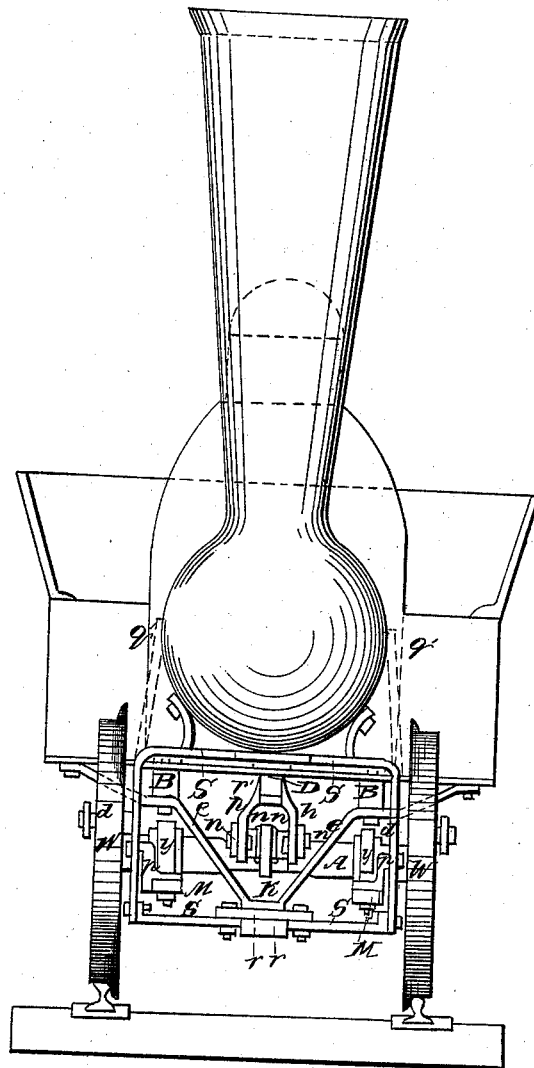
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Locomotive.

No. 3,866.

Patented Dec. 31, 1844.

Fig. 11.



Witnesses

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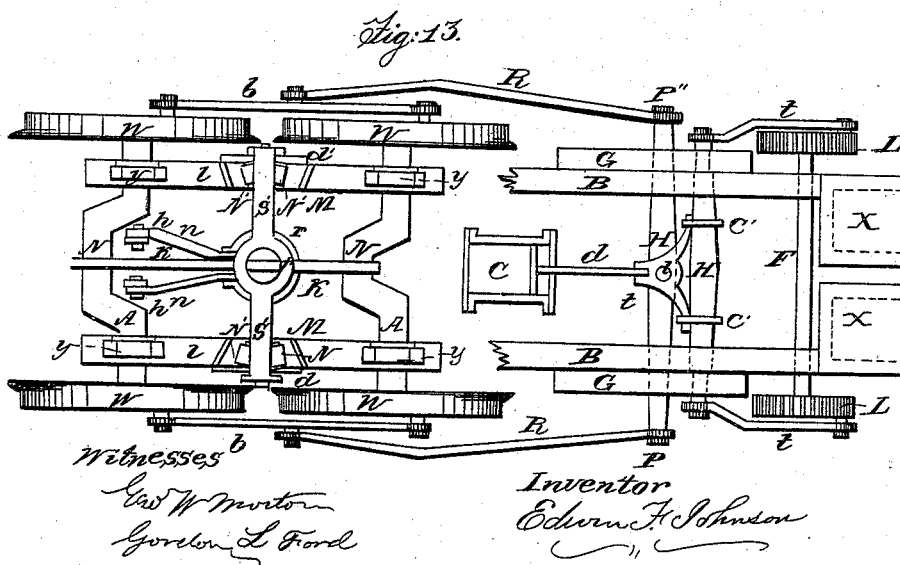
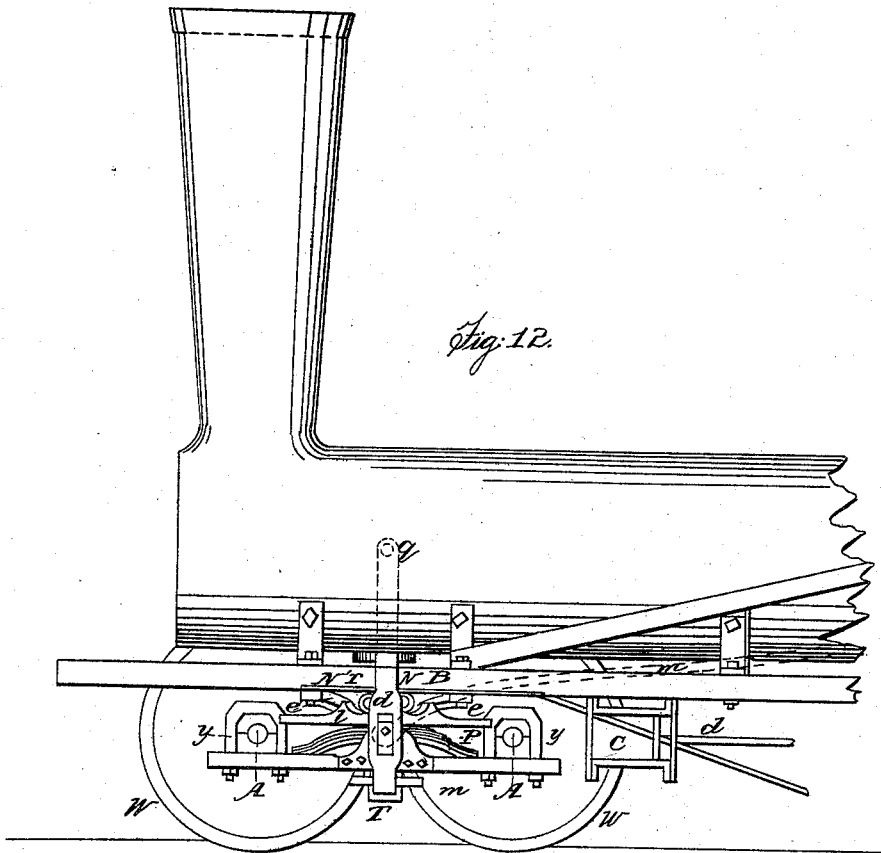
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Locomotive.

No. 3,866.

Patented Dec. 31, 1844.



UNITED STATES PATENT OFFICE.

EDWIN F. JOHNSON, OF MIDDLETOWN, CONNECTICUT.

LOCOMOTIVE STEAM-ENGINE.

Specification of Letters Patent No. 3,866, dated December 31, 1844.

To all whom it may concern:

Be it known that I, EDWIN F. JOHNSON, of Middletown, county of Middlesex, State of Connecticut, have invented certain Improvements in the Mode of Constructing Locomotive Steam-Engines for Railroads, a full and exact description of which is as follows.

All the parts of a locomotive engine and its tender are comprised or contained in one frame or body, which body is supported by eight or twelve wheels of equal size, all of which are drawing or driving wheels. When eight wheels are used the description is as follows: Four wheels are placed under each end of the body or frame of the engine, their position and arrangement being somewhat similar to those of an ordinary eight-wheel passenger or freight car for railroads. W, W, W, Figures 1, 2 and 3, are the four wheels supporting one end of the engine (see the drawings annexed which constitute a part of this specification). A, A, are the axles to which the wheels are firmly attached in the usual manner. In the middle of each axle is a crank N, and near each end, inside of the wheels is a journal inclosed or revolving in a box. Each box is embraced by a yoke or band Y, which is firmly bolted to the ends of two beams M, M, connecting the axles of the two pair of wheels. From these beams proceed two or more braces S, S, &c., which are bolted to and support the ring *r*. Into this ring is inserted a stem T which stem is firmly connected by braces *e*, *e*, &c., Figs. 1 and 5, with the frame or body of the engine B, B. Upon each of the beams or bars M, M, Figs. 1, 2 and 7, rests a spring P, on which is placed a horizontal plate *l*. Upon each of these plates is placed one or more frustums of cones N, N, &c., the axes of which are horizontal or nearly so, and when produced, meet in a point over the center of the ring *r*. Upon these frustums of cones the main body or frame of the machine rests. By this arrangement the weight of the body of the engine is sustained by the springs *s*, *s*, in such a manner as to allow to the two pair of wheels a movement backward or forward, around a vertical line passing through the center of the stem T, which enables them to conform to the curvature of the rails.

Each set or pair of conical frustums N, N, are secured in their places by connecting their axes with two bars *a*, *a*, Fig. 7. In the cen-

ter of each bar is a pin Z which works in a slit in a vertical bar I. This bar turns on a pin *x* at its upper end, inserted in the frame B, and near the other end is another slit in which works a pin *i* fixed in the plate *l*. The two pins *x* and *i* must be equidistant from the pin Z, one below and the other above it, the three pins being in the same right line. The bar I may have its center of motion at *i* instead of *x*, in this case the bar is inverted the end having the slit being upward. If but one frustum of a cone is used, the end of its axis works in the slit in the middle of the bar I instead of the pin Z.

Motion is communicated to the wheels W, W, as follows: A steam cylinder is placed at *c*, its axis is horizontal and on a level or nearly so with the axles of the wheels. *d* is the piston rod, united by two branches *d'* *d'* with the cross-head H. This cross-head moves in horizontal guides G, G, attached to the body B of the machine. From each end of this cross-head proceed connecting rods R, R, which are attached at the other end by a pin or socket joint to the middle of the two crank bars *b*, *b*, respectively, which bars are connected to the wheels W, W, &c., by crank pins on the outside of each. By this arrangement when motion is communicated to the piston *d* and crosshead H, the wheels W, W, &c., are made to revolve in the same direction, through the intervention of the rods R, R, and bars *b*, *b*.

To enable the wheels when rolling to conform to the direction of the rails upon the curved portions of the road, the cross-head H has a vibratory movement, being connected with the piston by circular collars *c'* *c'*, and provided with journals in the guides, so as to allow it to revolve or turn partially around within the collars, the center of motion being a line or axis passing longitudinally through it. The connecting rods R, R, are united with the ends of the cross-head H by a pin or socket joint, the one above, and the other below the line of its axis as at *p* *p*, Fig. 6. By this means when one connecting rod is thrown back by the curvature of the road acting upon the wheels, the other is thrown forward, and vice versa, a movement which gives to the cross-head its vibratory motion, but does not interfere with the regular working of the piston and cross-head. In order that the points of junction of the connecting rods with the cross-heads may be in the same level line or nearly so with the

axles, the cross-head may be inclined as represented in Fig. 6.

The other end of the body of the machine is supported upon four wheels like the end just described, which are propelled in the same manner, by a cylinder similarly situated, with a cross-head, connecting rods, &c., as already described and represented in the plan.

In order that the power applied to one set of wheels, may constantly act at right angles, or nearly so, to the power applied to the other set, the two sets are connected by a rod or bar D, Fig. 4, extending lengthwise under the body of the carriage, midway between the wheels. This rod or bar has a reciprocating motion, in the direction of its length, through guides *i, i*, &c., attached to the frame or body of the engine and passes by a cylindrical opening through the fire box of the boiler, or through the space formed by a division of the fire box into two parts or compartments as represented by *x, x*, Fig. 2. From near each end of this bar, two branches or arms *h, h*, Figs. 2, 4 and 5, project downward, from each of which proceeds a small bar *n*. The two bars *n, n*, are connected by joints to the two branches, at one end, and at the other end by a pin or socket joint to the middle of the crank bar *k*, which connects the cranks formed on the middle of the axles of the two pair of wheels, and which has a motion similar to the crank bars *b, b*, on the outside. The cranks which are in the middle of the axles of all the wheels have a common direction such as to bisect the angles formed by the outside cranks of the two sets of wheels, or those to which the moving power is applied.

The branches *h, h*, of the bar D are separated far enough to allow of the necessary lateral movement of the ends of the bar *k* upon the curves of the road. To avoid placing the ring *r* too low, the bar *k* may be bent or curved upward in the middle as represented in Figs. 4 and 5. The crank bars *b, b* on the outside, may also be bent in a similar manner to make their centers conform to the position of the cross heads when the points of junction of the latter with the connecting rods are either above or below the level of the axles of the wheels. Friction wheels or rollers are placed in the guides or points of support of the rod or bar D to lessen the resistance to sliding from the friction.

To give the requisite degree of steadiness and accuracy to the motion of the cross-heads, two vertical cog or toothed wheels as L, L, Figs. 2 and 3, are introduced between the cross heads on each side of the engine. These wheels work into each other and are made to revolve by means of connecting rods *t, t*, extending respectively to

the cross-heads. The teeth or cogs upon these wheels have all the same pitch, but the radius of the pitch circle varies in each so as to suit their unequal motion, since in certain parts of their revolution one revolves faster or slower than the other. This follows from the manner in which motion is communicated to them from the drawing wheels W, W, &c., through the connecting rods R, R, and *t, t*, &c.

Instead of the crank bar *b* two cog wheels E, E, of equal size may be attached to the ends of each pair of axles, or formed as represented in the figure (Fig. 10) upon the sides of the wheels. Between each pair of wheels E, E, a third wheel O is inserted, the latter revolving upon a journal firmly fixed in the beam or bar M, and working into the wheels on each side of it, by which means both of the axles have a like motion. When this plan is adopted the connecting rod R is applied to a crank pin inserted in the wheel O. The cog wheels E, E, and O may be formed either on the inside or outside of the wheels W, W, &c. In the former case the connecting rod *r* must be bent so as not to interfere in its motion with the axle nearest the cross-head.

For the purpose of giving, if necessary, more steadiness of motion to the two sets of drawing or driving wheels, they are held or confined in their position by means of two rods *m, m*, represented by dotted lines in Fig. 1, extending from pins *i, i*, in the center or middle of the beam M, one from each beam, and attached at the other end to a lever V' near the middle of the engine, one above and the other below the center of motion or fulcrum of the lever, so that by operating the lever, the points *i i* may be made to approach or recede, to suit the straightness or curvature of the road, and retained in any given position. To render also the control over the motions of the two sets of wheels more effectual, another pair of rods similarly arranged are applied to the opposite side of the machine. Each pair of rods may be operated separately, by endless screws as W' Fig. 1, working in a rack formed in the lever V', or what is better, the two pair of rods may be connected so as to be operated both of them, by the same movement or a single screw or lever, which, by means of an index may be readily adjusted to conform the two sets of wheels to the direction or curvature of the rails.

The frame of the machine is strengthened by diagonal bracing, both horizontally and vertically not fully represented in the plan. The boiler with its appendages occupies the space from about midway of the machine, to one end, the fire-box being near the middle and projecting down between the cylinders. The space at the other end is occupied by the fuel and tanks for containing water. The

tubes leading from the tank to the boiler are inflexible, and are secured to the platform or frame of the carriage. The steam pipes pass from the steam chamber over the fire box, down the sides of the fire-box, and thence to the cylinders. The steam is introduced into and discharged from the cylinders by means of slide valves worked in the usual manner. The motion for working the valves may be taken, either from the slide rod D, or the shaft of the wheels L L. The waste or escape steam is conducted by tubes placed underneath the boiler to the smoke pipe to increase its draft as in other engines, or it may be conveyed into the tank to raise the temperature of the water required for the supply of the boiler.

In the plan of the machine, as described, above, the center of motion, or of vibration of each set of four wheels is below the level of the axles, namely at the level of the ring r , and does not therefore coincide with the centers of motion, of the ends of the connecting rods, or of the middle points of the bars b, b . In order to obviate any rigidity or irregularity in the motion from this cause, the two centers of motion may be made to coincide by an arrangement as follows: The braces s, s , &c., Figs. 11, and 13, which support the ring r , instead of being connected with the beams or bars M, M, are to constitute the lower side of a strong rectangular frame, the two vertical sides of which are a', a' . The upper side is provided with a ring r' inclosing a stem, which stem is connected like the stem T with the main frame or body of the machine, the centers of the two rings or stems being in the same vertical line around which the lower or truck frame revolves. In each of the vertical sides a', a' , of this frame, is a vertical slit or opening, extending a little above and below the level of the axles of the wheels. This slit or opening receives a tenon or pin p' Fig. 14, which is firmly connected at one end with the beams or bars M, M, so as to bring its center in the same plane with the axles of the drawing wheels. To reduce the friction and wear of the pin or tenon p' on the slides of the slit or opening, the pin is inclosed by a box shown in Fig. 14, the latter having a vertical movement in the slit, the two sides of which serve as guides to confine and give it a proper direction. By this arrangement the two pairs of wheels, together with the frame have a horizontal movement around the vertical line passing through the centers of the two rings r, r' , and a vertical movement about a line intersecting the latter and passing through the tenons or pins p' which are situated as above described on a level with or in the same plane with the axles of the drawing wheels. Whenever this arrangement is adopted the rods m, m , Fig. 1,

are to be connected with the tenons or pins p', p' , which are to project far enough outside of the truck frame for the purpose.

Instead of the entire rectangular frame $s a' s' a'$ Fig. 11, the upper side of the frame s', s' may be dispensed with, and the vertical sides $a' a'$ extended upward, connecting with the body of the machine by a pin or socket joint. This extension upward is represented by dotted lines in Figs. 11 and 12 the joints being at q', q' . In this case the side pieces a', a' are connected with the lower side s, s , by joints such as to permit of a forward or back movement of the sides $a' a'$ about the centers q', q' , sufficient to allow the wheels to conform to the curvature of the road. Whenever the slide rod D and crank bars K, K, are dispensed with, the arrangement just described becomes unnecessary, so also in respect to the rectangular frame $s a', s' a'$. The ring r in this case is placed on a level, or in the same plane with the axles of the drawing wheels.

When six drawing wheels are used in one set, or embraced in one frame, instead of four, as above described, they may be arranged as represented in Fig. 9. In this case the connecting rods R, R, are attached to the crank pins of the middle pair of wheels W' ; and from these crank pins crank bars b, b , extend to crank pins, similarly inserted in the other pair of wheels composing the set. The mode of connecting in one frame the three pair of wheels is similar to that described above for two pair, that is, journals are formed on the axles near the wheels on the inside. These are inclosed by boxes which are confined by yokes y, y, y , Fig. 8, to a horizontal bar M, on the under side, of which there are two, and from which extend diagonal braces, horizontal or nearly so, supporting a ring in a horizontal position under the center of the middle axle, which ring receives a stem or king bolt joined by branches to the main frame or body of the engine similar to what is represented in Fig. 5. Under this arrangement, the body of the engine bears upon the horizontal bars M, as in the former case but the bearing points instead of being near the axles are placed at the two points V V Fig. 8, so situated as to make the pressure equal upon all the wheels. Between V, and V there extends a steel spring or elastic steel bar as represented in Fig. 8, upon which are placed two conical frustums N', N' which receive the weight of the body of the engine and lessen the friction upon the curves and which are retained in their places by the two vertical bars I, I, arranged nearly as described in Fig. 7.

The improvements claimed and for which Letters Patent are desired are the following:

1. The vibratory cross head as represented

in Figs. 2, 3 and 6, and mode of attaching the two connecting rods R, R, thereto so as to permit the drawing or driving wheels to conform to the curvature of the road without interfering with the movement of the steam pistons.

2. The mode of maintaining or preserving the relative motions of the two sets of drawing or driving wheels by the combination of the horizontal slide rod D, Fig. 4, the arms *h h* the crank bars *h* and the cranks N, N on the axles of said wheels.

3. The mode of communicating the motion from the cross heads to the crank bars *b, b*, by attaching the connecting rods R, R, to the crank bars between the crank pins.

4. Also, the mode described and represented of retaining the frustums of cones in

their proper positions, by means of the vertical bars I, I, and horizontal bars *a, a*, Fig. 7. 20

5. The mode of giving steadiness and support to the vibrating cross heads H by combining with them the eccentric cog wheels L L and rods *t, t*, as described, and the attaching of one pair of said wheels firmly to the same shaft F, Fig. 2. 25

6. The use and application of the rods *m, m*, and lever V' on the two sides of the machine as represented in Fig. 1, to conform the drawing or driving wheels to the curvature of the road. 30

Middletown, Conn., Nov. 14, 1844.

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