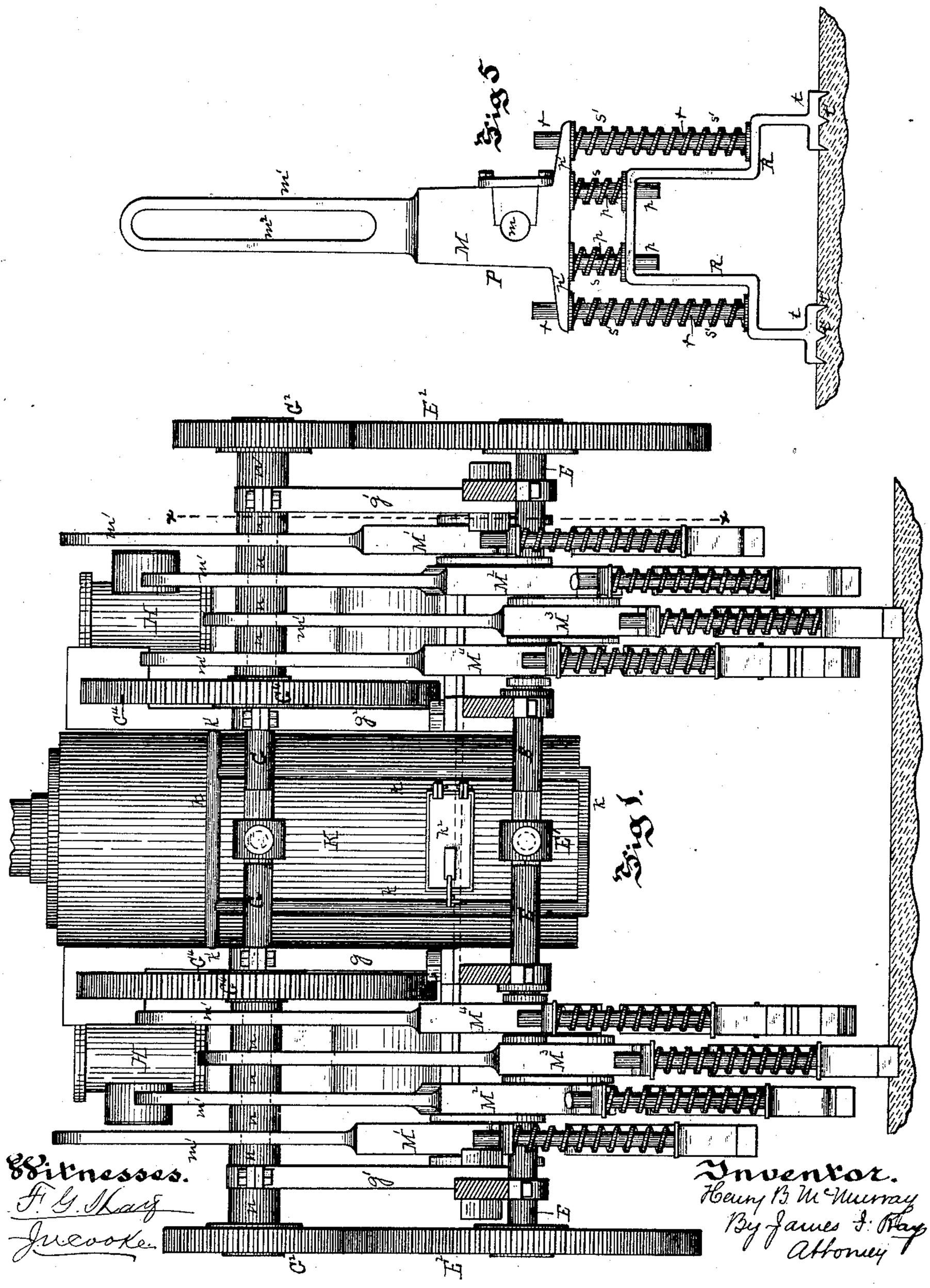
(No Model.) 3 Sheets—Sheet 1.

H. B. McMURRAY.

TRACTION ENGINE.

No. 318,194. Patented May 19, 1885.



Witnesses.
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(No Model.)

3 Sheets—Sheet 2.

H. B. McMURRAY

TRACTION ENGINE.

No. 318,194. Patented May 19, 1885.

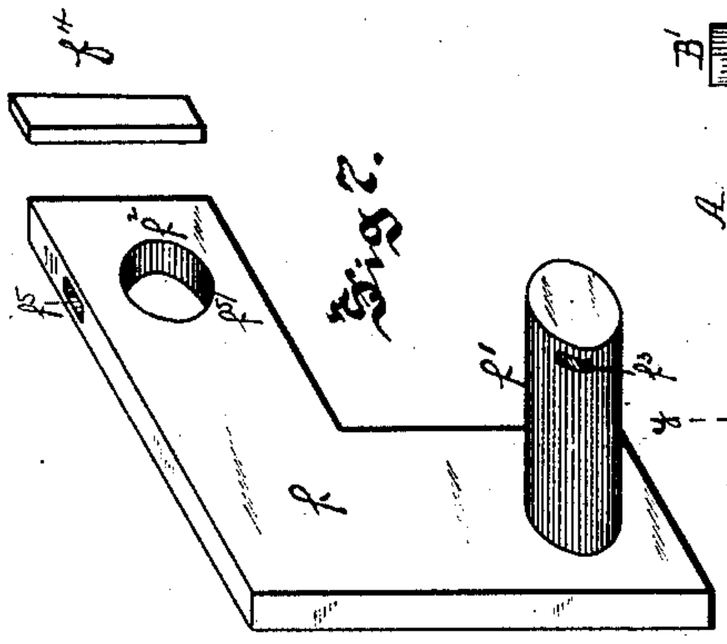

Fig. 3.

Fig. 2.

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(No Model.)

3 Sheets—Sheet 3.

H. B. McMURRAY.

TRACTION ENGINE.

No. 318,194. Patented May 19, 1885.

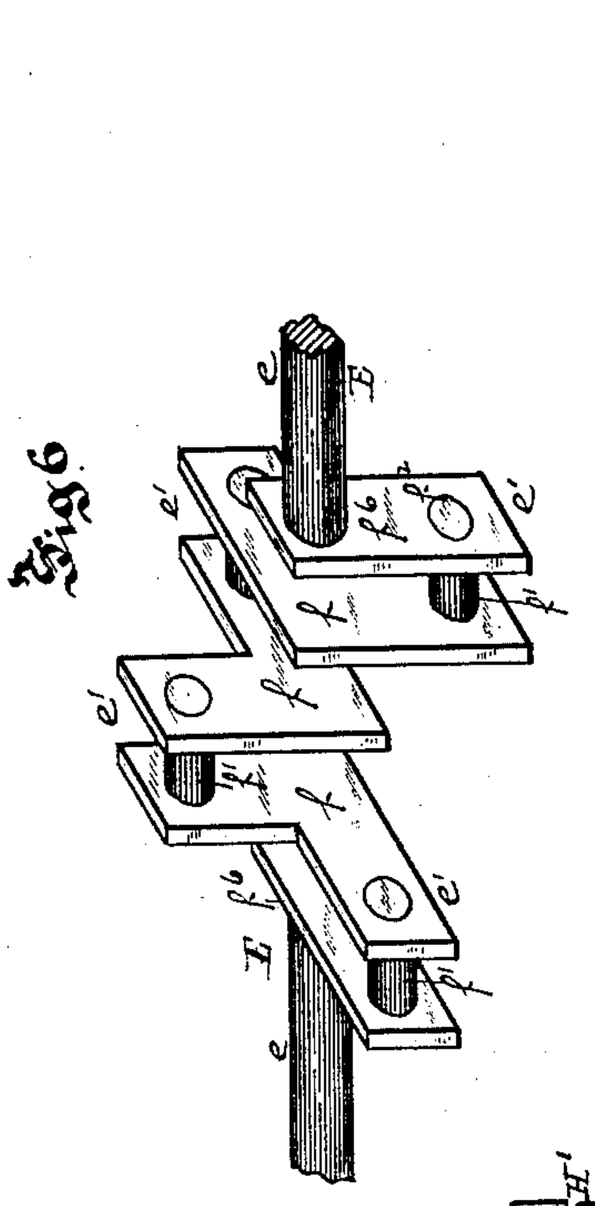

Fig. 6.

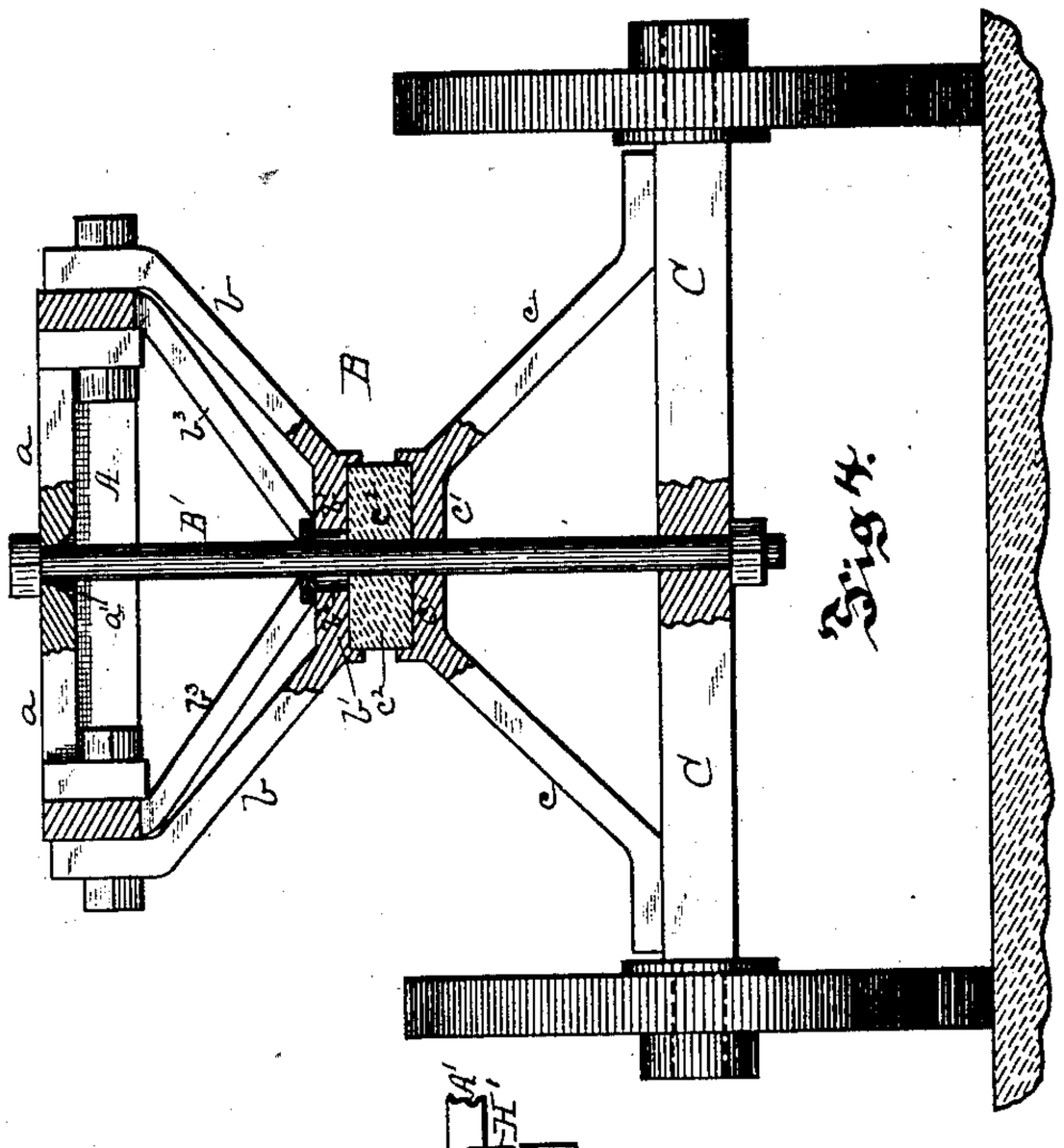

Fig. 4.

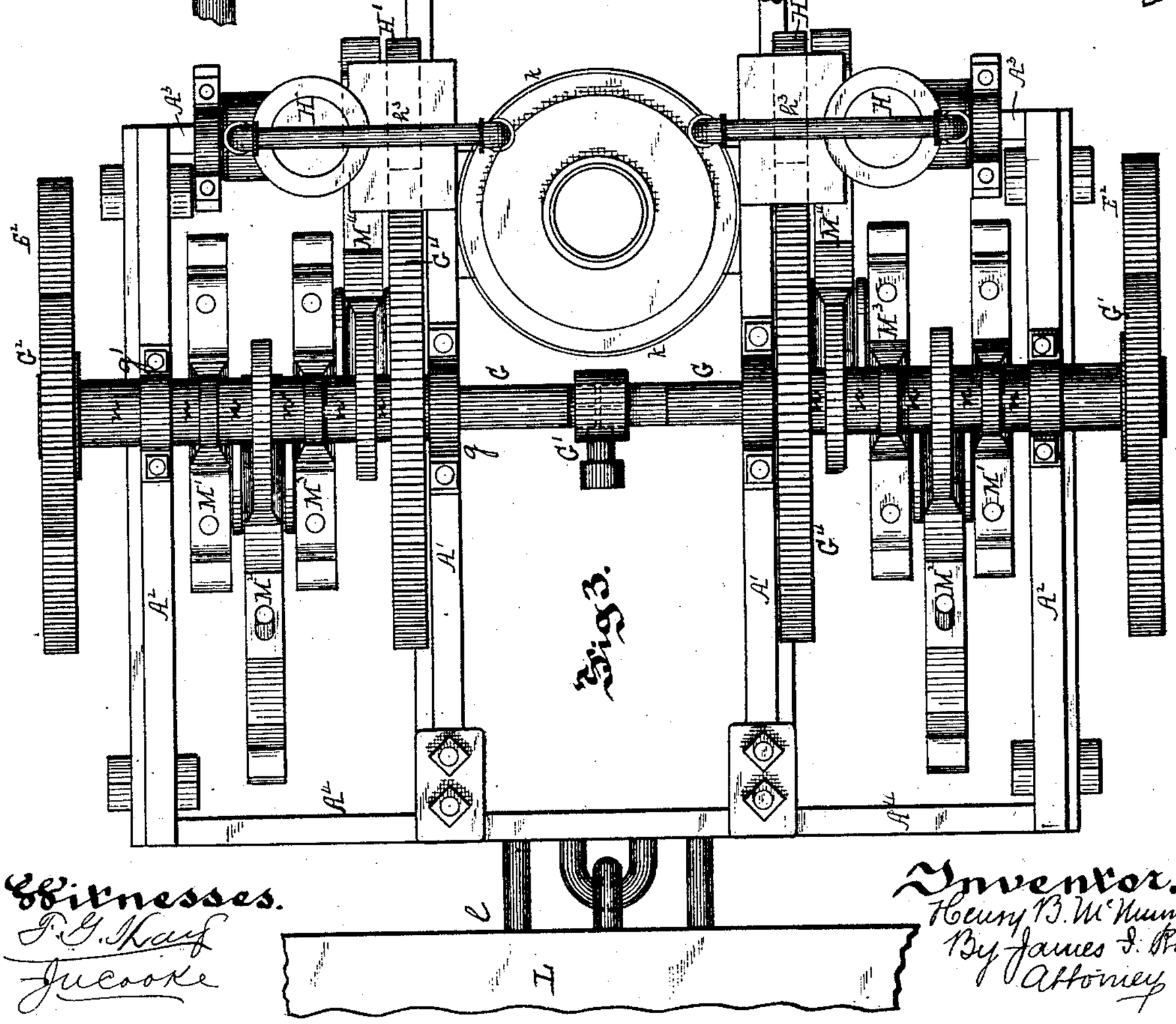

Fig. 3.

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UNITED STATES PATENT OFFICE.

HENRY B. McMURRAY, OF BURGETTSTOWN, PENNSYLVANIA.

TRACTION-ENGINE.

SPECIFICATION forming part of Letters Patent No. 318,194, dated May 19, 1885.

Application filed March 28, 1885. (No model.)

To all whom it may concern:

Be it known that I, HENRY B. McMURRAY, of Burgettstown, in the county of Washington and State of Pennsylvania, have invented a new and useful Improvement in Traction-Engines; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to traction-powers employed on roads or fields for the purpose of drawing cars, wagons, or like vehicles, plows or other agricultural implements, and has special reference to certain improvements in the traction-engine described and shown in Letters Patent No. 296,862, granted to me April 15, 1884. In that patent is described a suitable carriage or frame supported at the front end on a truck and wheels, and having at the rear a power-shaft carrying a series of eccentrics journaled in legs or bars, the legs or bars supporting the rear of the frame, and on the rotation of the power-shaft the legs were caused to engage with the ground and by a backward stroke push forward the engine, and when they reached the end of the stroke they were raised from the ground and carried forward to the first position to repeat the stroke. The upper ends of the legs had a limited longitudinal movement within a guide-frame above the power-shaft and terminated in curved extensions provided with weights, to cause the upper ends to fall forward when raised from the ground into proper position for the following stroke. The boiler and engine were supported at the forward end of the apparatus.

In the practical working of this apparatus I have found that the eccentrics, because of the large bearing-surfaces, caused great friction between the parts, and consequently largely increased the force necessary to operate the engine, and that when the engine was running rapidly the upper ends of the legs were liable to jar the engine by their blows against the guide-frame, and the legs struck too hard a blow on the ground. I also found that the weight of the boiler and steam-engine, fuel, and water at the forward end was so great as to press the guide-wheels down into any ditch or depression and prevent the engine from passing over.

The object of my invention is to overcome these difficulties and to improve the construction of the engine in other particulars.

In my improved engine the legs are journaled on and operated by a power-shaft having a series of cranks, the legs acting to support the rear of the traction-engine through the crank-shaft, and the friction is reduced to about one-third that of the eccentrics. The upper ends of the legs are provided with longitudinal slots, through which passes a horizontal guide-shaft, this construction making the apparatus strong, and at the same time imparting to the legs a positive movement. Each leg is provided with cushioning-springs in such manner that but little of the jar of the feet striking the ground is imparted to the body of the engine.

The construction of the engine and its parts is also improved in other particulars, as hereinafter particularly set forth.

To enable others skilled in the art to make and use my invention, I will describe fully its construction and operation, referring to the accompanying drawings, in which—

Figure 1 is a rear view of my traction-engine. Fig. 2 is a longitudinal section on the line *x x*, Fig. 1. Fig. 3 is a top view of the rear end. Fig. 4 is a cross-section on the line *y y*, Fig. 2, partly broken away. Fig. 5 is a side view of one of the legs. Fig. 6 is a perspective view of the crank-shaft. Fig. 7 is a like view of one section thereof.

The body A of the traction-engine is preferably made of iron beams to obtain the desired strength, **I**-beams being suitable for the purpose. At the forward end is the guide-truck B, which is of peculiar form, to obtain the desired movements and strength, the truck having the bent frames *b c*, one secured to and rigid with the body A, and the other secured to and rigid with the axle C. The frame *b* has the bearing-plate *b'*, and the frame *c* the bearing-plate *c'*, and the king-bolt B' passes through a plate, *a*, secured to the body A, the bearing-plates *b' c'*, the axle C, and a rubber or other cushioning spring, c^2, placed between the bearing-plates *b' c'*, thus securing the parts of the truck together. The hole in the plate *a* is flaring from its top downward, as at *a'*, to allow the king-bolt to swing therein, and the

hole b^2 in the bearing-plate b' is larger than the king-bolt to permit side movement of the bolt therein, and as the axle C and frame c are rigid with the king-bolt this bolt will swing within the frame b whenever the truck is passing over sidling or uneven ground, the king-bolt swinging within the bearing-plate b', and the spring c^2 yielding according to the pressure between the bearing-faces.

In order to hold the king-bolt centrally within the hole b^2 of the bearing-plate b', I provide the spring-bars b^3, one end of the bars being secured to the body A of the engine at the outward forward end thereof, and the other end fitting around the king-bolt above the bearing-plate, and these bars not only strengthen the truck, but draw the king-bolt back to its normal position when the strain thereon is removed. As the king-bolt extends from the top of the body A through the truck and axle frame and the body of the axle, it is evident that a strong support is obtained. In order to operate this front guide-truck and guide the traction-engine, I secure to the axle C, at each end thereof close to the wheels, chains D, passing one over and one under the reel d, mounted in suitable bearings on the body A of the machine, and at one end of said bar d is the bevel or worm-gear wheel d', in which meshes the corresponding bevel-gear or worm d^2, this wheel being secured to the shaft d^3, mounted in suitable bearings and extending back to the platform a^3 at the rear of the body A within reach of the engineer, and by means of this apparatus the guide-wheel can be turned in whichever direction desired by the engineer from the rear of the body A. At the rear of the engine the body A is formed of the longitudinal beams A′ A^2, the cross-beam A^3, and the rear cross-beam, A^4, the longitudinal beams A′ forming the main part of the body A, and the beams A^2 running parallel thereto and outside thereof, the four beams being connected by the cross-beams A^3 and the rear beam, A^4.

Journaled in suitable boxes on the beams A′ A^2 are the main power-shafts E E, these shafts being what are termed "crank-shafts," and having the cranks thereof extending out at right angles to each other, each shaft having four cranks therein to receive the four legs supported on each side of the engine, the rear of the traction-engine being supported on these legs through the crank-shafts. The exact construction of these crank-shafts is fully shown in Figs. 6 and 7, in which e are the main bearings journaled to the horizontal beams A′ A^2, and e' e' are the cranks of said power-shaft, each crank being at right angles to the one next to it, so that the bearings of the legs journaled on these cranks are arranged to move in a circle upon the rotation of the crank-shaft. This crank-shaft E is formed in a peculiar manner, in order to obtain the necessary strength and rigidity, being formed in sections such as shown in Fig. 7, each section being formed of the crank-plate f and the crank-bearing f', cast or forged in one solid piece from cast-steel, the crank-bearing f' extending out at one end, and the crank-plate f having at its opposite end the seat f^2 for the reception of the crank-bearing of the adjacent crank-plate, and passing through the crank-bearing f' is the cotter-hole f^3 for the reception of the cotter f^4, which is driven through the cotter-holes f^5 in the crank-plate f, said cotter-holes extending through the plate into the seat f^2; and in order to connect the different parts of the crank-shaft together the crank-bearing f' is firmly seated in the seat f^2, and the cotter f^4 is driven through said cotter-holes f^3 and f^5, thus connecting the parts rigidly together and forming a strong and rigid crank-shaft, the end plates, f^6, of the crank-shaft having the bearings e formed thereon, and are connected to the adjacent sections of the sectional crank-shaft, in the manner above described. The two crank-shafts E are mounted in line with each other, and their inner ends are formed angular and united by the sleeve E′, so that the two shafts may operate together; but where it is desired to make a short turn, as in a narrow place on the road, the sleeve may be slipped off the end of one crank-shaft so as to be wholly supported by the other, and leave the two shafts separate, so they may be turned in different directions, as hereinafter described.

At the outer ends of the crank-shafts E are mounted the gear-wheels E^2, which gear into the gear-wheels G^2, mounted on the ends of the shafts G. These shafts G are supported in suitable bearings, g g', extending up from the beams A′ A^2 of the body A, and the shafts G being on or about the same vertical plane as the power-shafts E, and these shafts G G are connected by the sleeve G′ in substantially the manner as described as to the sleeve E′, connecting the shafts E E. The shafts G are provided with the gear-wheels G^4, which gear into the gear-wheels H′ on the engine-shaft h.

The engines H are supported on the inner bearings, g, in any suitable manner in a vertical position, and their pitmen h' are secured in the usual manner to the cranks h^2 of the engine-shafts h, so that the power from the engine is transmitted from the engine-shafts h through the gear-wheels H′ G^4 to the shafts G, and thence through the gear-wheels G^2 E^2 to the power crank-shafts E. Suitable levers extend from the engine-valves back to the platform a^3 within reach of the engineer.

The boiler K is supported in any suitable manner by the inner bearings, g, between said bearings in front of and close to the shafts E and G of the machine, the boiler and engines both being located in such position that they are supported by the operative legs heretofore referred to, and that but little weight is thrown upon the forward portion of the engine, and by so supporting them I am enabled to guide the machine much easier, as the guide-wheels and truck being comparatively free from weight, will mount any obstruction much more easily

than where they are weighted down, as shown in the patent before referred to, and I obtain the further advantage that the weight of the boiler and engine increase the traction or hold of the operative legs upon the ground without increasing the weight of the traction-engine. The boiler is preferably supported in the cage *k* bolted, as at *k'*, to the inner bearings, *g*, though the body of the boiler may be bolted to said bearings directly, if desired. I prefer, however, to support the boiler in this cage for the reason that its body is free to expand and contract without throwing strains upon its connecting-bolts, and it is therefore less liable to leak or get out of order. The boiler is provided with the pipes h^3, leading to the steam-chests of the engines, and the feed-door k^2 of the boiler faces the rear of the engine, so that it can be fed from platform a^3 at the rear of the engine-body A, the entire apparatus being thus in position to be controlled by the engineer at the rear of the engine. The fuel and water for the supply of the boiler are carried in the tender L at the back of the engine, a small portion of said tender being shown in Fig. 3, and the engine is thus relieved of the weight of the water and fuel, the fuel being within easy reach of the engineer for feeding the boiler. The water-tank of the tender is connected to the boiler by a suitable pipe, *l*, in the same manner as generally employed with locomotive-engines.

The engine is provided with four operative legs or bars, M, on each side thereof, the construction of each of said legs being the same as fully shown in Fig. 5 of the drawings. Each leg is journaled to one bearing-bar, *f'*, in the cranks *e'* of the power-shaft, said bearing-bar working within the journal-bearing *m* of the leg, and at the upper end or extension *m'* of the leg is the long slot m^2, through which the shaft G passes, so that each leg is mounted on the crank-shaft E and the guide-shaft G, and upon the rotation of the crank-shaft E the leg is first carried forward and then downward against the surface of the ground, with which it engages, and is then pushed backward, thus pushing forward the traction-engine, and when it reaches the end of its pushing-stroke is raised and carried upward and forward to its original position. During this stroke of the leg its extension *m'* slides over the guide-shaft G, this guide-shaft acting to hold the upper portion of the leg in its proper position, and the slot m^2 allowing of sufficient movement of the leg to enable it to make its stroke as it is carried around in its circular stroke by the crank-shaft.

In order to hold the upper ends of the leg the proper distance apart, I employ the loose collars *n* on said guide-shaft G between the slotted extensions of the leg, and these loose collars also prevent friction between the parts and prevent the swinging of the legs out of their proper vertical position with relation to the crank-bearings of the crank-shaft. Two of these legs engage with the ground at the same time, one on each side of the machine, they being arranged to move together, so that the rear of the engine is always supported on two operative legs. The movement of these legs is fully illustrated in Fig. 2 of the drawings, the legs M' engaging with the ground and being in the position for the pushing-stroke while the legs M^2 have reached the end of their pushing-stroke and been raised clear of the ground, and the legs M^3 have been carried to their highest position on the forward motion thereof, while the legs M^4 are in position just before they engage with the ground to make the next pushing-stroke of the legs. As the crank-shaft is turned the legs M^4 will be carried against the ground in the position of the legs M', and after their pushing-stroke is over they will be carried into the position of the legs M^2, thence to that of the legs M^3, and thence back to the position shown ready for the next pushing-stroke, the other legs passing through the same course, and one leg on each side thus engaging with the ground and acting to push forward the traction-engine at all times, so that the legs thus impart a continuous and steady forward motion to the traction-engine.

As the entire support of the rear of the engine is directly through the crank power-shaft it is evident that there is great friction between the eccentrics shown in my former patent and the bars on account of the pressure of the broad bearing-faces of the eccentrics, and in my present apparatus the crank-bearings *f'* of the cranks are of comparatively small diameter, so that the friction between the operative legs and the power shaft is reduced to less than one-third that of the apparatus shown in the patent above referred to, where eccentrics are employed, and consequently the power necessary to operate the traction-engine is proportionately reduced, and by the employment of this crank power-shaft instead of the eccentric-shaft I have reduced the power necessary to operate the traction-engine from one-third to one-half.

By the employment of the guide-shaft and the slotted extensions of the operative legs fitting around it I obtain a much better control of the operative legs than can be obtained where said legs are free to move within the guide-frame, as shown in said patent, and also overcome the jarring of the machine on account of the swinging of the upper ends of the legs or bars, and do away with all spring apparatus to take the jar, thus simplifying to a great extent the construction of the apparatus.

In order to prevent the jarring of the apparatus by the blow of the feet upon the ground where the traction-engine is moving rapidly, I have constructed the operative legs as shown in Fig. 5, the body P of the legs having the lugs *p'* extending out at the sides thereof and the vertical bars *p* rigidly secured thereto and extending down therefrom, the ends of the bars passing through seats or holes in the upper ends of the auxiliary frame R, said

frame R preferably having the rectangular form shown to lighten it, and having the bars *r* extending up therefrom and passing through seats or holes in the lugs *p'* of the body P, and around these bars *p* and *r*, respectively, between the body P and the frame R, are the cushioning-springs *s s'*, so that when the legs push against the ground the auxiliary frame R will be pressed upward and the springs be contracted, the frame R being guided in its movement by said bars *p* and *r*, and prevent the jarring of the body as well as relieve the crank-shafts and other operative parts from severe jar, to which they would be subjected if the leg was formed in one solid piece. The auxiliary frame R and the body P are held together by suitable nuts or cotters secured to said bars *p* and *r*. The springs *s s'* are sufficiently strong to bear the weight of the engine. The auxiliary frames R are provided with the feet *t*, having suitable engaging cleats or spikes, *t'*, to give them a hold upon the ground.

The operation of my improved traction-engine is as follows: The power from the engine is communicated through the gear-wheels H' G^4, the shafts G G, and the gear-wheels G^2 E^2 to the crank-shafts E, the power from the engine being, on account of the proportionate size of the gear-wheels, increased about ten times, so as to obtain the necessary power to operate the traction-engine with comparatively small steam-engines. Where the engine is passing in a comparatively steady course along the road or field, as the guide-shafts G G and power-shafts E E are connected by their sleeves G' E', and so operate together, the traction-engine may be guided in its movement by the engineer from the platform a^3 through the shaft *d* and gearing to the shaft d^3, and thence by the chains D to the wheels of the truck B. As the crank-shaft is turned, it brings two operative legs in contact with the ground, and by their backward movement pushes forward the engine, and as the shaft continues to rotate it brings each successive set of legs M' M^2 M^3 M^4 in contact with the ground, imparts to them a pushing-stroke, and raises them clear of the ground and draws them forward again to engage with the surface of the ground for the next stroke. In this manner the engine is propelled forward along the surface of the ground, and in case it encounters any irregularities in the surface thereof the jar is taken up by the springs *s s'* in the operative legs, as before described, and the severe jarring of the apparatus is thus prevented, the auxiliary frames R of the legs being made sufficiently strong to withstand these jars.

As friction has been reduced to a minimum, the power necessary to operate the traction-engine is but small, it requiring only from twenty to thirty pounds of steam to propel the engine and its tender, and consequently the engine can draw a very heavy load.

The movement of the traction-engine can be guided by the engineer from the platform at the rear thereof, and as the forward portion of the engine carries but little load, it will rise easily over an abrupt obstruction, such as in passing over a trough or gutter, and the traction-engine may be employed on rough roads or rough fields, or for hauling or for any agricultural purposes.

In case the forward wheels of the engine encounter any ruts or sidling ground, on account of the peculiar construction of the forward truck, as before referred to, it will accommodate itself thereto, the king-bolt swinging within the truck B, as before referred to, and allowing the wheels to accommodate themselves to the irregularities in the road, and as soon as they pass such rough or sidling ground the king-bolt and axle will be drawn back to their proper position by the spring-bars and cushioning-spring before referred to.

Where it is desired to turn the traction-engine in a very small space, the sleeves G' E' are loosened and slipped over so as to disengage the shafts G G E E from each other, and one of the engines can then be reversed, when the apparatus can be turned in a space very little larger than that occupied by the engine, the set of operating-legs on one side pushing backward and that on the other side pushing forward.

When necessary, both engines may be reversed and the apparatus can be backed thereby.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In traction-engines, the combination of a body or frame having guide-wheels at the forward end, a power-shaft mounted in said frame and having a series of cranks therein, and a series of supporting-legs journaled on the cranks of the power-shaft and acting to support the rear part of said frame through the power-shaft, substantially as set forth.

2. In traction-engines, the combination, with a power-shaft and a series of operative legs or bars journaled thereto and having imparted to them a pushing-stroke thereby, of a guide-shaft above the power-shaft and having said legs connected thereto by a sliding connection, substantially as set forth.

3. In traction-engines, the combination of a power-shaft having a series of cranks therein, a guide-shaft above it, and a series of operative legs or bars journaled to the cranks of said power-shaft and connected to said guide-shaft by a sliding connection, substantially as set forth.

4. In traction-engines, the combination, with the body A, of the crank-shafts E E, the legs M, journaled to the cranks thereof, and the connecting-sleeve E', substantially as and for the purposes set forth.

5. In traction-engines, the combination, with the body A, of the crank-shaft E, the guide-shaft G, and the legs M, journaled to the crank-shaft and having the extensions M', provided with the slots m^2, through which the

guide-shaft passes, substantially as and for the purposes set forth.

6. In traction-engines, the combination of the power-shaft E, the guide-shaft G, the legs M, journaled to said power-shaft and having slotted extensions through which the guide-shaft passes, and the collars *n* on said guide-shaft, substantially as and for the purposes set forth.

7. In traction-engines, the operative leg having the body P and auxiliary frame R, in combination with guide and spring connections between them, substantially as and for the purposes set forth.

8. In legs for traction-engines, the combination of the body P, having the guide-bars *p*, frame R, having guide-bars *r*, and springs around said bars confined between said body and frame, substantially as and for the purposes set forth.

9. The combination of the frame *b*, secured to the engine-body and having the bearing-plate, *b'* provided with the enlarged hole b^2, the frame *c*, secured to the axle and having the bearing-plate *c'*, the spring c^2, and the king-bolt, substantially as and for the purposes set forth.

10. The combination of the frame *b*, secured to the engine-body and having the bearing-plate *b'*, provided with the enlarged hole b^2, the frame *c*, secured to the axle and having the bearing-plate *c'*, the spring c^2, the king-bolt, and the spring-bars b^3, substantially as and for the purposes set forth.

In testimony whereof I, the said HENRY B. MCMURRAY, have hereunto set my hand.

HENRY B. MCMURRAY.

Witnesses:

W. W. VANCE,

C. M. ELDER.