No. 855,682. PATENTED JUNE 4, 1907.

J. F. WENTWORTH.

LOCOMOTIVE ENGINE.

APPLICATION FILED JULY 6, 1904.

4 SHEETS—SHEET 1.

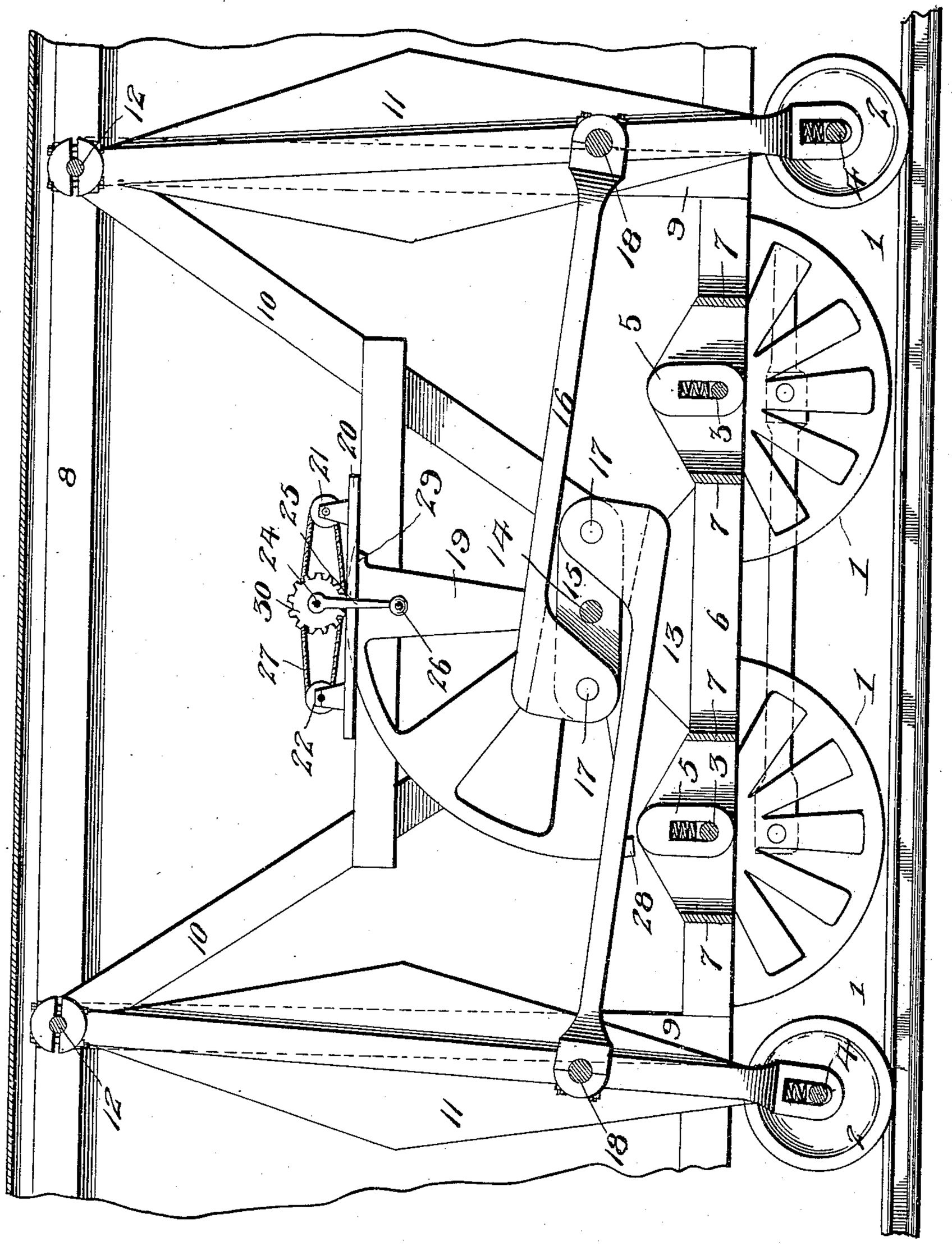

FIG. 1.

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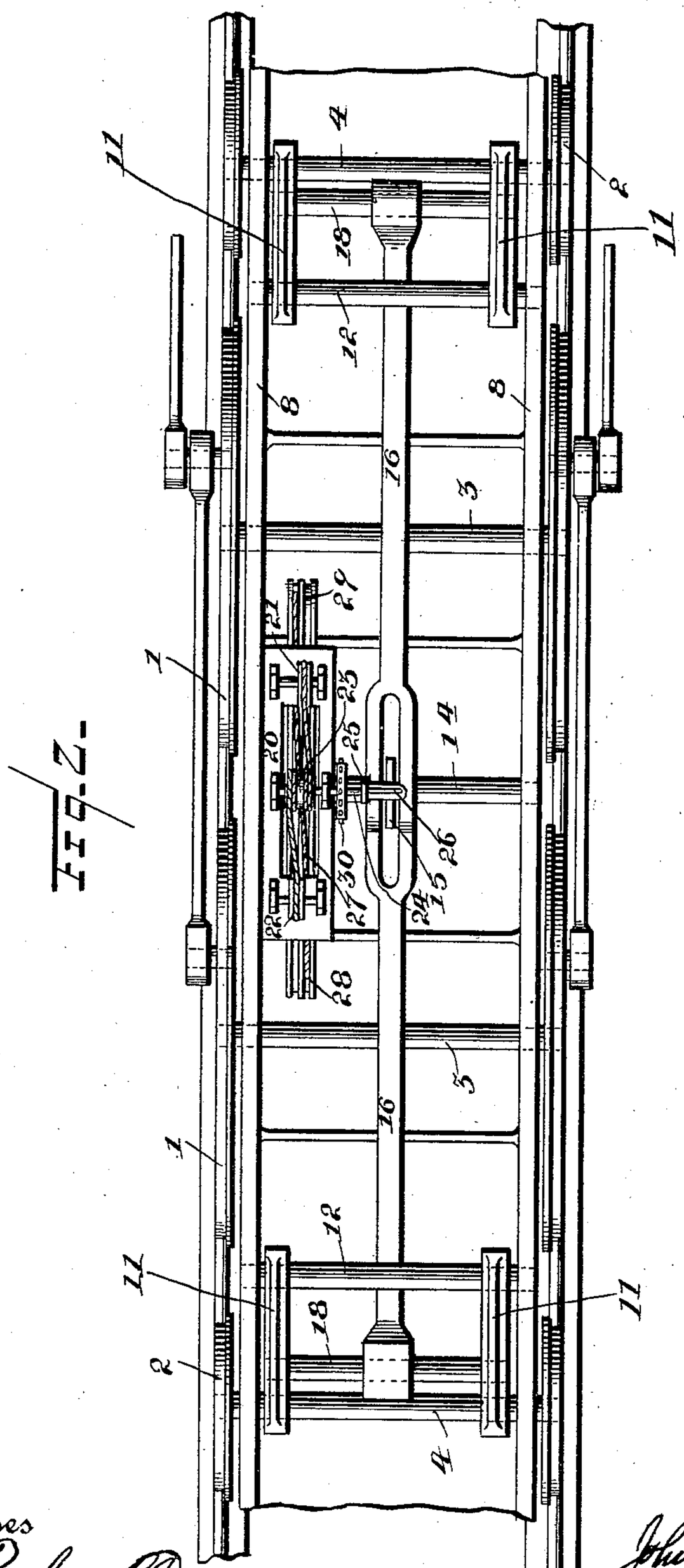
4 SHEETS—SHEET 2.

FIG. 2.



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4 SHEETS—SHEET 3.

FIG. 3.

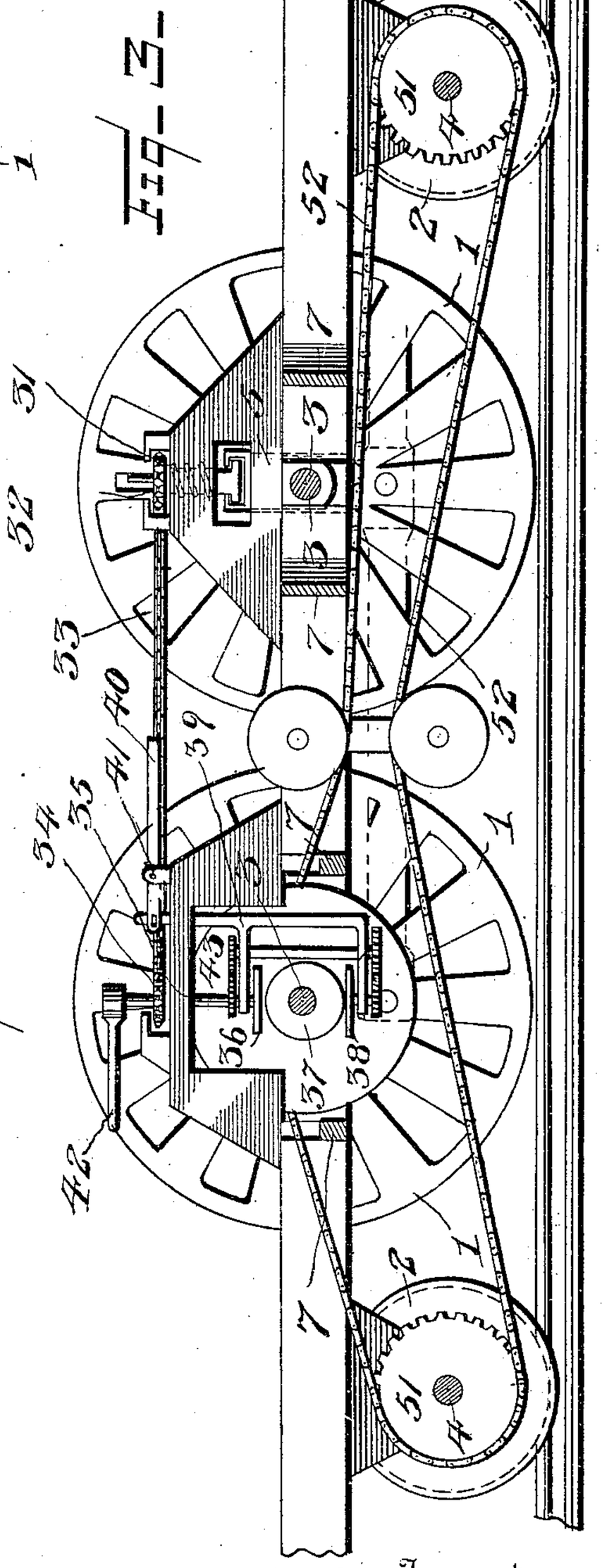

FIG. 4.

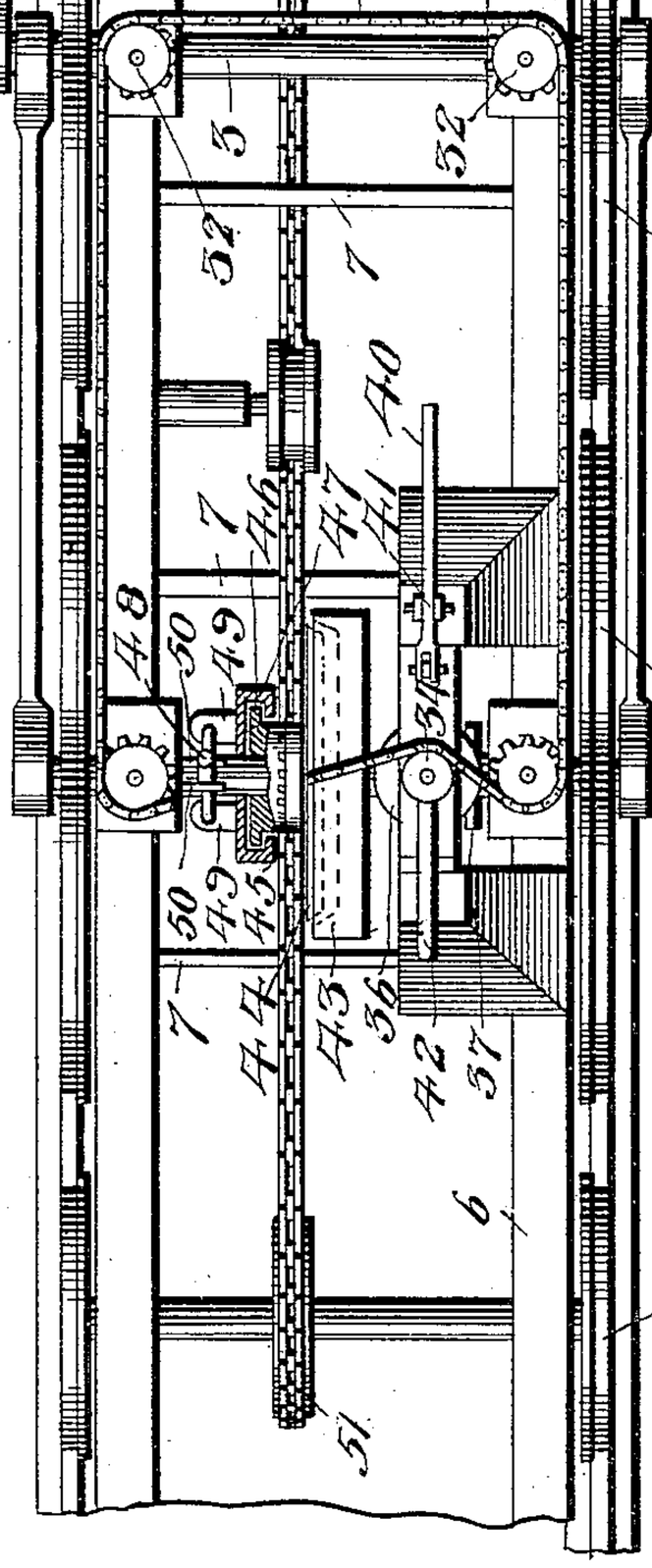

FIG. 5.

Witnesses

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4 SHEETS—SHEET 4.

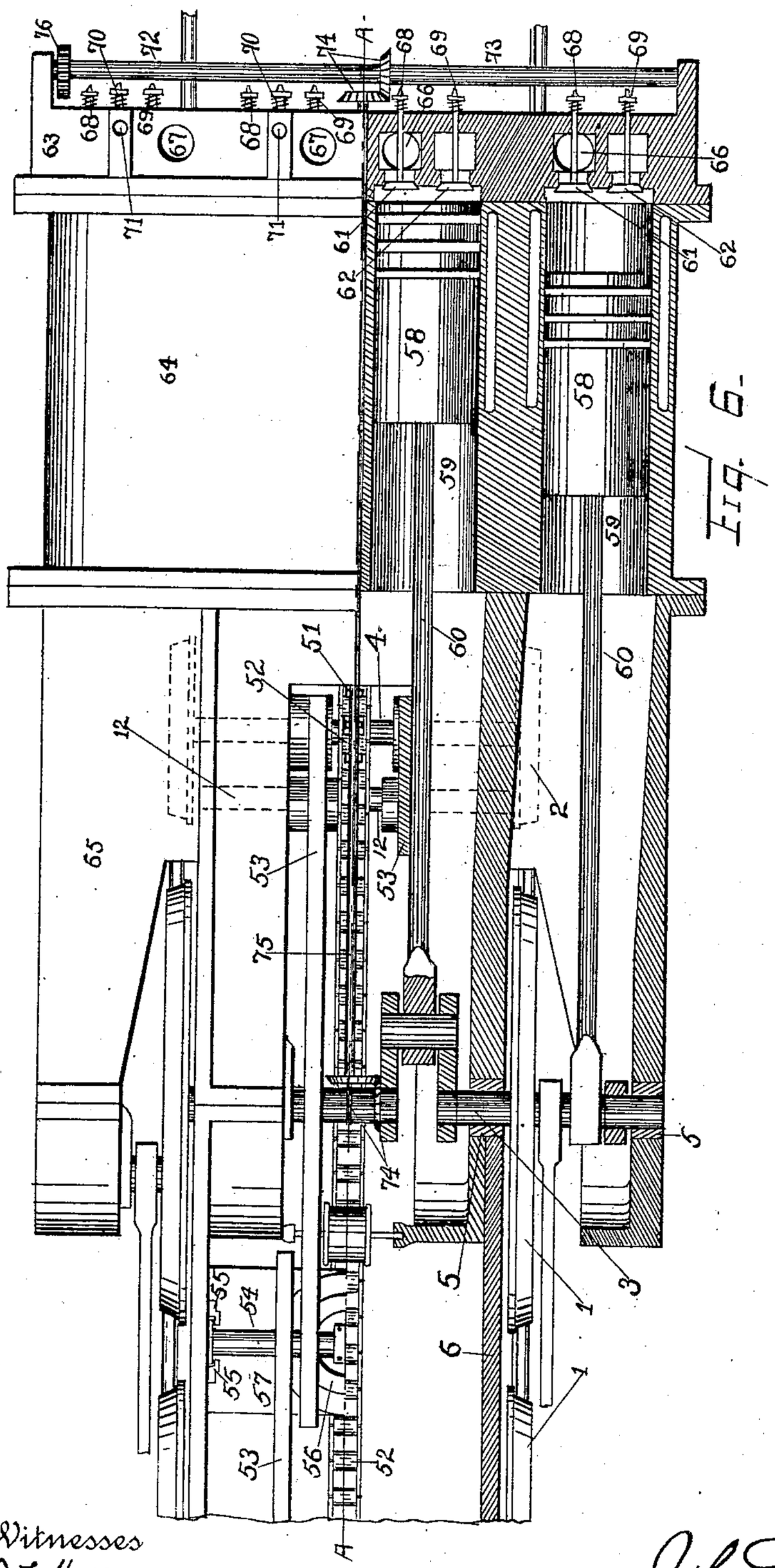

FIG. 6.

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UNITED STATES PATENT OFFICE.

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LOCOMOTIVE-ENGINE.

No. 855,682. Specification of Letters Patent. Patented June 4, 1907.

Application filed July 6, 1904. Serial No. 215,525.

To all whom it may concern:

Be it known that I, JOHN F. WENTWORTH, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Locomotive-Engines; and I do 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.

This invention relates to locomotives and has for its object to provide a simple and durable locomotive which may efficiently use for the motive power an internal combustion engine, a high potential electric motor or any form of power not adapted to easy starting under full load, and the invention hereinafter described has been developed with the particular idea of providing a way for using a suitable internal combustion engine as the motive power for locomotives.

The steam engine in its best form has an efficiency of about 12% against a corresponding efficiency of 30% for the best internal combustion engines. The steam locomotive has an efficiency of about 3 to 5%. This reduction in efficiency comes from the fact that for economy not over 20 pounds of coal is burned per sq. ft. of grate surface per hour, whereas in order to develop the necessary power in the locomotive the fuel consumption sometimes goes as high as 120 pounds of coal per sq. ft. of grate surface per hour. This forced consumption of the fuel causes a decrease in the efficiency. The internal combustion engine can be forced by increasing the revolutions per minute and there is no bad effect upon the efficiency. However owing to the difficulty of starting the internal combustion engine under load and in reversing the engine but little progress has been made along the line of adapting the internal combustion engine to railroad use.

The general idea of this invention is to connect the motive power direct to the driving wheels of the locomotive and to furnish means for taking the weight from the drivers while the motive power is being started and for putting the tractive load on the drivers when the motive power is operating perfectly and while the drivers are revolving.

In the accompanying drawings forming a part of this specification, Figure 1 is a longitudinal section of a simple form of my invention; Fig. 2 is a top plan view of the same; Fig. 3 is a vertical longitudinal section showing another form of my invention; Fig. 4 is a plan view of the same; Fig. 5 is a detailed sectional view. Fig. 6, a plan view of the front end of a locomotive showing one manner of applying the internal combustion engine and connecting the same to the running gear.

Referring to Fig. 1, the numeral 1 denotes the drivers, 2 the auxiliary wheels for assuming the weight of the locomotive when the weight is taken from the drivers 1. 3 represents the axles of the driving wheels, 4 the axles of the wheels 2, 5 the floating boxes for the drivers, 6 are the lower longitudinal members of the frame, 7 represents the cross members connecting the two members 6. In order to get suitable vertical rigidity, at the top of the locomotive frame, which is built roughly like a box car, longitudinal members 8 are provided. A short distance in front and behind the driver axles are two vertical members 9 supporting members 8. From the joints of members 8 and 9 diagonal pieces 10 run to the lower longitudinal members 6 and come together halfway between the drivers. The auxiliary wheels 2 are connected to the frame of the locomotive by vertical struts 11 running to shafts 12 running across the structure at the top as is shown. The ends of shafts 12 will be at the joints of 8, 9 and 10. The general structure of the frame is strong enough to enable the locomotive to be borne by axles 12 as is shown in Fig. 1, with the drivers off the rails. In the center of the locomotive between the drivers is a frame 13 built up from the main or lower longitudinal members 6 at each side. These supports 13 will bear the axle or shaft 14 which has in the center between the supports, as is shown by Fig. 2, single crank arms 15 formed of a single piece. The crank arms 15 are connected with the struts 11 by means of the long arms 16, wrist pins 17 in the crank arms 15 and shafts 18 in the struts 11. In order to lift the locomotive the shaft 14 is revolved not more than half a turn thus moving the auxiliary wheels 2 toward the drivers and into the position shown in Fig. 1, when the struts 11, in approaching a perpendicular position, will cause the shafts or axles 12 to rise and to take the weight of the locomotive off of the driving wheels and

throw it onto the wheels 2. In order to rotate the shaft 14, a quadrant 19 is keyed or secured to shaft or axle 14. The quadrant 19 has two grooves as shown in Fig. 2. As shown a shelf 20 carries two suitably journaled small pulleys 21 and 22 at its ends and a central pulley 23. The pulley 23 is revolved by a shaft 24 which is provided with a crank 25 and a handle 26 in order to rotate the same. A rope or chain 27, or some other simple flexible means is used to give the quadrant 19 motion from pulley 23. The cord or chain 27 has one end secured to quadrant at 28. As shown in Fig. 1, the said cord or chain runs in one of the grooves on the periphery of the quadrant and from thence over the pulley 21 to pulley 23 and is given several turns thereon, then over pulley 22 and to the quadrant where it is secured at 29. In this way, as fast as slack is taken up over pulley 21, it is paid out over pulley 22 and the quadrant can be absolutely controlled with practically no lost motion. Owing to the enormous leverage in the long struts 11 and to the fact that the rate at which the shaft 12 rises is constantly decreasing as the struts approach a perpendicular position and also owing to the fact that the rate of motion of the connecting rods 16 will decrease as the arms move through the last part of the last 90 degrees of the motion of the arms 15, it is evident that an ordinary man can easily lift the 50 tons of weight on the drivers the fraction of an inch necessary by means of the crank arm 25 and the handle 26. In case, however, that it is desired to use power for this purpose a small electric motor, (not shown) can be connected to the axle 24 by means of the sprocket wheel 30 and a suitable chain (not shown).

The method of operation of this locomotive is extremely simple. The drivers will be lifted till no weight is on them and then the motive power started. In case of high potential electricity, the electric current will be turned onto suitable motors (not shown) on axles 3. In case that the internal combustion engine is used for motive power the engine must be started by compressed air till the engine has gained sufficient momentum to carry it through its complete cycle. Then the engine will be switched off into its normal method of working, generating the power developed from the fuel and not from the compressed air. In any form when the engine has arrived at the stage where the cycle of the motive power is the normal working cycle, then by means of the quadrant 19 and the other mechanism the wheels 2 will be pushed apart and the revolving drivers 1 will be brought in contact with the rails and the tractive weight placed on the axles 3 by further motion of the auxiliary wheels 2. This will start the train with an excessive amount of slipping of the drivers on the rails in the first place but this slipping can be controlled to some degree and will entirely disappear as the train gains speed.

On the type of locomotive shown in Figs. 3, 4 and 5 the same general result, namely the taking of the weight from the drivers, is accomplished in another way. The main part of the frame of the locomotive is rigid enough to enable the weight to be borne by the auxiliary wheels 2 without excessive sagging of the locomotive frame. The auxiliary wheels are secured to the frame by suitable bearings. The driving wheels 1 are secured to the frame 6 of the locomotive between the wheels 2. The usual floating box 5 is secured to the frame 6 as shown in Fig. 5. The sliding box 5, Fig. 3 has a bearing for the foot of the screw 31. This screw is shown in dotted lines in Fig. 3. The thread of the screw 31 engages a thread in the frame 6 so that turning the screw causes the screw and consequently the floating box to move up or down according to the direction of rotation of the screw. Each of the floating boxes is provided with a similar screw and the rotation of the screw is governed by the sprocket 32 and the chain 33 so that all of the drivers will have the same vertical motion. The chain 33 is driven by a sprocket wheel 34 on a shaft 35, carrying a disk 36 at the end of the shaft. There is a disk 37 on the axle of the driver and below the disk 37 is a second horizontal disk 38. Disk 38 is connected to the shaft 35 by the train of gears shown. The direction of the motion of the chain 33 depends upon which disk, 36 or 38, is in contact with disk 37 as well as upon the direction of rotation of the axle 3. The train of gears as well as the two disks 36 and 38 are moved vertically by the frame 37 which in turn is moved by lever 40 pivoted at 41. The drivers and axles can be raised or lowered by the motion of the axle of the driver in the manner just described; that is to say through the shaft 36, sprocket 34 and chain 33 to the four sprockets each giving rotation to one screw and thus a vertical motion to the boxes of the drivers, or the chain can be moved by the hand lever 42 which is fastened to the shaft 35 enabling the drivers to be lifted from the rails before the motive power is started.

In order to start a very heavy train and to do it without excessive slipping of the drivers a modification is proposed as shown in Fig. 4, in which a friction clutch is placed on one driver axle. The clutch consists of a circular piece 43 having one side cut away so as to leave an inner beveled surface. This piece 43 is keyed to the axle 3. A thick beveled disk 44 is arranged loosely on the axle 3. Attached to or a part of disk 44 is a sprocket wheel 45 and an annular projection 46. A lipped plate 47 engages this projection 46 and any movement of plate 47 causes an equal

movement of the beveled disk 44. A forked lever 48 is connected with plate 47 by means of two ears or lugs 49. The lever 48 is pivoted at the lower end between two lugs 50 secured to the main frame of the locomotive. On axles 4 are sprocket wheels 51 which are geared to sprocket 45 by the chain 52. In this way if it is desired the wheels 2 can be revolved by the motive power by means of the friction clutch on the driver axle and the sprocket wheel 45, sprocket wheels 51 and chain 52.

In Fig. 6, is shown a method of connecting the internal combustion engine to the driving wheels, but it is not my intention to limit the invention to such method. In the Fig. (6,) named the invention is shown partly in plan and partly in horizontal section, the dividing line being at A—A. One of the driving wheels and a portion of the other is shown at each side. The design shown is for a four-wheeled locomotive, but there is no reason why the invention should be limited to a locomotive having any particular number of driving wheels. In Fig. 6, 1 is the driving wheels, 3 the forward or front driving axle, 5, the floating boxes, and 6 the longitudinal frame. The forward auxiliary trucks, 2, are indicated by dotted lines, and 4 designates their axles. The sprocket wheel 51 on axle 4 is driven by the chain 52, which receives its power through the sprocket wheel 45 on the rear driving axle shown in Fig. 4.

With a view to enable a more thorough understanding of my invention, I hereinafter describe the engine shown in Fig. 6, for supplying the necessary power for operation, but I do not make claim to any part thereof as any other preferred form, construction, or arrangement of parts to accomplish the purpose thereof may be used with equally good results.

The levers 53, shown in Fig. 6, differ slightly from the corresponding levers, 11, shown in Fig. 1, and the axles 12, about which the trucks 2 oscillate are arranged at the bottom of the longitudinal frame instead of at the top thereof as shown in Fig. 1. The trucks are oscillated by a continuation of the levers 53 which engage a shaft 54, which is fixed as to longitudinal movement but is capable of a vertical movement through the slides 55 on the vertical sides of the longitudinal members 6. The vertical movement of shaft 54 is accomplished by pressure on the under side of the piston (not shown) acting in the cylinder 56, which is borne by the platform 57. In this way the weight of the locomotive is lifted by means of the upward force acting on the ends of the levers 53 causing a depression of the lower ends of the levers 53 and a corresponding depression of the auxiliary trucks 2. This is merely a practical way of producing the downward movement of the trucks 2 without so much lateral movement of the trucks as to make it impossible to drive the auxiliary trucks by means of the chain and sprocket wheels.

In the part of the device shown in section in Fig. 6, 58 are the pistons, 59 the cylinders and 60 the connecting rods. As shown there are no piston rods but the pistons are connected with the forward driver axle 3 through the usual cranks and pins or with the drivers themselves by means of wrist pins. 61 denotes the air admission valve from the atmosphere and 62 the exhaust valve. The air inlet pipe (not shown) enters the head casting from below through the hole 66 in the head casting 63. The exhaust pipe enters the casting 63 at opening 67 as is shown in the part of Fig. 6, in plan. The type of internal combustion engine here shown is a four cycle four cylinder engine. The atmospheric air admission valves are operated by valve spindles 68 and the exhaust valves by spindles 69. Compressed air is admitted to the cylinders by valves, not shown, but operated by valve spindles 70. Compressed air is supplied to the cylinders by an air pipe (not shown) leading from a compressed air supply (not shown) and entering the casting 63 at opening 71. No means for feeding the fuel into the cylinders is shown since no invention is required to accomplish this result in view of the many satisfactory arrangements now on the market. A preferable arrangement would be to have the fuel fed into the cylinder by admitting compressed air into the passage behind the fuel. Fuel pumps and valves governing the supply of compressed air necessary to feed the fuel into the cylinders can be operated from shaft 72. Valves 68 and 69 are operated by shaft 73. Shaft 73 is driven from axle 3 by means of gears 74 and rod 75. Shaft 72 is directly above shaft 73 and is driven from shaft 73 by means of gears 76. The cam shafts 73 and 72 have cams (not shown) to operate the different valve spindles and some means (not shown) must be furnished for bringing the proper spindle in contact with the proper cam at the right time. A description of these features of the engine is not necessary here as any reversible engine will do for use with my invention.

The general idea of my invention is to have the cylinders form a complete engine with the forward driver axle as the main shaft of the engine. The operation of this invention, as far as the engine is concerned, is merely the operation of the certain type of engine used for a motive power in the locomotive.

With the locomotive resting on the drivers and the auxiliary wheels 2 clear of the rails. To lift the drivers off the track, the frame of the locomotive is first to be lowered by screwing up the driver boxes till the wheels 2 are resting on the rails. Then in order to

lift the weight of the frame from the drivers merely the weight of the drivers must be lifted. This can be easily done with the lever 42. In case that the motive power is a crude oil engine, the engine is first started with compressed air as before and when the engine is operating from the energy of the fuel the drivers could then be placed in contact with the rails while still revolving and the weight placed on the drivers by means of lowering the driver boxes from power obtained from the motive power through the means described above. Provided, however, that a heavy train is to be started while the drivers are still revolving in the air power could be taken from the axle of the driver through the friction clutch formed by 43 and 44 and the sprocket 51 and 45 and the chain 52. This would have the effect of greatly increasing the power of the locomotive from the fact that the driving wheels would be much smaller and would make only about half as many revolutions per stroke as before. In other words in the power of a locomotive two things help to increase the power, namely the revolutions of the engine and the M. E. P. Given the maximum M. E. P. the efficient power of the locomotive depends upon the speed of the train for when the linear velocity of the drivers exceeds the velocity of the train the difference is the slip of the drivers and all of this is waste. As shown in Figs. 3 and 4 it is possible to increase the power of the locomotive about fourfold by the use of the auxiliary trucks as driving wheels. This is on the basis that wheel 2 is less than half the diameter of driver 1 and the sprocket 45 is only about half the diameter of sprockets 51. While a friction clutch and gear would hardly do to stand the hard wear which a locomotive meets, it would seem that for the small use put to the auxiliary method of driving, an arrangement of this sort would be sufficiently durable for all practical purposes.

What I claim as new and desire to secure by Letters Patent is:

1. In a locomotive, the combination of a suitable frame, driving wheels secured in the frame by floating boxes, means for moving the said floating boxes in a vertical direction with regard to the frame of the locomotive, auxiliary wheels connected to the frame by floating boxes which are rigidly secured to said frame, and a motive power direct connected to said drivers.

2. In a locomotive, the combination of a suitable frame, driving wheels connected to the frame through suitable bearings, means for moving driving wheels, bearings and axles vertically with regard to the frame of the locomotive, auxiliary trucks suitably connected to the frame in front and behind the driving wheels and a motive power direct connected to the driving wheels.

3. In a locomotive, the combination of a suitable frame, driving wheels connected to the frame through suitable bearings, means for moving driving wheels, bearings and axles vertically with regard to the frame, auxiliary trucks suitably connected to the frame in front and behind the driving wheels, and a motive power connected to the auxiliary trucks through the driving axle by sprocket wheels, a chain and suitable mechanism for engaging and disengaging the auxiliary trucks and the driver axles.

4. In a locomotive, the combination of motive power, a rigid body, driving wheels directly connected with the motive power, auxiliary wheels connected to the motive power, means for lifting the driving wheels vertically from the track, gearing for driving the auxiliary wheels, and a friction clutch, whereby the auxiliary wheels may be used to start the locomotive by connecting the gearing with the revolving driver axle through the friction clutch.

5. In a locomotive, the combination of a motive power, driving wheels, a rigid body, auxiliary trucks in front and in rear of the driving wheels, means for depressing said trucks and lifting the driving wheels from the track, said means comprising two levers to each auxiliary truck, said levers being pivoted about shafts supported by the frame of the locomotive, and a source of power arranged between said trucks to move said levers with regard to the frame of the locomotive.

6. In a locomotive, the combination of an internal combustion engine, a rigid body, driving wheels, means for connecting the engine with the driving wheels, auxiliary trucks in front and in rear of said driving wheels, means for moving said trucks vertically, and means for driving the locomotive through said auxiliary trucks said means comprising gearing connecting the axles of the auxiliary trucks with one of the driving wheel axles by a friction clutch.

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

JOHN F. WENTWORTH.

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