Sept. 10, 1940. J. A. McGREW 2,214,424

LOCOMOTIVE

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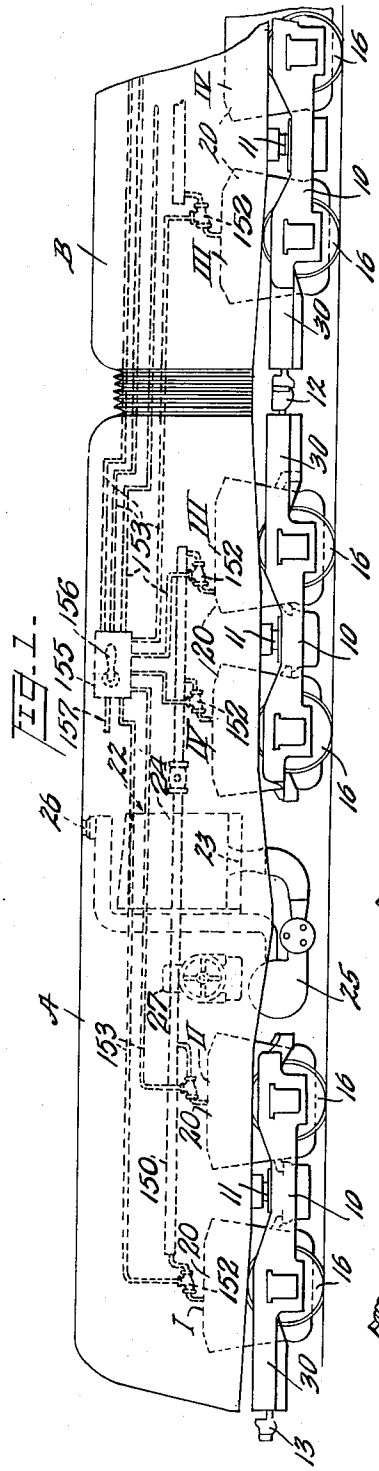

FIG. 1.

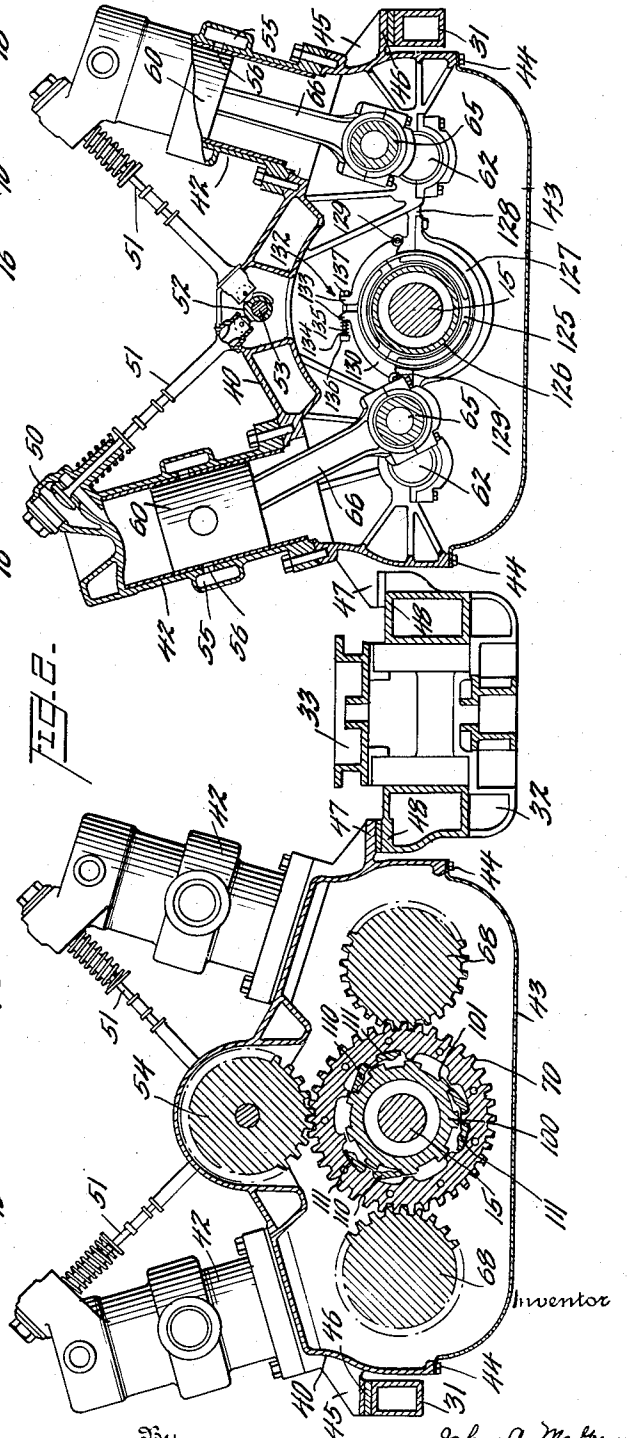

FIG. 2.

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FIG. 3.

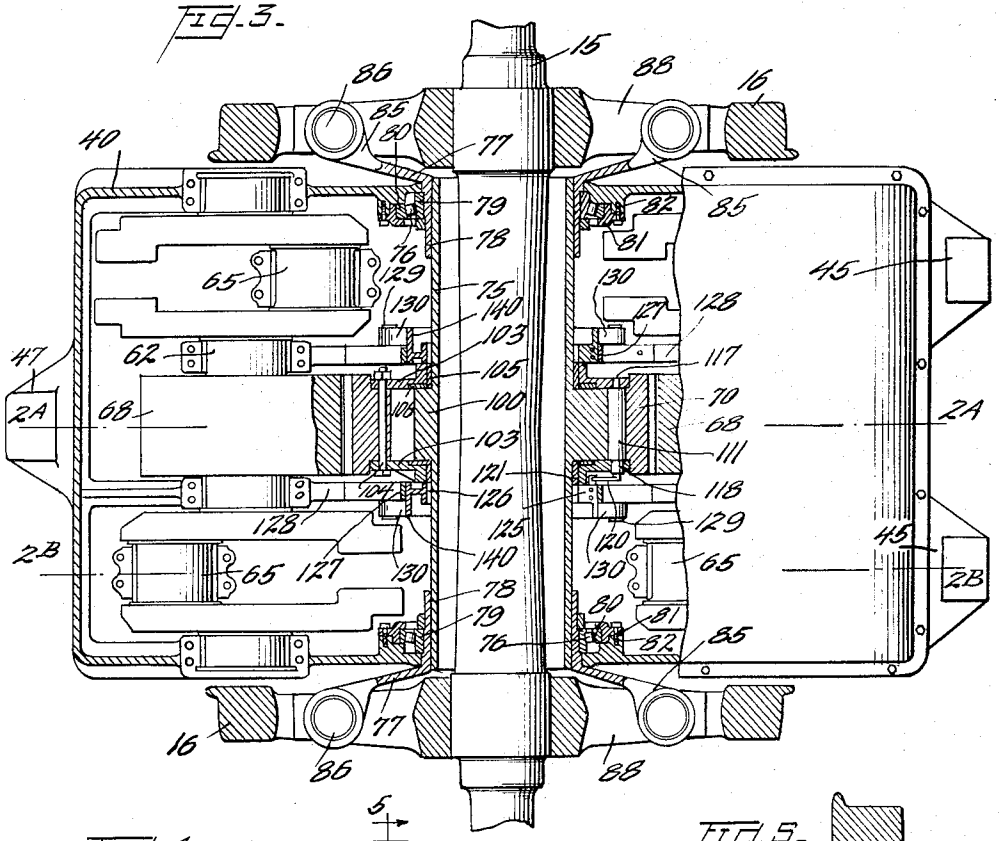

FIG. 4.

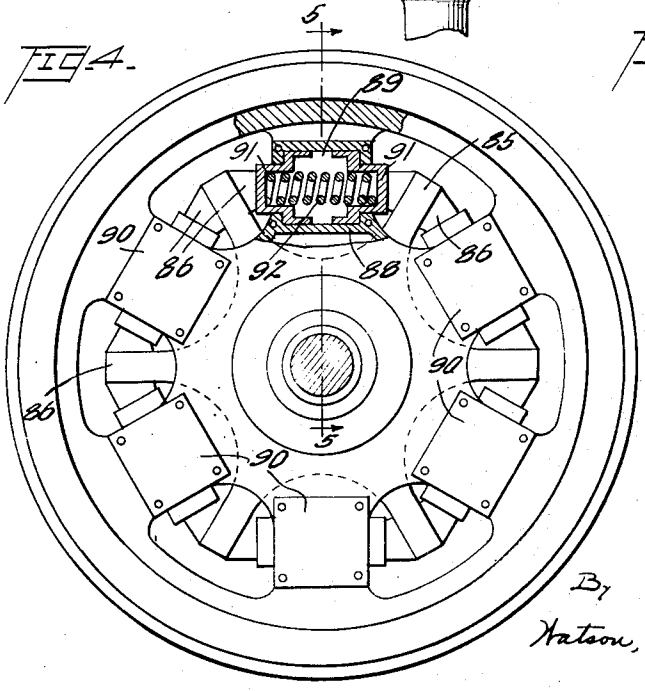

FIG. 5.

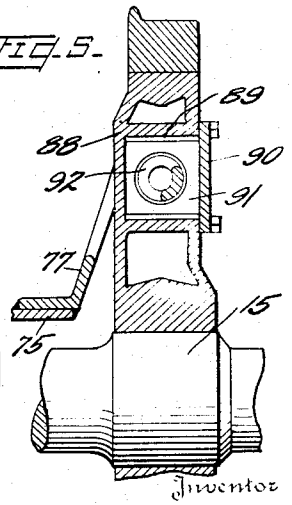

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FIG. 6.

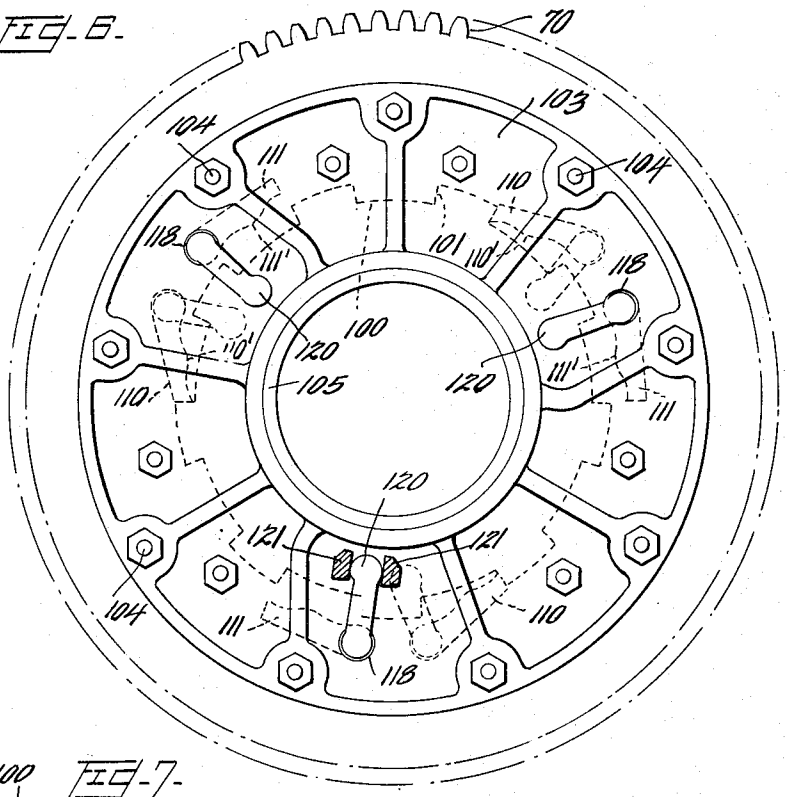


FIG. 7.

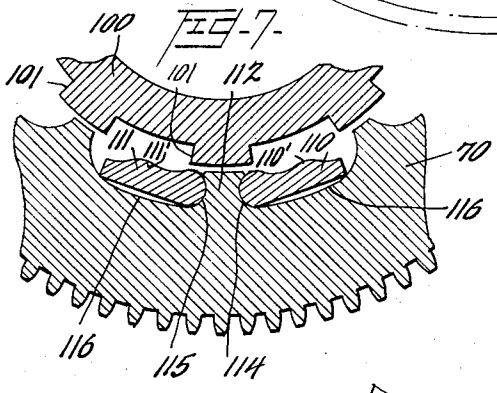


FIG. 8.

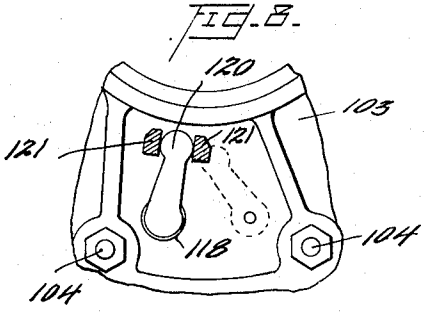
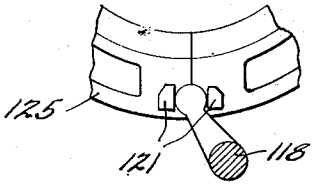


FIG. 9.



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UNITED STATES PATENT OFFICE

2,214,424

LOCOMOTIVE

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Application December 29, 1938, Serial No. 248,345

9 Claims. (Cl. 105—37)

This invention relates to locomotives, more particularly to railway locomotives having a plurality of independently operable engines, each of which is operatively connected with one or more of the driving axles or pairs of driving wheels of the locomotive. One example of this general type of locomotive is disclosed in my U. S. Patent No. 2,078,262, issued April 27, 1937, and in the specification of that patent there is set forth in considerable detail numerous advantages and economies attendant upon the use of these locomotives in both switching service and in high speed passenger and freight operation.

For example, there is mentioned the particular adaptability of this type of locomotive for use under operating conditions which are generally adverse to the economical utilization of steam propelled locomotives, as in mountainous or hilly districts, in sections where track curvatures are frequent and of short radius, and in freight yards and around terminals where frequent starting and stopping is necessary and the loads vary greatly.

By the employment of swivelled trucks having driving wheels of substantially the same diameter as the conventional car wheel, greater flexibility in operation is attained,—especially on tracks having curves of short radius,—than in the case of an ordinary steam locomotive of the same power but having comparatively rigid frames and large driving wheels permanently connected to pistons working in cylinders located in advance of the driving wheels.

The provision of a plurality of engines, each of which may be supplied with motive power independently of the others, results in greater economy of operation, the consumption of power being minimized for all operating speeds, and without regard to the variations in load or in the gradient of the track over which the locomotive passes.

When starting under heavy loads, or when ascending grades heavily loaded, all of the motors or engines may be energized and the maximum capacity of the boiler utilized. When proceeding under relatively light loads, a lesser number of engines may be employed, in this way economy of steam consumption being promoted. The engineman may at will connect one or more of the motors to the associated driving wheels, or he may disconnect all of the motors from the driving wheels as will be desirable when the locomotive is drifting on a down grade.

The general object of the present invention is to provide a novel and improved locomotive of this type in which there is provided an improved power plant and means for the safe and efficient transmission of the power developed therein to the driving wheels, whereby the source of power may be connected with the wheels for driving in either forward or reverse directions and automatically disconnected therefrom when conditions require it, the transmission also embodying features which serve to reduce the unsprung weight of the locomotive.

In its preferred embodiment, the invention contemplates a provision of a plurality of power units, each embodying a reversible steam actuated motor preferably of the uniflow type, the arrangement being such that steam may be applied to one, or a plurality, or all of these units, depending upon the loads imposed upon the locomotive and the speed at which it is to be driven. Means are provided for operatively connecting the motor to, and disconnecting it from, the associated axle or pair of driving wheels, it being desired that one or more of the motors be automatically disconnected from the wheels with which they are associated when not supplied with steam, thereby greatly decreasing frictional losses and minimizing wear in the several individual propulsion units.

The novel transmission includes, as an important cooperating feature, a driving quill which is resiliently connected to the wheels associated therewith and which is alternatively connected to or disconnected from the driving means as conditions require, as will be described in detail in an appropriate part of the present specification.

Other objects and features of novelty will be apparent from the following specification when read in connection with the accompanying drawings in which certain embodiments of my invention are illustrated by way of example.

In the drawings,

Figure 1 is a diagrammatic view in side elevation of a locomotive embodying the principles of the invention, a portion of the duplicate articulated section of which is broken away;

Figure 2 is a vertical longitudinal offset section on an enlarged scale, through one of the swivelled trucks of the locomotive and of the engine supported thereby; the section through the engine and axle on the left hand side of the figure being substantially as taken on line 2A—2A of Figure 3, and the right hand section as taken on line 2B—2B of the same figure;

Figure 3 is a bottom plan view of one of the power units, certain portions thereof being broken away and other parts shown in horizontal section for the sake of clearness of illustration;

Figure 4 is a view in side elevation,—a part being in vertical section,—of one of the driving wheels and the quill drive connections;

Figure 5 is a fragmentary radial sectional view taken substantially on line 5—5 of Figure 4;

Figure 6 is a view in side elevation of a portion

of a transmission gearing on a further enlarged scale;

Figure 7 is a fragmentary view in vertical section and on a greatly enlarged scale of a portion of the means whereby the motor may be connected or disconnected from the driving quill; and

Figures 8 and 9 are detail views of certain parts of this connecting mechanism.

In Figure 1 of the drawings there is illustrated, in somewhat diagrammatic fashion, a locomotive embodying the principles of the present invention. The locomotive in the preferred embodiment shown comprises two articulated units designated A and B, each of these units being supported upon a pair of swivelled trucks **10** by means of the center bearings **11**, the adjacent trucks of the two sections A and B being coupled as at **12**, and similar coupling means **13** being provided for connection with the rolling stock to be drawn. Each of the trucks **10** is provided with suitable journals for the axles **15** which join opposite pairs of drive wheels **16**, there being two axles and four wheels to each of the trucks in the illustrated embodiment.

Upon each of the trucks **10** there are carried two power units **20** each operatively associated with one of the axles **15**. These power units are preferably four cylinder uniflow steam engines which will be described in detail in a later portion of the specification. These power units receive their supply of steam from a steam generator **22** which in the preferred arrangement comprises a vertically disposed boiler consisting essentially of a centrally disposed vaporizing type of oil burner shown very diagrammatically at **23**, which is surrounded by a group of concentric coils of steel tubing, these coils occupying the cylindrical portion indicated diagrammatically at **24**. A blower is provided as shown at **25** and the exhaust gases may be discharged through an opening indicated at **26** in the roof of the locomotive. Various necessary auxiliaries of the usual type are carried by the locomotive as exemplified by the unit indicated at **27**.

For the purpose of providing the proper power advantages for driving the locomotive at different speeds by the use of one or more of these power units, they are each constructed to give a different gear ratio and for the purpose of distinguishing between these units in this respect, the engines of each section of the locomotive are designated by the reference characters I, II, III, and IV. Although the gear ratios may vary to a considerable extent depending upon the particular installation, in the present example the following ratios are employed: the gear ratio of engine I is 32:68; engine II, 36:64; engine III, 38:62; and engine IV, 40:60.

Obviously suitable controls are provided for individually and collectively supplying and cutting off the steam from the several engines, as suggested by the arrangement disclosed in the patent referred to above. For example, in the steam line **150** connecting the boiler **22** with the power units **20** there are disposed the pneumatically controlled throttle valves **152**. These throttle valves are interposed at the branches of the steam line leading to the individual engines and are adapted to be separately controlled by air connections **153** leading from a multiple control valve **155** adapted to be operated by the engine driver as by means of the hand lever **156**. A pipe **157** is provided to connect the valve with a source of compressed air.

One example of the mode of operation of the locomotive is as follows. Up to a speed of approximately 20–25 M. P. H., to secure a maximum of tractive effort in starting, all of the engines may be employed. Then, between approximately 25 and 40 M. P. H. the engines numbered I may be cut out, the locomotive being driven by the remaining six units. Then, between speeds of approximately 38–40 and 75 M. P. H. the engines numbered II may also be disconnected and the locomotive operated by the remaining units. From speeds higher than say 75 M. P. H., the locomotive may be driven only by the engines numbered IV.

By the provision of the multiple engines and by the proper selection of the type of engine and steam generator, great economy of operation has been effected.

Referring now more particularly to Figures 2 and 3 of the drawings, it will be seen that the truck **10** is provided with side frame portions **30** which are connected at the ends of the truck by means of the end frames **31** and at the center by the bolster or transom construction **32** which supports the center bearing as provided for at **33**. Each of the power units comprises a cast metal supporting frame **40** which encloses the transmission mechanism and serves to support the four generally vertically disposed cylinders **42**. A bottom pan or casing **43** is provided which may be connected to the main casting **40** as by means of the bolts **44**. The engine frame castings **40** are supported from the end truck frame members **31** by means of the two projections **45** which are formed with pads **46** which rest upon the end frame. A single lug or projection **47** extends from the inwardly disposed portions of the frames **40** and rest upon the shelves or ledges **48** provided on the central bolster or transom **32**.

As already stated, the engines are of the uniflow type and thus the cylinders **42** are provided with poppet valves **50**, the stems **51** of which are actuated by the cams **52** carried upon the cam shaft **53** which is driven by the gear **54** connected to a main driving gear to be later described. The valve stems **51** of longitudinally oppositely disposed cylinders are preferably substantially in alignment and a single cam shaft is disposed between these cylinders to conveniently actuate all of the valves. An exhaust passage **55** surrounds each of the cylinders **42** and is placed in communication with the cylinder by means of the passages **56** which are uncovered by the piston **60** at a certain point on its downward movement in a manner which is well known in this type of engine. A pair of crank shafts **62** are provided for each power unit and one is disposed upon either side of the associated axle **15**. These crank shafts are of the usual construction being provided with counter-weighted crank portions **65** and which are connected, by means of connecting rods **66**, with the pistons **60**. Each crank shaft is provided with the centrally disposed driving pinion **68** which meshes with the large gear **70** which is adapted to be automatically connected and disconnected with the driving wheels **16** by mechanism which will be presently described.

In order to greatly reduce the amount of unsprung load of the locomotive, and to attain other decided advantages over the conventional constructions, there is provided in the present arrangement a quill drive which is interposed between the wheels and the transmission mechanism. As clearly illustrated in Figures 3, 4, and 5 of the drawings, the quill **75** surrounds the axle **15**

and is rotatably supported in the side walls of the housing 40 by means of the roller bearings 76. The quill tube 75 has welded to each of its ends the quill spiders 77, the tubular portions 78 of which surround the ends of the quill 75 and are shown interposed between the quill and the inner bearing race 79. The outer bearing race 80 is retained by means of a shouldered and flanged annular member 81 which is attached to the frame 40 as by means of the bolts 82. The quill spiders are flared radially outwardly beyond the ends of the quill and are provided with separate radial arms 85 provided with angular, oppositely directed abutment faces 86.

The wheels 16 are provided with spokes 88, several or all of which are provided with spring pockets 89 having cover plates 90. Seated for sliding movement within the spring pockets 89 are the pairs of movable, piston-like spring casings 91 which are socketed for the reception of the coil spring 92. Each of the members 91 are, of course, urged outwardly by the spring 92 and their outward faces are disposed in contact with the abutment portions 86 of the arms of the quill spider, each of which is disposed between the adjacent spokes of the wheel. It will thus be seen that there are provided resilient drive connections between the quill 75 and the wheels 16 which eliminate shocks from sudden starting or changes of speed of the locomotive. Furthermore, it will be noted that this resilient arrangement cooperates particularly with the automatically disengageable driving means which will now be described.

Intermediate its ends the quill 75 is formed with, or otherwise provided with, a ratchet member 100, which is provided with the shouldered projections or abutments 101, resembling rather widely spaced teeth on the periphery of the member. The large driving gear 70, with which the driving pinions 68 of the crank shaft mesh, is in the form of a hollow cylinder, the inner surface of which is spaced from the outer surface of the ratchet member 101 by a slight clearance. The driving gear 70 is, however, axially supported for rotation upon the quill 75, annular end plates 103 being rigidly secured to the gear as by means of the bolts 104 and having their inner flanged margins rotatably supported upon the quill through the interposed annular bearing members 105; lateral bearing elements 106 may also be provided between the member 100 and the plates 103. Gear 70 is thus supported for free rotation upon the quill and is maintained against sliding movement longitudinally thereof by reason of the interengagement of the ratchet 100 with the side plates 103.

Intermediate the inner face of the gear 70 and the outer face of the ratchet member 100 are disposed two sets of swinging pawls, the pawls of one set being indicated by the numerals 110 and the other set by the numerals 111, the pawls of one set being similar to the pawls of the other set, but extending in opposite directions. Each pawl is adapted to swing angularly about an axis fixed with respect to the gear 70 and to rest at all times against an abutment surface rigid and movable with the gear 70. Thus, in the embodiment illustrated in the drawings, the gear is provided with a plurality of abutments 112, projecting radially inwardly toward the member 100, each such abutment being provided with two cylindrical pawl seats indicated in Figure 7 at 114 and 115 respectively, the first being for one of the pawls 110 and the other for one of the pawls 111. Each pawl is adapted to swing about an axis closely adjacent to its abutment or seat and to be moved during such swinging motion either into position to engage one or another of the outwardly projecting abutments or teeth 101 of the inner ratchet member 100, or outwardly into a recess 116 formed in the inner surface of the gear 70 for its reception. As shown in Figures 2 and 6, the several pawls 110 have been swung inwardly so that their free ends operatively engage certain teeth of the member 100 and the pawls 111 are shown in their outward or inoperative positions; a driving connection, therefore, being established between the gear 70 and the quill 75 through the ratchet member 100, in the event that gear 70 is rotated between pinions 68 in a counter-clockwise direction. When the motors are reversed, the driving connection between the gear 70 and the ratchet member 100 is effected by the retraction of the pawls 110 and the inward movement of the set of pawls designated 111, so that it is by means of the operation of the two sets of pawls alternatively as just described, that an effective driving connection between the gear 70 and the quill and wheels may be established, regardless of the direction of operation of the motor.

In the normal operation of the locomotive, the positions of the pawls are changed automatically when the motion of the gear 70 is reversed by the reversal of the drive of the motor, and when the motor is de-energized when the axle is rotating, both sets of pawls are caused to occupy their inoperative positions, as shown in the fragmentary view, Figure 7. The means for causing the pawls to thus automatically operate will now be described. Each pawl is provided at the ends thereof with trunnions which are coaxial with the axis of rotation of the pawl when swinging upon its seating surface on the gear 70, the trunnions of one of the pawls 111 being indicated at 117 and 118 in Figure 3. Trunnion 117 fits closely within a cylindrical aperture formed in the adjacent side plate 103 and the trunnion 118 projects through an opening in the opposite side plate. Integral with the trunnion 118 is a trunnion arm 120 projecting inwardly toward the quill. The end of the trunnion arm 120 is rounded, as shown in Figure 6, and lies between the spaced lugs 121 formed on an annular ring 125 which surrounds the quill, but is spaced therefrom by the narrow clearance indicated at 126. The ring 125 is rotatably supported in the saddle member 127 which is secured or forms a part of the longitudinal web 128 which forms a portion of the bearing for the crank shaft 62. The supporting member 127 may be continued all the way around the ring 125, or a companion piece may be employed for retaining the upper part of the ring in its proper position.

Pivoted as at 129 upon a portion of the web 128 are the segmental friction shoes 130, the upper ends thereof being resiliently drawn together at all times by spring means 132 clearly illustrated in Figure 2 of the drawings. Thus, the adjacent ends of the shoes 130 are provided with upwardly extending portions 133 positioned in close proximity to each other and provided with aligned apertures to which the resiliently disposed rod 134 extends. Encircling the rod 41 is the coiled compression spring 135 which bears at one end upon the projecting end 133 of a shoe 130 and at the other against the nut 136. The rod 134 is headed as at 137 upon its opposite end, and this head provides a stop abutment for the upwardly extending end 133 of the other shoe 130.

By adjusting the nut 136, the tension of the spring 135 may be increased or decreased as desired, and consequently the adjacent ends of the friction shoes urged more or less strongly toward each other and against the outer periphery of the laterally extended portion 140 of the ring 125; the larger portion of the ring 130 being substantially H-shaped in section with one of the vertical portions thereof being extended to form the offset braking surface 140, all as clearly illustrated in Figure 3 of the drawings.

When the proper degree of frictional opposition to rotation of the ring 130 is attained by the adjustment just described, the ring will oppose revolution of the inner end of the trunnion arm 120 when the gear 70 begins to rotate about the quill 75 and will, when the gear is rotated in one direction, tend to move the associated pawls into operative position, and when rotated in the opposite direction, will tend to move the pawls into inoperative position. It will be seen that two of the annular rings and frictional retarding mechanisms are provided, one upon each side of the gear 70, as shown in Figure 3, and that the trunnion arms 120 of one set of pawls will be operatively connected to one of these rings 130 and the trunnion arms of the second set of pawls to the other ring 130. The effect of this arrangement of course is to cause one set of pawls to move into position to engage the teeth or abutments 101 of the member 100 when gear 70 is moved in one direction, the second set of pawls being simultaneously moved to inoperative position, the movements of the pawls being reversed when the direction of rotation of the gear 70 is reversed, so that an operative connection between gear 70 and the quill 75 will be automatically established corresponding with the direction of drive of the motor.

In attaining the stated objects of the invention, it is essential, of course, that the means just described for establishing the driving connection between the motor and the driving wheels, regardless of the direction of drive of the motor, shall not interfere with the free rotation of the quill and wheels when the motor is cut off from its supply of power. The construction just described is such that the set of pawls which may be functioning to establish the driving connection between the gear 70 and the quill 75 at the time of de-energization of the motor will be automatically and instantly removed to inoperative position. Thus, in Figures 2 and 6 of the drawings, the several pawls 110 are shown in engaged position, disposed respectively substantially tangentially to the outer face of member 100, and the free ends of the pawls are in contact with the teeth 101 projecting from that member. Counter-clockwise rotation of the gear 70 is communicated to the member 100 by means of these pawls 110. Should the locomotive with which the propulsion unit is used be in motion when this particular motor is de-energized, the gear 70 will of course cease to rotate while the quill 75 and its enlargement 101 will continue to rotate in the counter-clockwise direction. Hence, the inner surfaces of the several pawls 110 will be immediately engaged by the still revolving teeth 101 of the member 100 and the pawls will be thrust outwardly into the several recesses 116 provided for their reception, by the action of these teeth. The inner faces of the pawls are provided with longitudinally extending raised portions 110', and 111', which actually comprise cam portions with which the teeth 101 cooperate. After effecting complete displacement of pawls 110 from the paths of the revolving teeth 101, pawls 110 will be firmly retained in their outer or inoperative positions by the action of the annular ring 125 to which they are operatively connected, this ring being frictionally held in fixed position upon its supporting sleeve by action of the friction shoes 130, as soon as the outward swinging motion of the pawls 110 under the action of the teeth 101 has ceased.

Both sets of pawls are of course similarly moved into and held in inoperative positions, pawls 111 being provided with similar cam surfaces 111' for coaction with teeth 101 of the member 100.

It will thus be seen that there is provided a very efficient and rugged automatic means for coupling and uncoupling the quill drive with the motor to accommodate forward, reverse, and idle functioning thereof during various conditions of operation of the locomotive. It is obvious that electrically powered motors could be employed with this novel quill drive and transmission, or suitably adapted internal combustion engines might be used; although the present combination of the transmission with the straight-line, uniflow steam engines has many advantages. It will also be clear that the present invention in its entirety provides a very efficient and practical locomotive, finding a wide variety of uses in all fields of railway operation, due to its simplicity, increased flexibility, and economical use of motive power for all purposes for which it is adapted and for all operating speeds.

It is understood that various changes and modifications can be made in the embodiment illustrated and described herein without departing from the scope of the invention as defined by the following claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A locomotive of the class described comprising, in combination, a body carrying a boiler and auxiliaries of the usual type, a plurality of swivelled trucks upon which said body is mounted, each of said trucks supported upon a plurality of pairs of driving wheels, a driving quill resiliently connected with each pair of wheels, a plurality of steam actuated motors supported directly upon the trucks, each motor being associated with and adapted to drive one of said quills, control means for individually supplying said motors with steam and cutting them off from the steam supply, a train of gearing for transmitting motion from each of said motors through the quill to its associated wheels, and means for automatically engaging each of said transmission gearings with its pair of driving wheels when the associated motor is driven either forwardly or in reverse, and for automatically disconnecting said gearing from said wheels when said motor is cut off from the source of steam and the locomotive is in motion, whereby all of the motors, some of them, or any one of them, may be respectively energized to drive the locomotive with suitable driving power under varying conditions of operation.

2. A locomotive of the class described comprising, in combination, a body carrying a boiler and auxiliaries of the usual type, a plurality of swivelled wheel-supported trucks upon which said body is mounted, a plurality of steam actuated motors supported directly upon said trucks, control means for individually supplying said motors

with steam and cutting them off from the steam supply, and a plurality of sets of gearing each adapted for transmitting motion from one of said motors to certain of the wheels of the truck upon which said motor is mounted, certain of said sets of gearing being of different ratios from the others.

3. A locomotive of the class described comprising, in combination, a body carrying a boiler and auxiliaries of the usual type, a plurality of swivelled trucks upon which said body is mounted, each of said trucks supported upon a plurality of pairs of driving wheels, a plurality of steam actuated motors supported directly upon the trucks, each motor being associated with and adapted to drive one of said pairs of wheels, control means for individually supplying said motors with steam and cutting them off from the steam supply, a train of gearing for transmitting motion from each of said motors to the associated wheels, the train of gearing of each motor being of a different ratio from the other trains.

4. A locomotive of the class described comprising, in combination, an articulated body comprising two sections, each carrying a boiler and auxiliaries of the usual type, a pair of swivelled four-wheeled trucks upon which each of said sections is mounted, two independently actuatable steam engines on each truck, each operatively associated with a pair of wheels, a plurality of sets of transmission gearing each set connecting one of the engines with its associated wheels, the sets of gearing of each locomotive section having different gear ratios, the arrangement of motor and wheel groups of the two locomotive sections being duplicates but disposed in reverse order.

5. In a locomotive of the class described, a swivelled four-wheeled supporting truck comprising side frames, end frames and a central transversely extending member, a pair of wheels and an axle supporting said truck and disposed between one of said end frames and the bolster, a driving quill surrounding said axle and resiliently connected with said wheels, a steam engine having horizontally projecting pads resting respectively upon said end frame and said bolster for supporting said engine above said axle, a crankshaft disposed transversely of said truck on each side of said axle, both crankshafts operatively connected with said engine, a driving pinion on each of said crankshafts, both of said pinions meshing with a driving gear surrounding said quill and means for automatically connecting and disconnecting said driving gear and said quill depending upon the relative direction and speed of rotation of the driving gear and quill.

6. In a locomotive of the class described, a swivelled four-wheeled supporting truck comprising side frames, end frames, and a central transversely extending member, a pair of wheels and an axle supporting said truck and disposed between one of said end frames and the bolster, a four cylinder steam engine, two of the cylinders of which are disposed in substantially vertical positions upon either side of said quill, a supporting frame for said cylinders provided with horizontally projecting pads resting upon said end frame and said bolster, respectively, a crankshaft disposed transversely of said truck on each side of said quill and connected with the pistons of the two cylinders which are disposed upon the same side of said quill, valves for admitting steam to said cylinders, a transverse cam shaft disposed above the quill and adapted to actuate the valves of all four cylinders, and gearing for driving said cam shaft in synchronism with the cycles of said engine, and means for automatically connecting and disconnecting said crankshafts with said quill depending upon the relative direction and speed of rotation of said crankshafts and quill.

7. In a locomotive of the class described, the combination of a pair of driving wheels connected by an axle, a driving quill surrounding said axle and resiliently connected with said wheels, a frame supported by said axle and having laterally spaced bearings within which the axle rotates, a gear mounted for rotation upon said quill at an intermediate point, annular members disposed for relative rotation with respect to said quill, friction means for resisting rotation of said members at all times, rocking pawls carried by said gear, and means connecting said pawls and said members whereby certain of said pawls are rocked by one of said members to operatively engage said quill when the gear is rotated in one direction, and whereby others of said pawls are rocked by the other of said members to operatively engage said quill when the gear is rotated in the opposite direction, said rocking being effected by relative rotation of the gear and annular members.

8. In a locomotive of the class described, the combination of a pair of driving wheels connected by an axle, a driving quill surrounding said axle and resiliently connected with said wheels, a frame supported by said axle and having laterally spaced bearings within which the axle rotates, a gear mounted for rotation upon said quill at an intermediate point, annular members disposed for relative rotation with respect to said quill upon either side of said gear, an external guiding bearing supported by said frame surrounding each of said annular members and against which the outer periphery of said members are adapted to rotate, friction means for resisting rotation of said members at all times, rocking pawls carried by said gear, and means connecting said pawls and said members whereby certain of said pawls are rocked by one of said members to operatively engage abutments disposed upon said quill when the gear is rotated in one direction, and whereby others of said pawls are rocked by the other of said members to operatively engage abutments on said quill when the gear is rotated in the opposite direction, said rocking being effected by relative rotation of the gear and annular members.

9. A locomotive of the class described comprising, in combination, a body carrying a boiler and auxiliaries of the usual type, and trucks upon which said body is mounted, each of said trucks having a plurality of pairs of driving wheels, a plurality of driving quills associated with each truck and each resiliently connected with and mounted upon one of said pairs of wheels, a plurality of separate independently operable reversible power units carried by each of said trucks and operatively associated through the respective quills with the pairs of driving wheels, and automatic transmission means for establishing operative engagement between each of said motors and its driving quill for either forward or reverse running, and for disconnecting said motor and quill when said motor is individually de-energized while the wheels continue to rotate, either through the driving force of another of said motors on the truck or when drifting.

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