Nov. 28, 1939. J. A. McGREW 2,181,244

PROPULSION UNIT

Original Filed May 16, 1935 3 Sheets-Sheet 1

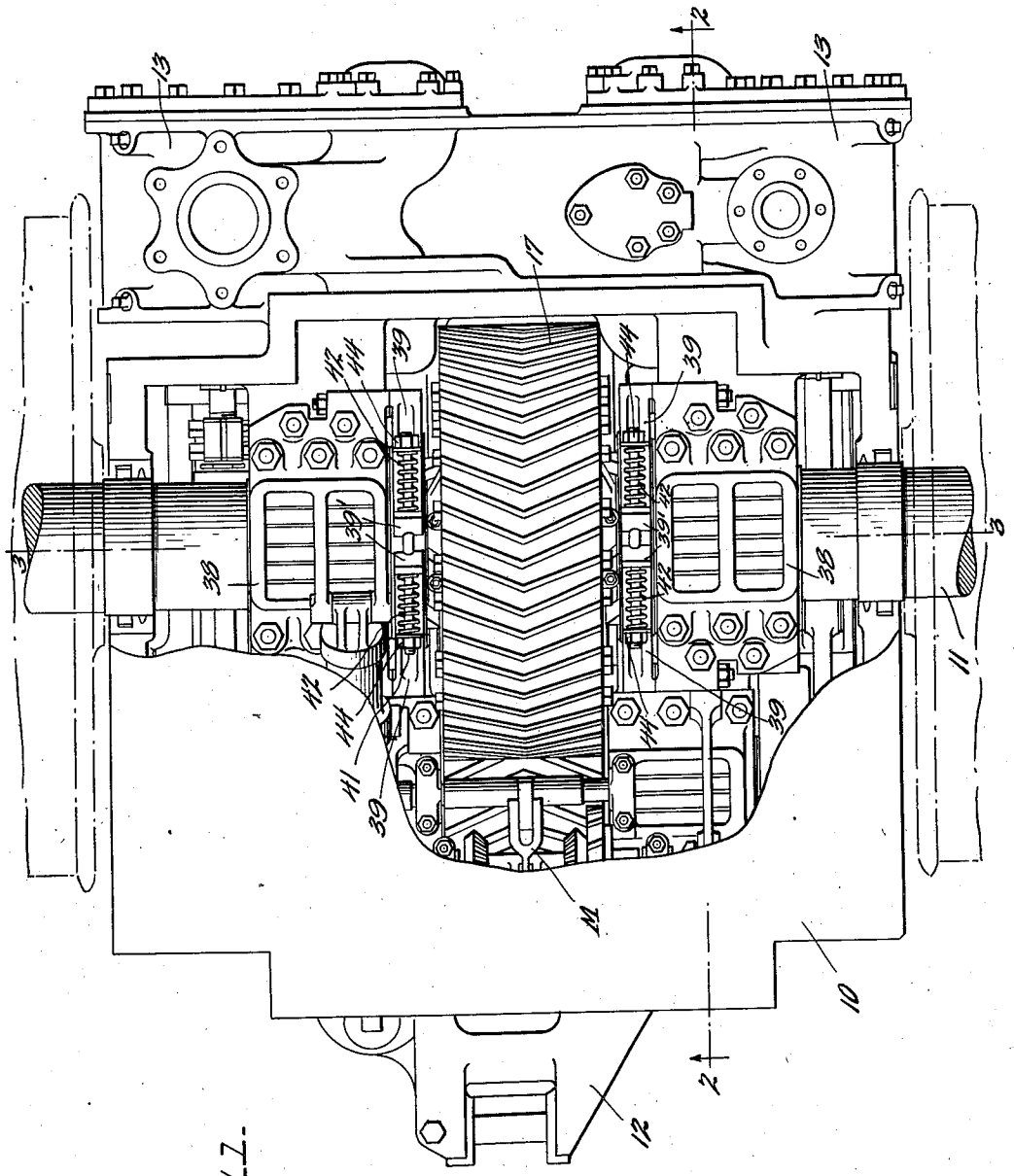

FIG. 1.

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PROPULSION UNIT

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FIG. 2.

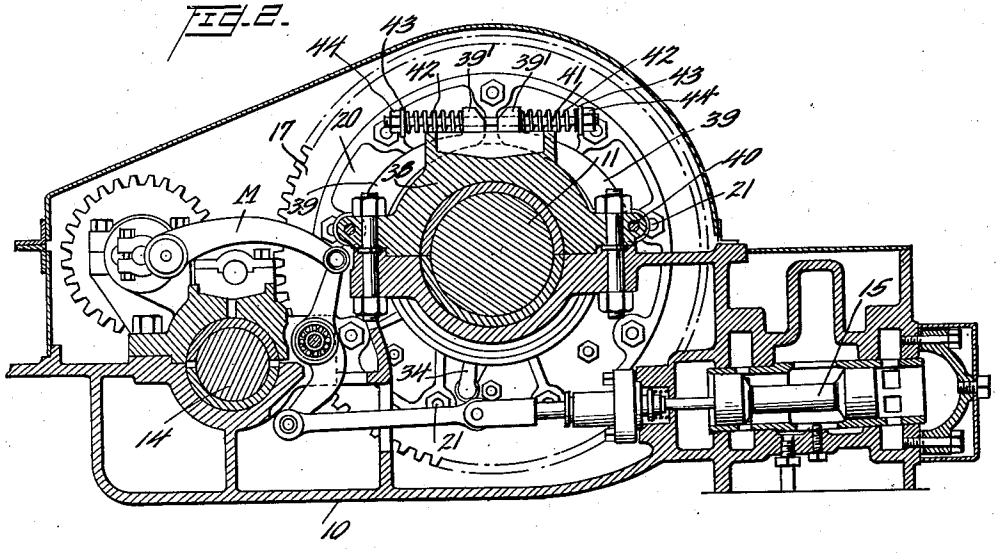


FIG. 3.

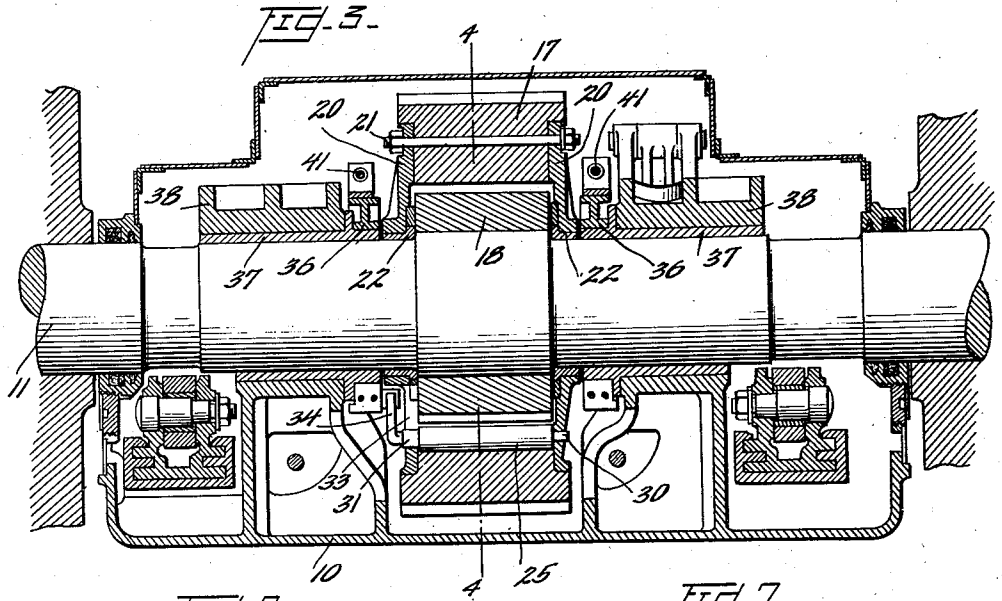


FIG. 6.

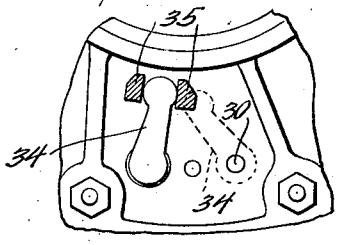
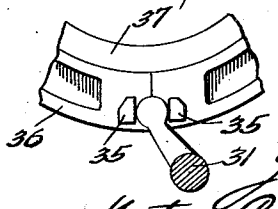


FIG. 7.



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PROPULSION UNIT

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FIG. 4.

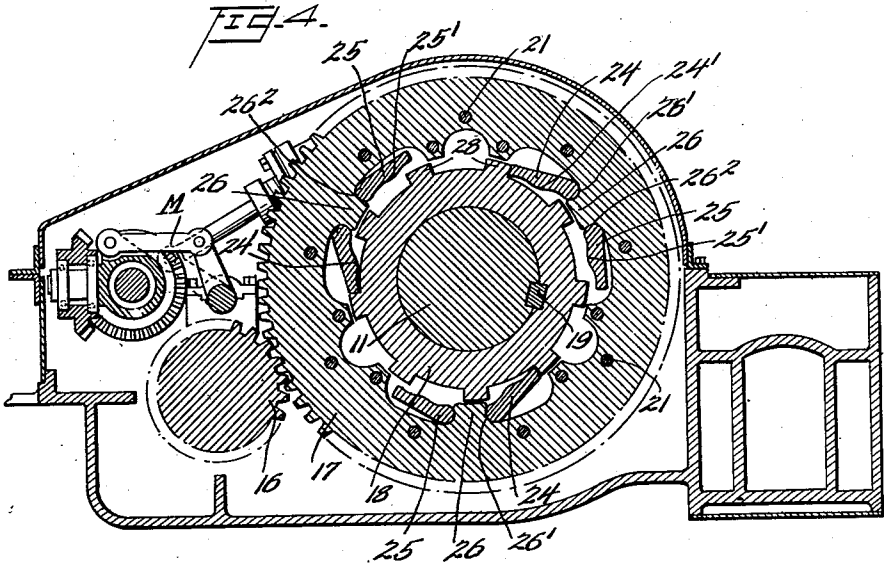
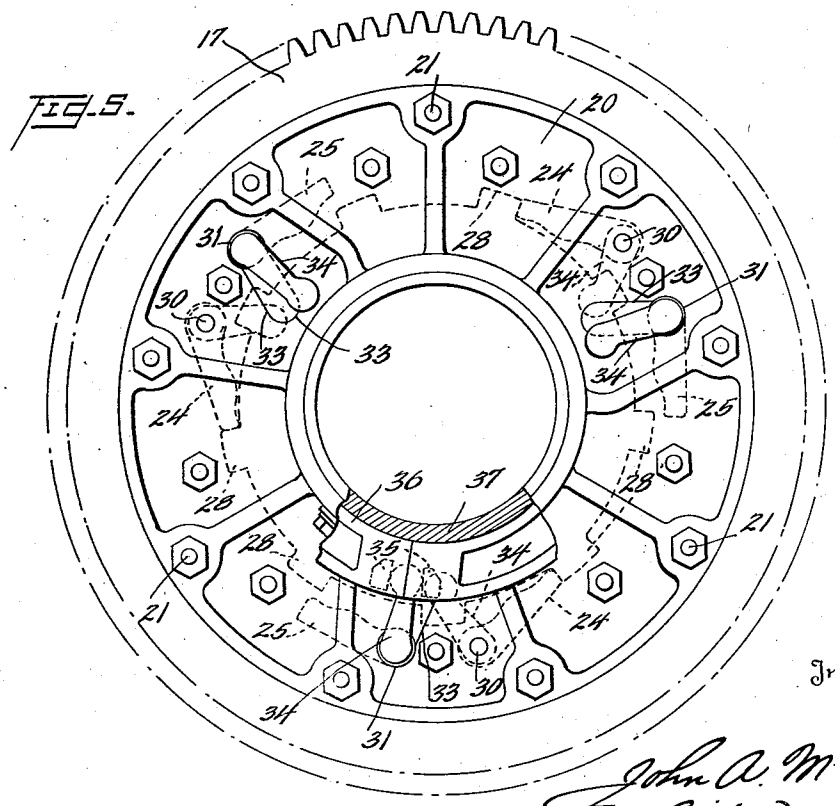


FIG. 5.



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UNITED STATES PATENT OFFICE

2,181,244

PROPULSION UNIT

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Original application May 16, 1935, Serial No. 21,855, now Patent No. 2,078,262, dated April 27, 1937. Divided and this application December 4, 1936, Serial No. 114,240

5 Claims. (Cl. 74—576)

The present invention relates to propulsion units and particularly to propulsion units of the steam energized type and adapted for use on railroads for the propulsion of railroad rolling stock.

In my copending application, Serial No. 21,855, filed May 16, 1935, which has now matured as Patent No. 2,078,262, granted April 27, 1937, of which the present application is a division, is disclosed and claimed a locomotive comprising a plurality of relatively small compact individual propulsion units, each such unit being associated with a single driven axle. The arrangement is such that steam may be supplied 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. Each unit embodies a steam actuated motor of reversible type and means for operatively connecting the motor to, and disconnecting it from, the associated axle, it being desired that one or more of the motors be disconnected from the axles with which they are associated when not supplied with steam, thereby greatly decreasing frictional losses during the operation of the locomotive and minimizing wear of the several individual propulsion units. The present invention contemplates particularly details of construction of the individual propulsion units, particularly the organization of elements whereby the ready connection of the motor and axle is effected when the motor is initially energized, and disconnection brought about when the motor is deenergized, this connecting and disconnecting means being operative for either direction of movement of the crank shaft and the motor, the motor being reversible.

It will be understood that in a propulsion unit designed and intended for use as one of a plurality of similar units of a locomotive, ruggedness and compactness of construction are primary considerations. It is an object of the present invention to provide a unit of the general type described in which the several parts are of simple nature while rugged and durable in use and which parts occupy such relationships to each other when assembled that the propulsion unit as a whole occupies but small space and hence may be readily assembled, together with a number of other units, beneath a locomotive boiler, without causing the overall height of the locomotive to be excessive.

In the several figures of the drawings one embodiment of the invention is illustrated in detail, by way of example, and will now be described.

In the drawings:

Figure 1 shows in plan one of the improved propulsion units, a portion of the upper cover or casing being broken away and disclosing in plan a number of the operating parts;

Figure 2 is a section on line 2—2 of Figure 1;

Figure 3 is a section on line 3—3 of Figure 1;

Figure 4 is a section on line 4—4 of Figure 3;

Figure 5 is a side elevation of a portion of the gearing of the propulsion unit, upon a somewhat larger scale;

Figures 6 and 7 are detailed views illustrating certain parts of the connecting means whereby the motor may be connected to or disconnected from the axle to be driven.

The drawings do not show all details of the propulsion unit, only such elements thereof as are necessary to a full understanding of the present invention being illustrated. For a full and complete understanding of all details of the unit reference may be had to my patent, previously referred to.

In Figure 1, which is a plan view of the unit, partly broken away, the unit is seen to comprise a frame or casing which is generally indicated by the numeral 10, and which frame or casing is mainly supported upon an axle 11 to be driven, a bracket 12 at one end of the casing, however, being adapted to be connected to a truck frame member carried in part by axle 11, and in part by one or more additional axles, in order to prevent any substantial movement of rotation of the frame 10 about the axis of the axle 11. Cylinders of the motor carried by the frame 10 are positioned at one end of the frame, being indicated at 13 and a crank shaft to be driven by the motor is indicated at 14, being positioned upon the opposite side of the driven axle 11 from the cylinders and being operatively connected to the pistons mounted for reciprocation in the cylinders by the usual piston rod, cross head and link construction, which it is not necessary to describe. Each cylinder is equipped with a suitable valve mechanism for controlling the flow of steam to and from the same, one of the valves being indicated at 15, in Figure 2, and this valve being actuated from crank shaft 14 by a valve operating mechanism, generally indicated at M, which includes means for reversing the motor. So far as the present invention is concerned this valve reversing mechanism may be varied in design and details of construction.

Fixed upon crank shaft 14, or forming an integral part thereof, is a driving pinion 16 the teeth of which are in constant mesh with those of a much larger driving gear 17 mounted for rotation about the axis of axle 11. Gear 17 is in the general form of a hollow cylinder, as clearly

shown in Figure 4, the inner surface of which is spaced from the outer surface of a sleeve 18 mounted upon the axle 11 and constrained to rotate with the axle, being preferably keyed to the axle by means of one or more keys such as indicated at 19. For all practical purposes, the rigidly attached sleeve member 18 may be considered a part of the axle.

Gear 17, however, is axially supported for rotation upon the axle 11, annular end plates 20 at the ends of the gear being rigidly secured to the gear as by means of bolts 21 and having their inner flanged margins rotatably supported upon the axle through the intermediate annular bearing members 22 of angular cross-section, each such bearing member having a cylindrical portion bearing against the cylindrical outer face of the axle and also an annular face bearing against the adjacent annular face of sleeve 18 fixed to the axle, gear 17 being thus supported for free rotation upon the axle and being maintained against sliding movement longitudinally of the axle by reason of the interengagement of sleeve 18 and annular bearing members 22.

Intermediate the inner face of gear 17 and the outer face of sleeve 18 are positioned two sets of swinging pawls, one set of these pawls being indicated by the numerals 24 and the other set by the numerals 25, the pawls of one set being similar to the pawls of the other set but oppositely directed. Each pawl is adapted to swing angularly about an axis fixed with respect to gear 17 and to rest at all times against an abutment surface rigid and movable with gear 17. Thus the gear is shown to be provided with a plurality of abutments 26, projecting radially inwardly toward sleeve 18, each such abutment being provided with two cylindrical pawl seats, indicated at 26′ and 26^2, respectively, the first being for one of the pawls 24 and the second for one of the pawls 25. Each pawl is adapted to swing about an axis closely adjacent its seat and to be moved by such swinging motion either into position to engage one or another of the outwardly projecting abutments or teeth 28 of sleeve 18, or outwardly into a recess formed in gear 17 for its reception. In Figure 4 of the drawings the several pawls 24 are shown to be swung inwardly so that their free ends operatively engage, respectively, certain teeth of sleeve 18, and the pawls 25 are shown in their outward or inoperative positions, a driving connection being therefore established between the gear 17 and axle 11, through sleeve 18, in the event that gear 17 is rotated by pinion 16 in a counter-clockwise direction. When the motor is reversed, the driving connection between gear 17 and sleeve 18 is brought about by retraction of pawls 24 and inward movement of the set of pawls 25 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 17 and axle 11 may be established, regardless of the direction of operation of the motor.

In the normal operation of the propulsion unit the positions of the pawls are changed automatically when reversal of motion of gear 17 is effected by reversal of drive of the motor, and when the motor is deenergized while the axle is rotating, both sets of pawls are caused to occupy their inoperative positions. The means for causing the pawls to thus automatically operate will now be described. Each pawl is provided at the ends thereof with trunnions coaxial with the axis of rotation of the pawl when swinging upon its seating surface, trunnions 30 and 31 of one of the pawls 25 being illustrated in Figure 3. Trunnion 30 fits closely within a cylindrical aperture formed in the adjacent side plate 20 and trunnion 31 projects through a slot 33, formed in the opposite side plate 20, being seated for rotation in the curved outer end of such slot, which functions as a bearing for the trunnion. Integral with trunnion 31 is a trunnion arm 34 projecting inwardly toward the axle. The end of trunnion arm 34 is rounded and lies between spaced lugs 35 which comprise integral portions of an annular ring 36 rotatably mounted upon a bearing sleeve 37 retained within and forming a part of bearing assembly 38 which comprises one of the main supporting bearings whereby the weight of the frame, motor and other parts, are transmitted to the axle. Engaging the outer cylindrical surface of ring 36 are segmental friction shoes 39, each pivotally mounted at its lower end upon a pin 40 supported in the cap of bearing 38 and the upper ends of shoes 39 being resiliently drawn together at all times by spring means such as clearly illustrated in Figure 2. Thus the adjacent ends of shoes 39 are provided with upwardly extending portions 39′ positioned in close proximity to each other and these portions 39′ are provided with aligned cylindrical apertures through which the horizontally disposed rod 41 extends.

Encircling rod 41 are the coiled compression springs 42, each spring bearing at one end upon the associated friction shoe projection 39′ and upon the other end against a collar or washer 43, which in turn rests against a nut 44 having threaded engagement with rod 41. By adjusting nuts 44, the tension of springs 42 may be increased or decreased as desired and hence the adjacent ends of friction shoes 39 urged more or less strongly toward each other and against ring 36. By adjusting this spring mechanism, therefore, the degree of frictional opposition to rotation to ring 36 may be varied. In any event, ring 36 will oppose revolution of the inner end of trunnion arm 34, when gear 17 is initially rotated about axle 11 and will, when the gear is rotated in one direction, tend to move the associated pawl into operative position, and when rotated in the opposite direction, will tend to move the associated pawl into inoperative position. It will be appreciated that two of the annular rings and frictional retarding mechanism are provided, one upon each side of gear 17, as clearly shown in Figure 3, and that the trunnion arms 34 of one set of pawls will be operatively connected to one of these rings 36 and the trunnion arms of the second set of pawls to the second ring 36. The effect of this arrangement of course is to cause one set of pawls to move into position to engage the teeth 28 of sleeve 18 when gear 17 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 gear 17 about the axle is reversed, so that an operative connection between gear 17 and axle 11 is established regardless of the direction of drive of the motor.

It is essential, of course, that the means just described for establishing the driving connection between motor and axle, regardless of the direction of drive of the motor, shall not interfere with the free rotation of the axle when the motor is not in operation. The construction just described is such that the set of pawls which may be func-

tioning to establish the driving connection between gear 17 and the axle at the time of deenergization of the motor will be automatically and instantly removed to inoperative position. Thus in Figure 4 of the drawings the several pawls 24 are shown in engaged position, disposed, respectively, substantially tangentially to the outer face of sleeve 18 and the free ends of the pawls being in contact with teeth 28 projecting from this sleeve. Counter-clockwise rotation of gear 17 is communicated to the sleeve 18 by means of these pawls 24. Should the locomotive with which the propulsion unit is used be in motion when the motor is deenergized, gear 17 will of course cease to rotate while the axle 11 and sleeve 18 will continue to rotate in a counter-clockwise direction. Hence the inner surfaces of the several pawls 24 will be immediately engaged by the still revolving teeth 28 of sleeve 18 and will be thrust outwardly into the several recesses provided for their reception, by the action of these teeth, the inner faces of the pawls being provided with longitudinally extending raised portions 24' which in reality comprise cam portions coacting with the teeth 28. After effecting complete displacement of pawls 24 from the paths of the revolving teeth 28, pawls 24 will be firmly retained in their outer or inoperative positions by the action of the annular ring 36 to which they are operatively connected, this ring being frictionally held in fixed position upon its supporting sleeve by the action of the friction shoes 39, as soon as the outward swinging motion of pawls 24 under the action of teeth 28 have ceased. Both sets of pawls are of course similarly moved into, and held, in inoperative positions, pawls 25 being provided with similar cam surfaces 25' for coaction with teeth 28 of sleeve 18.

It is clear therefore that the foregoing arrangement provides a most compact as well as a rugged, durable, and automatically operating means for operatively connecting a reversible motor to a driven axle, regardless of the direction of operation of the motor, and which likewise effects the complete automatic disconnection of the motor and driven axle when the motor is deenergized. Hence the advantage of utilizing the invention in a propulsion unit for railroad rolling stock is clear.

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

1. In a propulsion unit for use on railroads or the like, which includes an axle to be driven, and a gear encircling the axle, rotatable thereon and always adapted to be driven in either direction; the combination of opposed sets of rocking pawls disposed intermediate said gear and axle and trunnioned in said gear, one set for operatively connecting the gear and axle when the gear is rotated in one direction and the second set acting to connect the gear and axle when the gear is rotated in the reverse direction, cam portions formed on said pawls and adapted to be engaged by the axle to positively disengage the pawls therefrom when the axle overruns the gear, a frictionally retarded element positioned upon one side of said gear and operatively connected with and relatively movable with respect to one set of pawls to rock them into engagement with said axle when said gear is rotated in one direction, and another frictionally retarded element positioned upon the opposite side of said gear and operatively connected with and relatively movable with respect to the other set of pawls to rock them into engagement with the axle when the gear is rotated in the reverse direction.

2. In a propulsion unit for use on railroads or the like, which includes an axle to be driven, and a gear encircling the axle, rotatable thereon, and always adapted to be driven in either direction; the combination of opposed sets of rocking pawls disposed intermediate said gear and axle and trunnioned in said gear, one set of pawls for operatively connecting the gear and axle when the gear is rotated in one direction and the other set acting to connect the gear and axle when the gear is rotated in the reverse direction, a frictionally retarded element positioned upon one side of said gear and operatively connected with one set of pawls to rock them into engagement with said axle when said gear is rotated in one direction, another frictionally retarded element positioned upon the opposite side of said gear and operatively connected with the other set of pawls to rock them into engagement with the axle when the gear is rotated in the reverse direction, and oppositely extending crank arms on the pawls of said respective sets and operatively connected with said frictionally retarded elements.

3. In a locomotive propulsion unit or the like, which includes a driving axle member and a gear member rotatably mounted thereon; the combination of pawls rockably trunnioned in one of said members and movable into and out of engagement with the second member, means operatively connected with said pawls for effecting their engagement when relative rotation of said members in one direction occurs and for disengaging the pawls when said members relatively rotate in the opposite direction, said means including an annular ring supported upon a stationary portion of said unit concentric with the axle, and an adjustable spring pressed braking element for engaging said ring to restrict rotary movement thereof in either direction.

4. In a propulsion unit, which includes an axle to be driven, and a gear member encircling the axle, rotatable thereon and adapted to be driven in either direction; the combination of opposed sets of rocking pawls positioned intermediate said gear and axle, each of said pawls being provided with oppositely directed trunnions pivotally mounted in said gear member, one set of pawls for operatively connecting the gear member and axle when the gear member is rotated in one direction and the second set acting to connect the gear member and axle when the gear member is rotated in the reverse direction, a frictionally retarded element positioned upon one side of said gear member and operatively connected with and relatively movable with respect to one set of pawls to rock them into engagement with said axle when said gear member is rotated in one direction, and another frictionally retarded element positioned upon the opposite side of said gear member and operatively connected with and relatively movable with respect to the other set of pawls to rock them into engagement with the axle when the gear member is rotated in the reverse direction.

5. In a propulsion unit, which includes an axle to be driven, and a gear encircling the axle, rotatable thereon, and adapted to be driven in either direction; the combination of opposed sets of rocking pawls disposed intermediate said gear and axle and trunnioned in said gear, one set of pawls for operatively connecting the gear and axle when the gear is rotated in one direction

and the other set acting to connect the gear and axle when the gear is rotated in the reverse direction, a frictionally retarded element positioned upon one side of said gear and operatively connected with one set of pawls to rock them into engagement with said axle when said gear is rotated in one direction, another frictionally retarded element positioned upon the opposite side of said gear and operatively connected with the other set of pawls to rock them into engagement with the axle when the gear is rotated in the reverse direction, each frictionally retarded element comprising an annular ring rotatably supported upon a stationary portion of said unit concentric with said axle, the means for retarding said elements comprising adjustable spring-pressed brake shoes bearing upon a portion of the periphery of each ring, and oppositely extending crank arms on the pawls of said respective sets and operatively connected with said frictionally retarded elements.

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