J. V. PETRELLI.

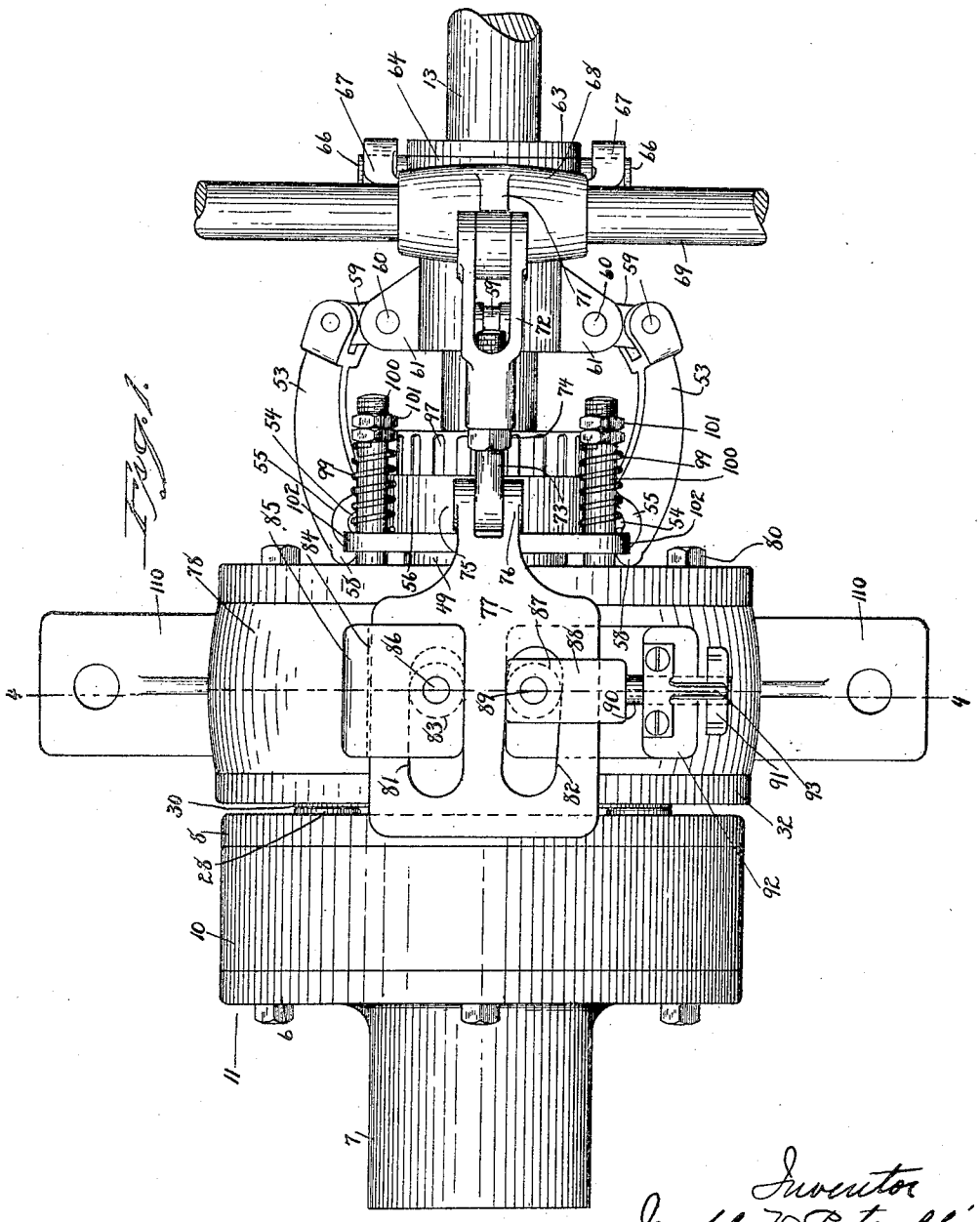
REVERSING MECHANISM.

APPLICATION FILED APR. 21, 1917.

1,397,111.

Patented Nov. 15, 1921.

5 SHEETS—SHEET 1.



Inventor
Joseph V. Petrelli
by Seymour Earle
Atty

J. V. PETRELLI.

REVERSING MECHANISM.

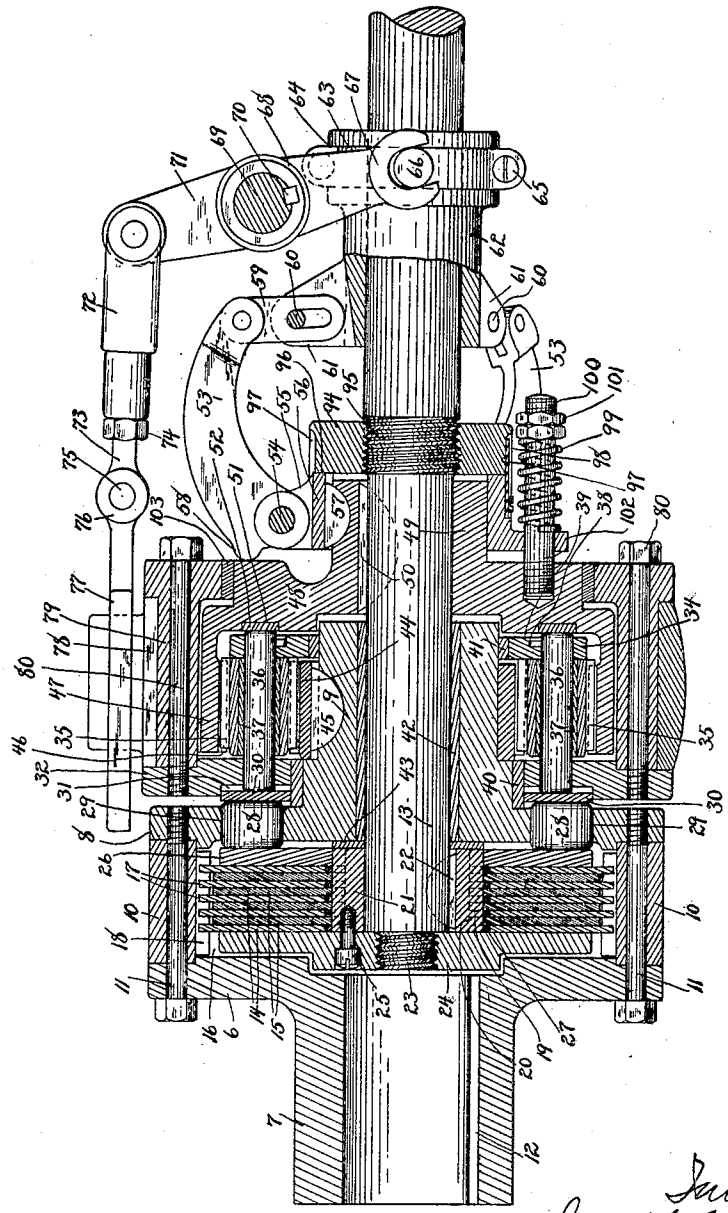
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5 SHEETS—SHEET 2.

Fig. 2.



Inventor
Joseph V. Petrelli
by Seymour & Earle
Attys

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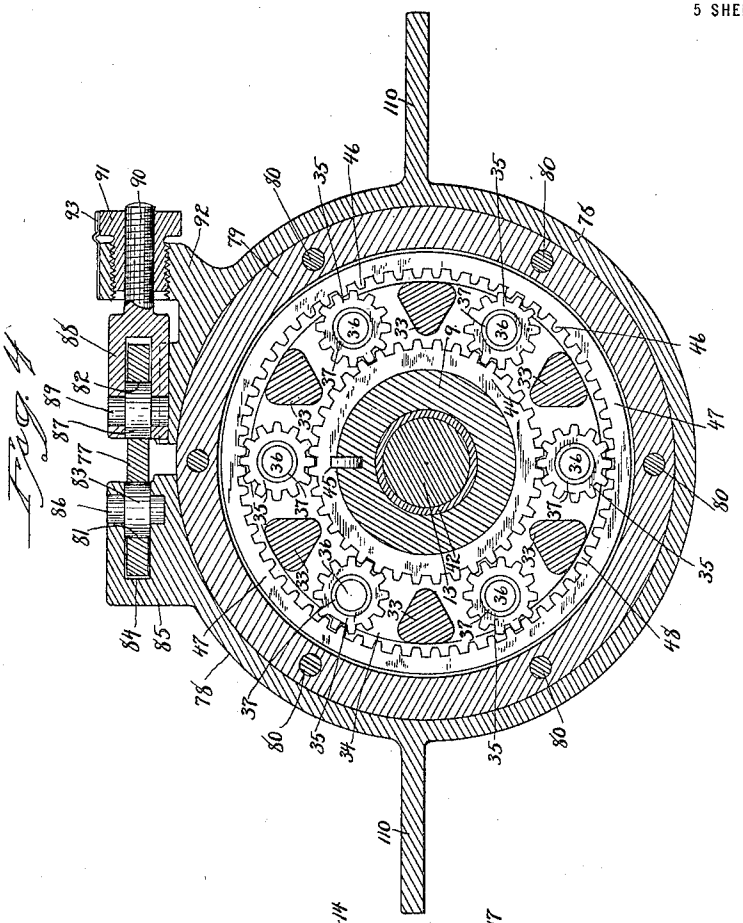


Fig. 4.

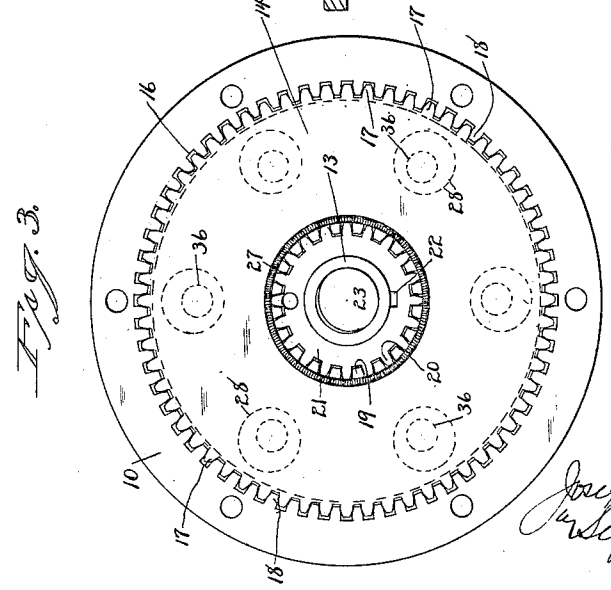


Fig. 3.

Inventor
Joseph V. Petrelli
by Seymour & Earle
Attys

J. V. PETRELLI.

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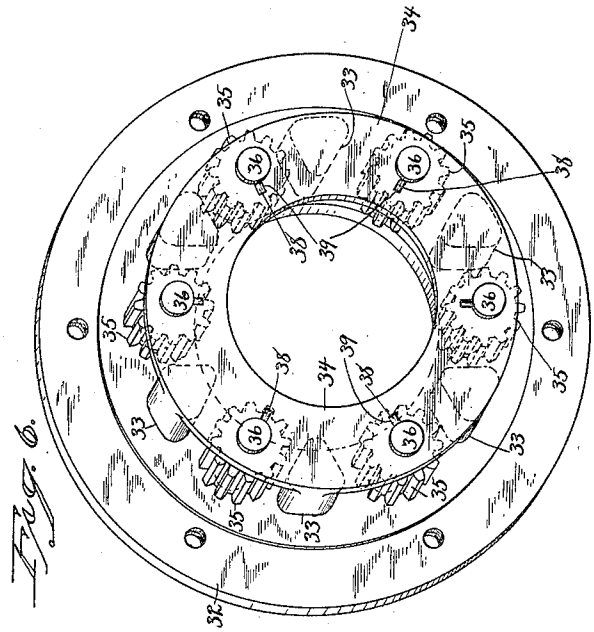


Fig. 6.

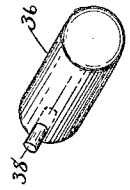


Fig. 8

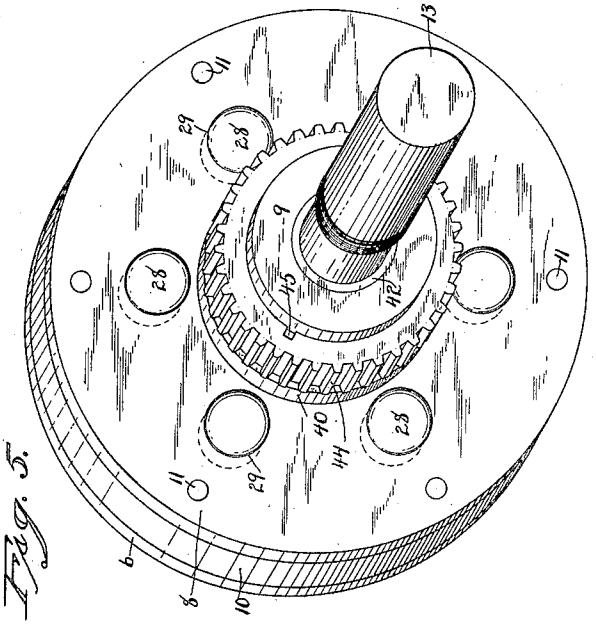


Fig. 5.



Fig. 7.

Inventor
Joseph V. Petrelli
by Seymour & Earle
Attys

J. V. PETRELLI.

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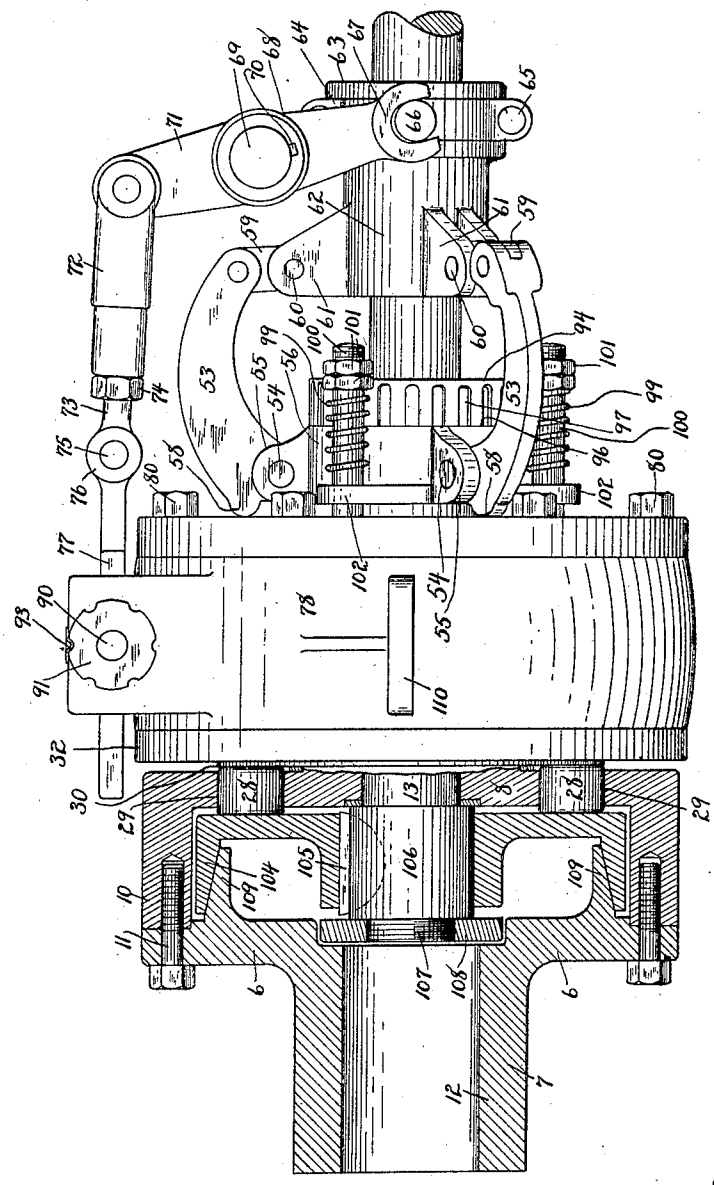


Fig. 5.

Inventor
Joseph V. Petrelli
by Seymour & Earle
Attys

UNITED STATES PATENT OFFICE.

JOSEPH V. PETRELLI, OF NEW HAVEN, CONNECTICUT, ASSIGNOR TO THE NAVY GEAR MANUFACTURING CORPORATION, OF NEW HAVEN, CONNECTICUT, A CORPORATION OF DELAWARE.

REVERSING MECHANISM.

1,397,111. Specification of Letters Patent. Patented Nov. 15, 1921.

Application filed April 21, 1917. Serial No. 163,591.

To all whom it may concern:

Be it known that I, JOSEPH V. PETRELLI, a citizen of the United States, residing at New Haven, in the county of New Haven and State of Connecticut, have invented a new and useful Improvement in Reversing Mechanism; and I do hereby declare the following, when taken in connection with the accompanying drawings and the characters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this application, and represent in—

Figure 1 a plan view of my improved reversing mechanism.

Fig. 2 a view thereof in vertical longitudinal section.

Fig. 3 a view in elevation of the forward or driving end of the mechanism with the outer plate of its chambered driving-member and the compression-plate of its friction-clutch mechanism removed.

Fig. 4 a view in vertical transverse section on the line 4—4 of Fig. 1.

Fig. 5 a detached perspective view of the separately organized friction-clutch of the mechanism, together with the driving gear of the separately organized gear mechanism and the driven-shaft.

Fig. 6 a detached perspective view of the gear-cage.

Fig. 7 a detached edge view of one of the springs employed to separate the friction disks.

Fig. 8 a detached perspective view of one of the pinion-gear pintles which also act as actuating plungers for the friction-clutch mechanism.

Fig. 9 a view partly in side elevation and partly in section of one of the modified forms which my improved reversing mechanism may assume.

My invention relates to an improved reversing mechanism primarily designed for use in motor boats, but also available for use in other situations, the object being to produce a simple, strong, durable and compact mechanism constructed with particular reference to ease of access for adjustment, for cleaning, and for repair, and to minimizing the heating of the mechanism especially during the reverse drive.

With these ends in view, my invention consists in a reversing mechanism characterized by having its driving and driven members directly connected by an isolated friction-clutch mechanism for the forward drive to the exclusion of the transmission of any forward driving energy through the gear.

My invention further consists in a reversing mechanism characterized by having its friction-clutch mechanism and its gearing isolated from each other in separate compartments.

My invention further consists in a reversing mechanism characterized by having its driving and driven members interrelated so as to have bearing one upon the other for mutual support.

My invention further consists in a reversing mechanism having certain details of construction and combinations of parts as will be hereinafter described and pointed out in the claims.

In carrying out my invention as herein shown, I employ a three-part driving member constructed to form a special isolated chamber for the friction-clutch mechanism and comprising a circular outer plate 6 formed with a concentric outwardly extending coupling-sleeve 7, a corresponding circular inner plate 8 formed with a concentric inwardly extending bearing-sleeve 9, and a spacing-ring 10 interposed between the edges of the plates 6 and 8 and formed with transverse holes for the reception of assembling bolts 11 also passing through holes in the edges of the plates, as shown in Fig. 2. The coupling-sleeve 7, before mentioned, is formed with a key-way 12 and is intended to receive the crank-shaft of the engine or other part designed to connect the reversing mechanism with the source of power, whatever that may be. I call attention to the fact that under my improvement, the friction-clutch housing constitutes the prime-mover of the device.

The chambered driving-member or friction-clutch housing, as thus described, is connected directly with the driven-shaft 13 by means of alternately arranged bronze and steel friction-disks 14 and 15 located within the chamber 16 of the housing, the bronze disks 14 having their peripheries formed with teeth 17 which are interlocked with corresponding internal teeth 18 upon the spacing-ring 10, whereby the bronze disks 14 are positively connected with the driving-member for constant rotation therewith. On the other hand, the steel disks 15

are formed upon the inner edges of their central openings with teeth 19 which mesh into corresponding teeth 20 formed upon the periphery of a collar 21 secured by a key 22 to the extreme forward end of the driven-shaft 13 which projects into the said chamber 16 and is furnished with a threaded stem 23 for the application to it of a heavy, circular, compression-plate 24 formed with a large hub and held against rotation by a screw 25 passing from front to rear through the said hub and entering the collar 21 whereby the plate 24 is fixed to, and rotates with, the driven-shaft 13. Under this construction all of the steel friction-disks 15 are permanently connected with the driven-shaft 13 for constant rotation therewith. Complementary to the compression-plate 24, I employ a flat laterally movable or floating pressure-plate 26 located in the inner portion of the chamber 16 and mounted so as to rotate freely upon the inner end of the said collar 21. The alternately arranged bronze and steel friction-disks 14 and 15 and the plates 24 and 26 between which they are interposed, are located entirely within the chamber 16 within the driving-member as aforesaid.

Helically wound springs 27 having their ends joined to form circles and transversely bowed as shown in Fig. 7, are arranged within the enlarged central openings of the bronze disks 14 and exert a constant effort to separate all of the steel disks, and by so acting on the steel disks tend to separate all of the disks when pressure is removed from the floating pressure-plate 26 during the reverse drive, and also in the neutral position of the mechanism.

For compressing the friction-disks 14 and 15 so as to frictionally couple the chambered driving-member and the driven shaft 13 for the forward drive, I employ short, blocky compression-plungers 28 arranged in a circular series of six holes 29 in the inner plate 8 of the driving-member, the said plungers being slightly longer than the depth of the holes 29 so as to project therefrom. The projecting outer ends of these plungers 28 engage with the adjacent or rear face of the floating pressure-plate 26, while their projecting inner ends bear upon a floating anti-friction thrust-ring 30 located in a concentric annular recess 31 in the forward face of the circular gear-cage plate 32 which is formed upon its opposite or rear face with a circular series of heavy integral webs 33 (Fig. 6) substantially triangular in cross-section and having a gear-cage plate 34 cast upon their rear ends, the said webs 33 connecting and spacing the two gear-cage plates 32 and 34.

A series of six intermediate pinion-gears 35 interposed between the plates 32 and 34 and also between the webs 33 (Fig. 6) are loosely mounted upon as many longitudinally movable pintles 36, the ends of which have sliding bearing in complementary holes formed for their reception in the plates 32 and 34. Each of the pinion-gears 35 is provided with a bushing 37 rotating with it upon its pintle 36. The projecting rear ends of the pintles 36 are furnished with radial pins 38 (Fig. 8) entering notches 39 in the plate 34 whereby the pintles are prevented from turning.

The said gear-cage is mounted so as to rotate upon the sleeve 9 of the inner plate 8 of the chambered driving-member, and since the gear-cage and driving-member rotate independently of each other, an anti-friction bearing-ring 40 is interposed between the plate 32 and the sleeve 9, while a corresponding but smaller bearing-ring 41 is interposed between the plate 34 and the sleeve 9 as shown in Fig. 2.

The said sleeve 9 is furnished with an anti-friction bushing 42 so as to reduce friction between the said sleeve and the driven-shaft 13 when they rotate relative to each other. A thrust ring 43 is interposed between the collar 21 on the shaft 13 and the forward face of the plate 8 as shown in Fig. 2, for taking the rearward pull on the driven-shaft 13.

Upon the sleeve 9 which is a component part, as already explained, of the driving-member, I locate a driving-gear 44 secured by a key 45 and meshed into by the pinions 35 which also mesh into internal gear-teeth 46 on the inner face of an annular housing-flange 47 extending forward at a right angle from a circular thrust-head 48 the hub 49 of which is secured by a key 50 to the driven-shaft 13. The forward face of the thrust-head 48 is formed with a shallow annular-recess 51 receiving a thrust-ring 52 engaging with the projecting rear ends of the pintles 36 before described.

For the operation of the friction-clutch for the forward drive, I employ, as shown, three radially arranged operating-levers 53 hung on studs 54 in lugs 55 radiating from a collar 56 slidably mounted upon the rearwardly projecting end of the said hub 49 upon which it is held against rotation by a key 57. The forward ends of the said levers 53 are formed with heels 58 which engage with the rear face of the thrust-head 48, whereby the same is forced forward for imparting corresponding forward movement to the pintles 36.

The rear ends of the said levers 53 are connected through slotted toggle-links 59 and pins 60, with bifurcated lugs 61 radiating from the forward end of a sleeve 62 arranged to slide upon the driven-shaft 13, the said sleeve having at its rear end a grooved collar 63 receiving a two-part band or strap 64 the parts of which are held together by

screws 65 and respectively provided with oppositely extending short trunnions 66 coacting with the slotted arms 67 of a forked lever 68 mounted upon a controller-shaft 69 (Fig. 4) to which it is secured by a key 70. The said lever 68 is formed with an upwardly extending arm 71 connected to a forked link 72 receiving a threaded eye-bolt 73 locked in any position of adjustment by a nut 74. The said eye-bolt 73 is connected by a stud 75 with a knuckle 76 formed at the rear end of a cam-plate 77 which is employed for operating the brake-band 78 which encircles a brake-drum 79 secured by bolts 80 to the plate 32 of the gear-cage and constitutes a housing for the gear-cage and the parts carried thereby and associated therewith.

For the operation of the brake-band 78 by the cam-plate 77, the same is formed with two slots 81 and 82 of which the latter is inclined with respect to the former so as to act as a cam-slot. The said slot 81 receives an anti-friction roller 83 located in a horizontal slot 84 formed in a boss 85 upstanding from one end of the band 78 and turning upon a stud 86 journaled in the said boss 85 the slot 84 of which receives one edge of the cam-plate 77.

The inclined slot 82 in the cam-plate 77 receives an anti-friction roller 87 located between the arms of an adjusting-fork 88 and journaled upon a stud 89 mounted therein near the outer end thereof, the fork also receiving the adjacent edge of the plate 77 as clearly shown in Fig. 4. The threaded stem 90 of the fork receives an adjusting-nut 91 threaded into an arm 92 upstanding from the other end of the brake-band 78. The said nut 91 is peripherally notched, and held against rotation by means of a spring-finger 93, and provides for compensating for wear between the brake-band 78 and the brake-drum 79.

For compensating for wear between the bronze and steel friction-disks 14 and 15 of the friction-clutch mechanism, I employ a nut-like adjusting collar 94 (Fig. 2) mounted upon the threaded portion 95 of the driven-shaft 13 in position to engage with the rear edge 96 of the sliding collar 56 which positions the thrust-heels 58 of the operating-levers 53 with respect to the rear face of the thrust-head 48. The periphery of the nut 94 is formed with notches 97 for the reception of a spring-locking-finger 98.

To offset the action of centrifugal force tending to separate the outer ends of the operating-levers 53, and therefore tending to apply the friction-clutch, I employ, as shown, three helical safety springs 99 (Fig. 2) encircling as many bolts 100 screwed into the thrust-head 48, the said springs being interposed between adjusting nuts 101 on the outer ends of the said bolts and integral lugs 102 offsetting from the collar 56 and perforated for the passage of the said bolts through them. The said springs as thus arranged, exert a constant effort to move the collar forward and hence counteract the tendency of centrifugal force to throw the levers 53 outward and bring the friction-clutch into play. The device just described, therefore, constitutes a safety device for preventing the untimely application of the friction-clutch in the operation of my improved reversing mechanism. To prevent wear due to relative rotation between the inner edge of the drum 79 and the periphery of the thrust-head 48, I interpose a bronze bearing-ring 103 between them, as shown in Fig. 2.

In the use of my improved reversing mechanism, the chambered driving-member and the driven-shaft 13 are frictionally coupled together for the forward drive by rocking the controller-shaft 69 to bring the parts into the position shown in Fig. 2, whereby the operating-levers 53 are moved outward against the tension of the safety-springs 99, thus seating the forward edge of the collar 56 against the inner face of the nut-like adjusting collar 94 after which the heels 58 of the levers 53 operate to force the thrust-head 48 forward with the effect of moving the pintles 36 forward in the gears 35, this movement being transmitted through the thrust-ring 30, compression-plungers 28, floating pressure-plate 26 and the friction-disks 14 and 15, whereby they are pinched between the said plate 26 and the compression-plate 24. In this manner the alternately arranged bronze and steel friction-disks are frictionally coupled together and effect the coupling of the chambered driving-member and the driven-shaft 13, for the forward drive entirely independently of the gearing. The driving-gear 44, the pinion-gears 35 and the thrust-head 48 turn with the driven-shaft 13 but are not utilized for the transmission of any power, having no relative movement, and no strain of any sort being imposed upon them during this period. Should anything happen to any of the gears or pinions during the forward drive, the same would be entirely unaffected.

For the reverse drive, the controller-shaft 69 is operated in the direction of sliding the sleeve 62 inward, whereby the operating-levers 53 are drawn inward toward the driven-shaft 13, causing their thrust-heels 58 to move away from the rear face of the thrust-head 48. The springs 27 now assert themselves to separate the friction-disks 14 and 15 so as to uncouple the driving-member from the driven-shaft. At the same time, the cam-plate 77 is drawn rearward with the effect of clamping the brake-band 78 upon the drum 79, whereby the gear-

cage is gripped and held stationary. The driving-member being continuously rotated now effects the rotation of the pinion-gears 35 upon the pintles 36, setting up a planetary movement which results in the reverse rotation of the thrust-head 48 through the internal gear-teeth 46, and consequently the reverse rotation of the driven-shaft 13 with respect to the driving-member which continues to rotate in the same direction as before. It will be understood that in the intermediate position of the controller-shaft 69 in which the lever 71 will stand in the vertical position, neither the friction-clutch will function, nor the friction-band 78. At this time, the driving-member will rotate idly. In reversing mechanisms as heretofore constructed, the driving-member has been coupled with the driven-member for the forward drive, by a friction-clutch, but by a friction-clutch organized with the gearing in such a manner as to cause the power of the driving-member to be transmitted to the driven-member through the gearing, which is the most vulnerable part of reversing mechanisms and the part most liable to become deranged. In mechanisms of this character, any accident of whatever description to the gearing has tended at least, and for the reason above stated, to cripple the mechanism for the forward drive which is the drive chiefly employed. This objection has been overcome by my improved construction in which the coupling of the driving-member and the driven-shaft for the forward drive is effected independently of the gearing in so far that none of the power of the driving-member is transmitted through the gearing to the driven-member. The gearing may therefore be said to be cut out of operation during the forward drive, during which, under my construction, the gearing is safeguarded against accident and kept in reserve for the reverse drive.

Under my construction the friction-clutch mechanism is organized independently and segregated from the gearing, the two mechanisms being self-contained and separately housed, as it were. Under this arrangement, grit which may find its way into the gearing cannot work its way into the friction-clutch to interfere with the operation thereof, and vice versa. The segregation of different types of lubricant is also effected by housing the clutch mechanism and gearing separately, this being important. Thus the graphite commonly used for lubricating gearing, is highly detrimental to the action of friction-disks. Furthermore, under my construction, the driven-shaft is entered for some distance into the driving-member with the effect of securing a continuous or unbroken connection between the driving-member and the driven-shaft, which are thus virtually telescoped instead of being abutted, thereby preventing sagging, uneven wear of the parts, and loss of power. By my improved construction, I provide for the positive expansion of the brake-band as well as its positive contraction, insuring greater reliability in the operation of the reverse drive and the positive throwing off of the brake during the forward drive and in the neutral position of the mechanism as a whole. By segregating the friction-clutch from the gearing and housing the two devices in separate compartments, as it were, the heat developed by one is not communicated to the other and vice versa. This avoids the overheating of the respective devices so that when the friction-clutch is operated for the forward drive, it will not be handicapped by an excess of heat taken over from the gearing; and so that when the gearing is operated for the reverse drive, it will not be handicapped by an excess of heat taken over from the friction-clutch. This is particularly important in moving from the forward drive to the reverse drive, during which latter greater heat is developed than during the forward drive, the reverse drive in reversing mechanisms being limited in period of use by the heat developed. In prior reversing mechanisms, the gearing used in the reverse drive is preheated, as it were, by heat absorbed from the friction-clutch mechanism so that when thrown into action it is already hot and cannot, therefore, be driven for a great length of time before its heat becomes prohibitive and necessitates its being thrown out of action. My improved safety device counteracts the effect of centrifugal force which tends to apply the forward drive during the neutral and reverse positions of the mechanism and with the consequent production of friction and heat. On account of segregating the friction-clutch from the gearing, I am enabled to rotate the housing of the clutch continuously in one direction and therefore, if desired, the housing may be used directly as the driving-member. Thus the plate 6 and its sleeve 7 might be omitted, and the spacing-ring 10 secured directly to the face of a fly wheel or other part, supplying power.

By the employment of springs for the separation of the friction-disks, when they are not functioning in the forward drive, they are held sufficiently apart to operate without generating heat, which they would otherwise do, since they revolve in opposite directions with great rapidity in the neutral and reverse positions of the mechanism.

In the modified construction shown by Fig. 9 of the drawings, the alternately arranged friction-disks 14, 15, are replaced by a sliding friction-cone 104 non-rotatably secured by a key 105 to a shoulder 106 on the driven-shaft 13 which is here shown as

formed at its extreme forward end with a threaded stem 107 upon which a retaining-collar 108 is screwed. The cone 104 co-acts with a cone 109 consisting in effect, of a beveled annular flange formed integral with the inner face of the plate 6 of a driving-member in other respects substantially like that shown in Fig. 2.

The cone 104 is operated by short compression-plungers 28 mounted in the inner plate 8 constituting another element of the chambered driving-member already described. The short plungers 28 are operated by the mechanism already described for operating the friction-disk clutch mechanism best shown in Fig. 2, the only difference between the form already described and the form now being described is, that one is a friction-disk clutch and the other a cone-clutch.

Of the operation of the modified form of my mechanism shown by Fig. 9, it need only be said that the movement of the short plungers 28 crowds the two cones 104 and 109 of the cone-clutch into close engagement, thus effecting the coupling of the driving-member and driven-shaft without transmitting any power through the gearing during the forward drive. The brake-band 78 is provided, as shown in Fig. 4, with integral, oppositely located horizontal mounting-arms 110 by means of which the reversing mechanism as a whole is installed.

I claim:—

1. In a reversing mechanism, the combination with a sectional chamber driving member and a driven-member, of a friction-clutch for coupling the said members for the forward drive located within the said chambered driving-member, gearing connecting the said members for the reverse drive, means for operating the friction-clutch, including a sliding collar and operating-levers carried thereby and adjustable means co-acting with the said sliding collar for counteracting the effect of centrifugal force upon such operating means.

2. In a reversing mechanism, the combination with a driving and a driven-member, of a friction-clutch for coupling the said members for the forward drive, gearing connecting the said members for the reverse drive, means for operating the friction-clutch, including a sliding collar and pivotal operating-levers carried thereby, means connected with the said levers through the said sliding-collar for counteracting the effect of centrifugal force upon the same during the reverse and neutral positions of the mechanism and take-up means co-acting with the said collar.

3. In a reversing mechanism, the combination with a driving and driven-member, of a friction-clutch for coupling the said members for the forward drive, gearing connecting the said members for the reverse drive, means for operating the friction-clutch including a sliding collar mounting operating-levers, safety-springs connected with the said sliding collar and tending to move the said levers inward in opposition to centrifugal force, and means for adjusting the said springs.

4. In a reversing mechanism, the combination with a driving and a driven member, of a friction-clutch for coupling the said members for the forward drive, gearing connecting the said members for the reverse drive, including an internal gear slidably mounted upon the said driven member, operating levers co-acting with the said internal gear for applying the friction-clutch, a sliding collar mounted upon the said internal gear and mounting the said levers, and a collar adjustably mounted upon the said driven member and co-acting with the said sliding collar for taking the thrust of the levers when the same are operating against the internal gear for applying the friction-clutch for the forward drive.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

JOSEPH V. PETRELLI.

Witnesses:
FREDERIC C. EARLE,
M. P. NICHOLS.