L. J. CAMPBELL.

CLUTCH.

APPLICATION FILED APR. 24, 1914.

1,245,315.

Patented Nov. 6, 1917.

2 SHEETS—SHEET 1.

Fig. 1.

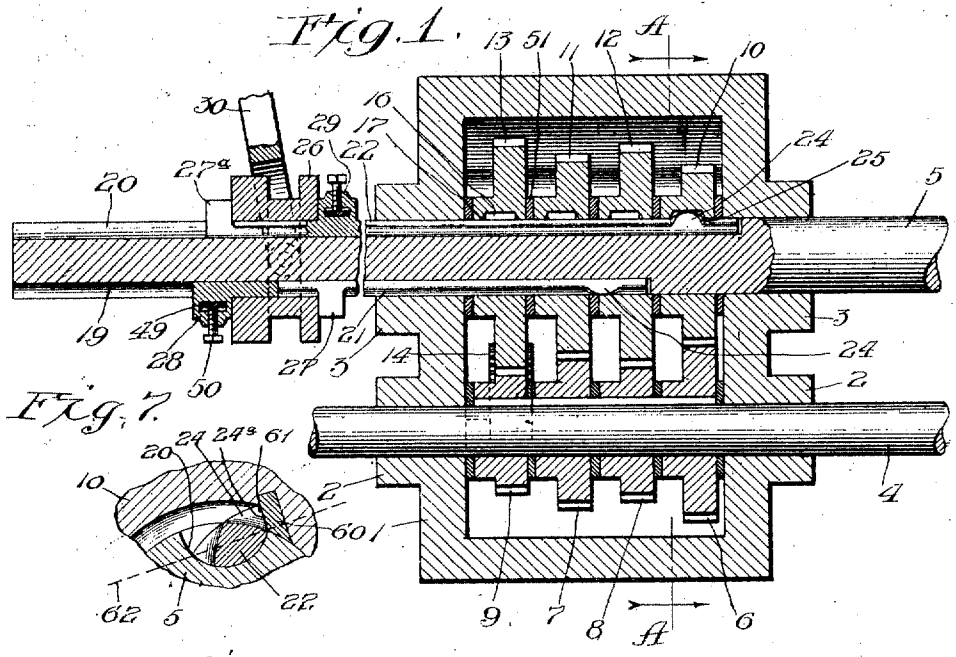


Fig. 2.

Fig. 3.

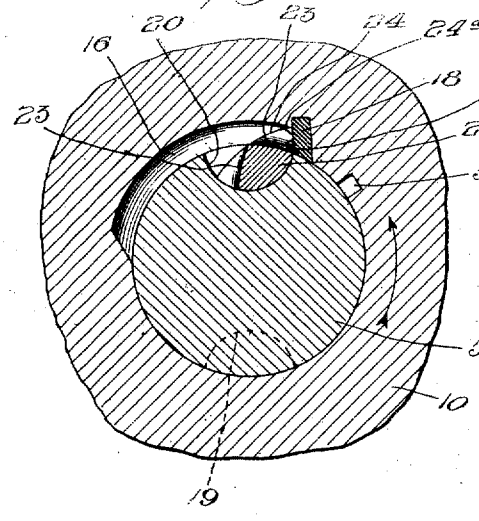
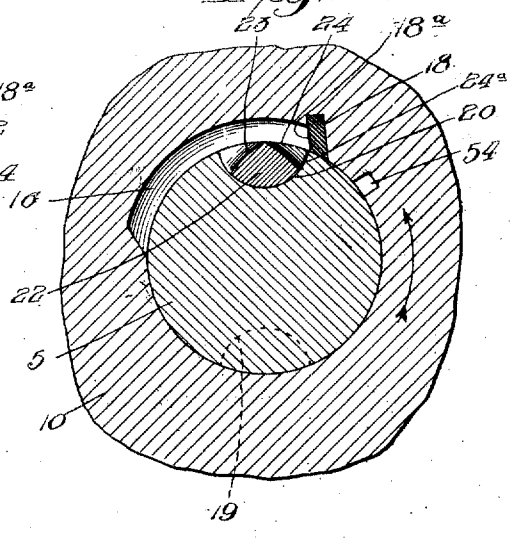


Fig. 4.



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2 SHEETS—SHEET 2.

Fig. 4.

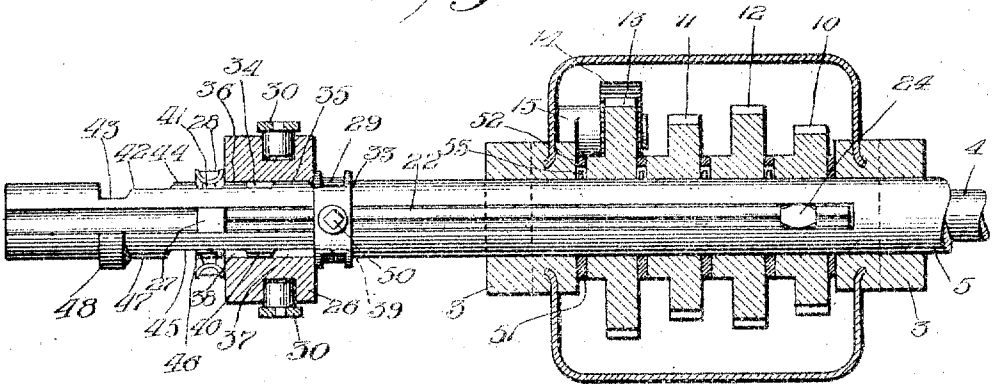


Fig. 5

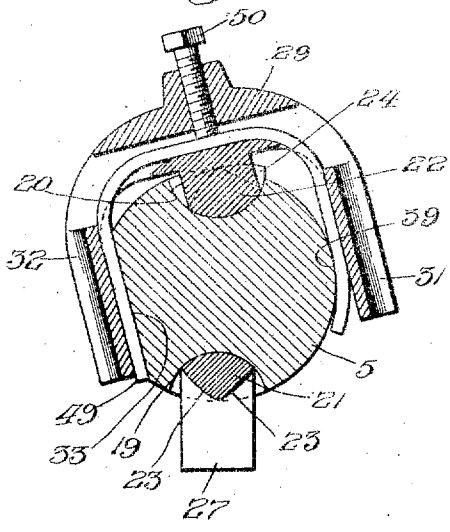
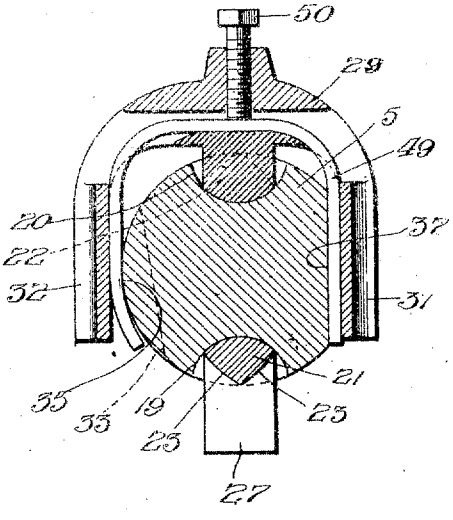


Fig. 6.



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CLUTCH.

1,245,315. Specification of Letters Patent. Patented Nov. 6, 1917.

Application filed April 24, 1914. Serial No. 834,075.

To all whom it may concern:

Be it known that I, LEON JAY CAMPBELL, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Clutches; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to a clutch mechanism, and more particularly to that type of such device best adapted to be applied to power transmission devices or variable speed gearing mechanisms, of the type shown and described in my prior Patent No. 1,135,354, granted April 13th, 1915.

The present invention relates to the clutch mechanism and consists in the matters hereinafter described and more particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is a view in horizontal section of a transmission gearing construction embodying a clutch mechanism constructed in accordance with my invention;

Fig. 2 is a view in vertical section of the transmission device shown in Fig. 1;

Fig. 3 is an enlarged detail sectional view of one of the rotative members or gear wheels, the driven shaft and the locking key, the latter being shown in locked position;

Fig. 4 is a view similar to Fig. 3, showing the locking key in unlocked position;

Fig. 5 is a view showing the driven shaft in section and one of the rocking yokes in position to hold one of the locking keys in locking position;

Fig. 6 is a view similar to Fig. 5, showing the rocking yoke in position to hold the said locking key in unlocked position; and

Fig. 7 is a fragmentary detail sectional view of the parts shown in Fig. 3, with the exception that the abutment plate which constitutes the locking shoulder on the rotative member or gear wheel is so arranged that its contact face is in a plane at a greater inclination to a vertical plane passing through the axes of rotation of the key and shaft than a plane passing through the contact face of the abutment plate illustrated in Fig. 3.

Referring to the drawings, the gear casing 1 is provided with bearings 2 and 3 in which are journaled the drive shaft 4 and the transmission or driven shaft 5. Rigidly secured upon one of said shafts, as herein shown the drive shaft 4, is a plurality of drive gears 6, 7, 8 and 9, which decrease in size in the order named. Loosely mounted upon the transmission shaft 5 is a plurality of selective or loose gears or rotative members 10, 11, 12 and 13, which increase in size in the order named. The loose gears 10, 11 and 12 mesh with the drive gears 6, 7 and 8, respectively, and provide the forward speeds for the transmission shaft. The loose gear 13, which is the reverse gear, meshes with an idle pinion 14 which is journaled in a bearing 15 on the casing and meshes with the drive gear 9.

Each of the rotative members or gears 10, 11, 12 and 13 is provided in its bore with a locking recess 16 which extends circumferentially of the bore a sufficient distance to permit the locking mechanism to act properly, and is provided with flaring or beveled sides 17. At the rear end of each recess, that is the end directed away from the direction of rotation of the gear, is a steel abutment plate 18 which is adapted to take the wear of the locking mechanism on the gear.

Extending longitudinally of the shaft 5 is a pair of key seats 19 and 20 which are circular in cross-section, and in which are the locking keys 21 and 22. Said keys are rounded on their inner sides complementally with the key seats so as to permit them to rock freely in their seats, and have their outer corners cut away, as at 23, for the greater portion of their lengths so that they will not project out of the seats beyond the periphery of the shaft in any position of the key. The remaining portion of the key, forming the locking lug 24, is curved transversely on its outer face in the same arc as the circumference of the shaft 5, so that when the key is in release position, as is shown in Figs. 4, and 6, said portion or lug will be flush with the periphery of the shaft, and the loose gears or rotative members may travel over the same and rotate freely on the shaft. Said lugs are of length

to fit transversely of the locking recesses 16 when they are brought into register with said recesses, and when in that position the keys may be rocked to turn one edge of the lug up into the recess in position to abut against the abutment plate 18, as shown more clearly in Figs. 1 and 3, thereby locking the gear to the shaft. The ends 25 of the lateral edges or corners of the lugs are beveled longitudinally of the key to bear against the beveled sides 17 of the recesses 16, so that when the key is in locking position, with one edge turned up into the recess 16, longitudinal movement of the key will cause the beveled portion 25 of the lug to bear against the beveled portion 17 of the recess, and since the beveled portion 25 is off center on the key, the key will be rocked back to normal position where it may be moved longitudinally of the shaft.

For the purpose of moving the keys longitudinally of the shaft to bring the locking lugs 24 into and out of locking position with respect to the various loose gears, a grooved collar 26 is loosely mounted on the shaft 5 outside of the casing 1, and the outer ends of the keys 21 and 22 extend through the collar. The key 21 is provided with a boss 27 near its outer end and with a yoke 28 at its outer end and the key 22 is provided with a boss 27^a at its outer end and a yoke 29 near its outer end. The collar 26 is mounted on the shaft between the lugs and yokes, with the latter situated on opposite sides thereof, so that when the collar is moved longitudinally of the shaft it will move the keys therewith. A forked lever 30 is connected with the collar 26 which is slidably mounted on the shaft. The lever is adapted to operate the keys by moving the collar on the shaft. The lugs 24 are so situated on the keys that both cannot be in locking position at the same time, and so that the lug on the key 22 will lock the gears 10 and 12 to the shaft 5, and the lug on the key 21 will lock the gears 11 and 13 to the shaft.

The yokes 28 and 29 are off center on the keys, that is the arm 31 of each yoke, or the arm which is on the same side of the key as the locking edge of the lug 24, is nearer the center of the key than is the arm 32, and the distance between the arms is less than the diameter of the shaft 5. Said yokes are adapted to rock the keys 21 and 22 to bring the lugs 24 into and out of locking position. For this purpose the yokes straddle the shaft, which is provided on its sides along those portions over which the yokes travel with a plurality of oppositely disposed notches and shoulders which are adapted to rock the yoke.

The collar 26 is of sufficient length to separate the yokes far enough apart so that neither yoke can travel in the notches of the other yoke, and the notches are so disposed that when one key is in locking position the other will be out of locking position, and so that there will be an interval between each two selective gears when neither key will be in locking position and all of the gears will run idle.

To operate the yoke 29 the shaft 5 is provided in one side with notches 33 and 34 and shoulders 35 and 36, and in the other side with notches 37 and 38 and shoulders 39 and 40, the notches in one side being disposed oppositely to the shoulders on the other side. To operate the yoke 28, the shaft is provided in one side with notches 41, 42 and 43, and a shoulder 44, and in the other side with a notch 45 and shoulders 46, 47 and 48, which are likewise oppositely disposed, and the notches and shoulders for the yoke 28 are arranged in the reverse order to those for the yoke 29. The shoulders, with the exception of the shoulder 48, are provided by the surface of the shaft adjacent to the notches, while the shoulder 48 is provided by a piece attached to the side of the shaft, and the notch 43, which is opposite the shoulder 48, is deeper than the other notches so as to throw the yoke 28 in the reverse direction to lock the reverse gear 13 to the shaft 5.

The inner faces of the yoke arms are rounded or beveled, and the sides of the notches are beveled so that when the collar 26 is moved longitudinally of the shaft the yoke arms will travel easily out of the notches and onto the shoulders and rock the keys into and out of locking position.

For the purpose of securing a quick rocking action of the keys, especially when the keys are being thrown to locking position, a U-shaped spring 49 is carried in an aperture in the central portion of the yoke which extends transversely of the key. The spring is held in the yoke by means of a set screw 50 which is carried in the central portion of the yoke and bears on the spring. The sides of the spring lie in recesses in the inner faces of the yoke arms to points about diametrically opposite on the shaft, and then said sides normally turn inwardly from the arms, in such a position that when the arm is on a shoulder or rounded portion of the shaft, the end of the spring will not be compressed but will curve beneath the shaft, and when the arm is in a notch the end of the spring will be compressed by the arm against the bottom of the notch.

For the purpose of preventing the lugs 24 from causing the selective gears to wear eccentric when the lugs are out of locking position, washers 51 of hard metal are interposed between the gears and each is provided with a notch 52 which opens from the aperture in the washer and is adapted to receive a pin 53 on the shaft which causes the

washer to rotate with the shaft. Each of the loose gears is provided with a notch 54 which permits the gear to be passed over the pin 53 into position on the shaft 5.

The operation of the construction shown is as follows: When the parts are in the position shown in Fig. 1 of the drawings, the gear 10 is locked to the shaft 5, and the gears or rotative members 11, 12 and 13 are running idle. In this position the arm 32 of the yoke 29 is in the notch 33 of the shaft 5, and the arm 31 is resting on the shoulder 39, and the lug 24 of the key 22 is turned into the locked recess of the gear 10. (See Figs. 1, 3 and 5.) The end of the spring 49 adjacent to the arm 32 is compressed against the bottom of the notch 33 and tends to rotate the key back to normal position. The other end of the spring is relaxed, since it is out of contact with the shaft. Also in this position the arm 32 of the yoke 28 is on the shoulder 46 and the arm 31 is in the notch 41, and the lug 24 of the key 21 is held in release position at a point between the recesses 16 of the gears 12 and 11, but nearer the recess in the gear 12. (See Fig. 1.)

When the collar 26 is moved away from the gear casing the beveled portion 25 of the lug 24 engages the beveled edge of the recess 16 of the gear 10 and tends to rotate the key 22 back to normal or release position, and at the same time the arm 31 of the yoke 29 passes off the shoulder 39 into the notch 37, and the arm 32 of said yoke passes out of the notch 33 onto the shoulder 35, thereby assisting in turning the key 22 back to normal position and retracting the lug 24 into the key seat 20. (See Fig. 6.) This movement compresses the end of the spring 49 against the arm 31 of the yoke 29 and relaxes the opposite end of the spring. The yoke 28 moves simultaneously with the yoke 29, and at the point where the lug 24 of the key 22 has just passed out of the locking recess of the gear 10, the lug 24 of the key 21 is about to enter the recess of the gear 11, and none of the gears are locked to the shaft. Further movement of the collar 26 in the same direction brings the arm 32 of the yoke 28 into the notch 45 and the arm 31 of said yoke onto the shoulder 44, thereby rotating the key 21 to bring its lug 24 to locking position to lock the gear 11 on the shaft. Further outward movement of the collar causes the key 22 to lock the gear 12 to the shaft, and still further movement causes the arm 32 of the yoke 28 to travel onto the shoulder 48 and the arm 31 of said yoke to travel into the notch 43, thereby rocking the key 21 in the reverse direction to lock the reverse gear 13 to the shaft. When the collar 26 is moved in the opposite direction on the shaft 5 the keys 21 and 22 travel inwardly and lock the gears in the reverse order. There is a point between each two adjacent gears where both keys are out of locking position, with the result that no power is then applied to the shaft 5. The transmission device above described and shown constitutes the subject-matter of my prior Patent No. 1,135,354, as aforesaid.

Now referring to the features of construction in the locking lug 24 and the abutment plate 18, these two elements constituting the clutch mechanism forming the subject-matter of the present application, attention is particularly invited to Figs. 3 and 4 of the drawings. As shown in said figures, the locking lug 24 of each key 21, 22, is provided with a flat contact face 24^a adapted, when the said lug extends beyond the circumferential surface of the shaft 5, to engage the shoulder formed by the abutment plate 18. To bring the lug 24 into the position just referred to, the locking key is rotated or rocked within its key seat 19, 20, as hereinbefore described. Referring to said Figs. 3 and 4, the abutment plate 18 is located laterally of a vertical plane passing through the axes of rotation of the shaft 5 and the key 22, and substantially parallel thereto. The inner face 18^a of said plate constitutes the contact face thereof, and is complementary to and adapted for contact with the face 24^a of the locking lug 24, and, for reasons hereinafter pointed out, this contact face of said plate is, by preference, slightly inclined to the above mentioned vertical plane, that is, the contact face 18^a lies in a plane inclined upwardly toward said vertical plane. By reason of the lateral displacement of the plate and the inclination of its contact surface, as before suggested, an important result is obtained which may be described as follows:

The pressure or force which is sustained by the lug 24, by reason of the contact between the said lug and the plate 18, is obviously distributed and directed along a plurality of lines which are parallel to each other and at right angles to the contact face 18^a. The greater pressure is of course, exerted at the base of the lug. Said lug 24, when in contact with the plate 18, has its outer longitudinal edge in contact with the downwardly facing surface of the locking recess 16, as shown in Fig. 3, and any part of the pressure exerted on the lug tending to turn the same and key in a direction away from the plate is resisted by the portion of the gear with which said lug is in contact. As a result, one of the component parts of the force exerted on the lug is in a direction to force the key toward and into contact with its seat. Consequently, the pressure on the lug and key is resisted by an unyielding part of the shaft 5. The key and lug thereby are subjected in part to a compressive force, which the parts are readily capable of understanding, due to the shaft

5 taking up in part the pressure exerted on the lug 24 by the plate 18, and hence there is less tendency of the lug being sheared or broken off by the shock due to the sudden contact of the lug with the abutment at the instant of engagement of the revolving gear wheel or rotative member and the non-rotative drive shaft. This advantage is readily appreciated by considering the conditions were the abutment plate radially arranged with respect to the shaft 5. If the said contact face were on a line radial to the shaft, the pressure of the locking shoulder or plate on the lug would tend to press the lug in the direction of a line tangential to the surface of the shaft, and such pressure would tend to shear or break off the part of the lug which projects outside of the circumference of the shaft, because the direct pressure of the shoulder would then be unresisted by the abutting of the lug against the gear wheel or rotative member and an opposed resisting surface of the shaft. When, however, the lug and shoulder 18 are arranged and made as described and shown, the pressure of the locking shoulder against the shoulder-engaging portion of the lug, tends to press the lug in a direction toward its key seat, so that the force or strain on the lug is in part a compressive one, tending to crush the lug, and obviating the tendency to shear or break off its part which projects from the shaft and engages said locking shoulder on the wheel. The lug made as described, therefore, is capable of withstanding, without injury, a pressure greatly in excess of that which it would withstand if subjected to a breaking or shearing strain only. This feature of construction in the lug is applicable to any form of clutch having a rocking or oscillating locking lug and need not be limited to an endwise slidable key, as herein shown and described. Should the contact face 18^a be radially disposed with respect to the shaft 5, as just stated, the key would sustain but a comparatively small part of the force exerted. The additional inclination of the contact surface of the lug and plate acts to direct the force of the contact to a greater degree away from the tangential and toward the axis of the shaft.

For instance, in Fig. 7 I have shown an abutment plate 60 so arranged that its contact face 61 is in a plane at a greater degree of inclination to a vertical plane passing through the axes of rotation of the shaft 5 and the key 22 than the plane in which the contact face 18^a of the abutment plate 18 is located. As a result of the arrangement shown in said Fig. 7, the pressure or force which is sustained by the lug 24, when the latter is in contact with the plate 60, is distributed and directed along plurality of lines parallel to each other and at right angles to the contact faces of such parts, and at a greater distance away from the tangential and nearer the axis of the shaft 5 than gained with the arrangement shown in Fig. 3. In Fig. 7, the dotted line 62 represents one of such lines of the force. As shown, said line 62 passes through the base of the contact face 61, through the lug and body of the key 22, and into the shaft 5 opposite the contact face 61, slightly below the outer face of the key. Such line therefore, illustrates that a portion of such force is therefore resisted by a portion of the concave face of the key seat with which the key is in contact. In the construction thus described and shown in Fig. 7 the advantages heretofore set out are accelerated, and the tendency to shear off the lug when the latter engages the plate 18 is reduced to the minimum under the usual loads to which the parts are subjected when in use.

The advantage of this construction of the lug and arrangement of the plate permits the parts to withstand excessive pressures and impacts without liability of injury and breakage. This feature of construction is applicable to any form of clutch, having a rocking or oscillating locking lug, and therefore I do not wish to be limited to the particular construction or application herein illustrated and described.

I claim as my invention:

1. The combination of a shaft provided with a concave key seat, a rotative member mounted on said shaft and provided with an internal shoulder, and a semi-cylindrical key rockably mounted in said concave key seat, said key being provided with a lug adapted to engage said shoulder, for locking said rotative member to said shaft, and the contact faces of said lug and shoulder being substantially flat.

2. The combination of a shaft provided with a concave key seat, a rotative member mounted on said shaft and provided with an internal shoulder, and a semi-cylindrical key rockably mounted in said concave key seat, said key being provided with a lug adapted to engage said shoulder, for locking said rotative member to said shaft; the contact faces of said lug and shoulder being substantially flat, and the contact face of said shoulder being, when the latter is in contact with said lug, in a plane substantially parallel to a plane passing through the axes of rotation of said shaft and said key.

3. The combination of a shaft provided with a key seat, a rotative member mounted on said shaft, an abutment plate secured to said rotative member and forming a locking shoulder, and a key rockably mounted in said key seat, said key being provided with a lug adapted to engage said plate, for locking said rotative member to said shaft; the contact face of said plate and said lug being sub-

stantially flat, and the contact face of said plate being, when the latter is in contact with said lug, in a plane laterally spaced from and slightly inclined outwardly toward a plane passing through the axes of rotation of said key and said shaft.

In testimony, that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 18th day of April A. D. 1914.

LEON JAY CAMPBELL.

Witnesses:
EUGENE C. WANN,
MAURICE D. HERMAN.