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STARTING APPARATUS

Original Filed Nov. 5, 1914

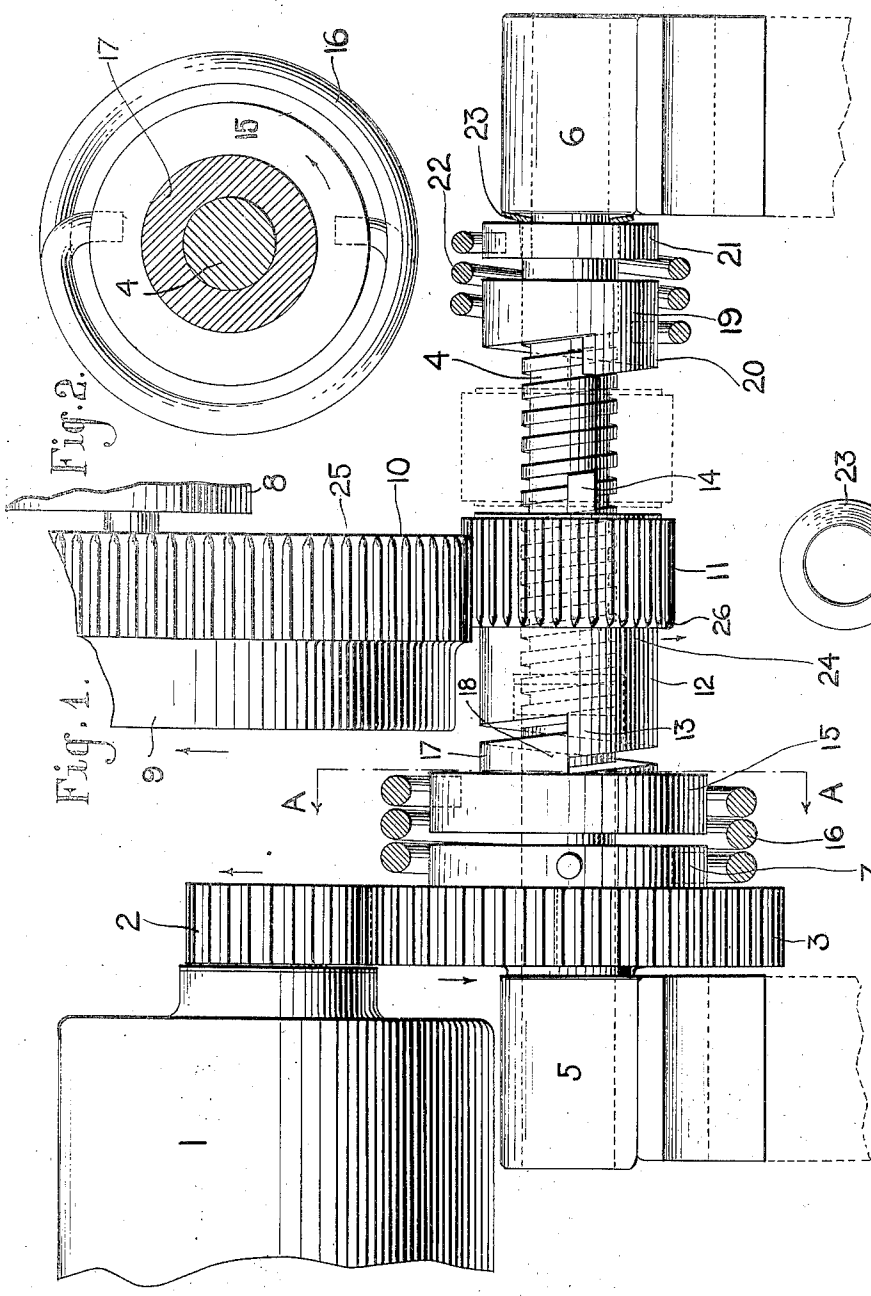


Fig. 1.

Fig. 2.

Fig. 3.

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STARTING APPARATUS.

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To all whom it may concern:

Be it known that I, JOSEPH BIJUR, a citizen of the United States, and residing at New York, in the county of New York and State of New York, have invented a new and Improved Starting Apparatus, of which the following specification is a full disclosure.

This invention relates to starting apparatus, particularly applicable to automobile engines and the like.

One of the objects thereof is to provide practical and effective apparatus of the above nature in which the power of the starting motor is most economically used.

Another object is to provide improved apparatus of the above type of reliable action and durable under conditions of use.

Another object is to provide simple apparatus of the above type in which the movements of the parts are automatic and in which the attention required is reduced to a minimum.

Other objects will be in part obvious from the annexed drawings and in part indicated in connection therewith by the following analysis of this invention.

This invention accordingly consists in the features of construction, combinations of parts, and in the unique relations of the members and in the relative proportioning and disposition thereof; all as more completely outlined herein.

To enable others skilled in the art so fully to comprehend the underlying features thereof that they may embody the same by the numerous modifications in structure and relation contemplated by this invention, drawings depicting a preferred form have been annexed as a part of this disclosure, and in such drawings, like characters of reference denote corresponding parts throughout all the views of which:—

Fig. 1 is a side elevation, certain parts being cut away in order to disclose the construction more clearly.

Fig. 2 is a sectional view taken substantially along the line A—A of Fig. 1.

Fig. 3 is a detail elevation of a spring.

Referring now to Fig. 1 of the drawings, there is shown at 1 a source of power, preferably an electric motor. The armature shaft of this motor is provided with a pinion 2 meshing with a larger gear 3 upon a shaft 4 journaled in bearings 5 and 6. Gear 3 is fast upon the shaft 4 and is provided with a hub 7 which turns therewith.

There is diagrammatically indicated at 8 an internal combustion engine, the fly wheel of which is shown at 9 and is provided with a gear portion 10.

Shaft 4 is threaded throughout a portion of its length and mounted thereon is a pinion 11 provided with an extended hub 12. The various parts are so formed and mounted that as the pinion 11 travels along shaft 4, as hereinafter described, it enters into mesh with the co-acting gear 10 upon the engine. The hub 12 is so formed as to provide a large ratchet tooth 13 and this disposition of its metal, in combination with the weight of the pin 14 upon the opposite side of pinion 11, unbalances the member of which they form a part, or, in other words, results in a material excess of weight upon one side of its axis of rotation with respect to the opposite side.

Loosely mounted upon shaft 4 is a collar 15 connected with the hub 7 by means of a heavy spiral spring 16 for a purpose hereinafter described. This collar is provided with a hub or extension 17 formed to present a tooth 18 for co-action with the tooth 13 upon the hub 12.

At the opposite end of shaft 4 is a collar 19 loosely mounted upon the shaft to permit angular and sliding motion with respect thereto. This collar is provided with a tooth portion 20 adapted to be engaged by the pin 14, as hereinafter described, and is connected with a collar 21, keyed to the shaft, by means of a spiral spring 22.

A slight end-wise movement of shaft 4 with respect to its bearings is permitted by a spring 23 interposed between the fixed collar 21 and the bearing 6. This spring, shown in plan in Fig. 3, preferably takes the form of a thin annulus of spring steel, slightly dished, as indicated in cross section in Fig. 1.

The action of the above described apparatus is substantially as follows:—

The pinion 11 normally occupies the position indicated by dotted lines in Fig. 1

of the drawings. Upon motor 1 being started it drives the gear 3 in the direction indicated by the arrow, giving a corresponding direction of turning to the threaded shaft 4. This action causes the pinion 11, with associated parts, rapidly to move along shaft 4 in the direction of gear 3; the longitudinal rather than rotary movement of the pinion being due partially to inertia and partially to its unbalanced weight. As the pinion 11 comes into mesh with gear 10 the tooth 13 is engaged by the tooth 18 formed upon the rotating hub 17. There is, however, no objectionable shock due to engagement as the spring 16 is at the first instant merely coiled, thus storing the momentum of the rotating parts for a more effective action in driving gear 10 and starting the engine 8. Upon the engine being started, it in turn drives pinion 11 at a higher rate of speed than that of the shaft 4 and by an action the reverse of that first described, the pinion immediately moves out of mesh. The pinion, now turning rapidly, passes toward collar 19 until pin 14 comes into engagement with the tooth 20, thus bringing the pinion down to the rate of rotation of shaft 4. It may be noted that the shock of engagement between the above parts is cushioned by the coiling of the lighter spring 22. The pinion stays in this position, turning with shaft 4 until the latter comes to rest, the centrifugal effect of its unbalanced weight tending to cause it to maintain the same rate of rotation as the shaft.

The teeth upon the pinion 11 are pointed at the end, as indicated at 24, in order to insure proper meshing with the teeth of gear 10 which are likewise pointed, as indicated at 25. Also the pointed ends of all of these teeth are rounded inwardly toward the axis of the gears as indicated at 26. If, however, it should so happen that these teeth meet precisely end to end, there is no binding of the parts as a slight endwise movement is permitted to the entire shaft 4 with the several devices mounted thereon. This movement tends to compress or flatten the disc spring 23, thus preventing the pinion from being jammed against the gear by the thread and permitting a slight rotation of the pinion to bring the teeth into proper meshing relation. It may also be noted that this disposition of the parts so that the pinion moves into mesh in the direction here shown, instead of the reverse, presents certain advantages in the matter of compactness of construction and efficiency of action. Furthermore, the pitch of the screw thread on shaft 4 is greater than the angle at which the pinion would jam at the end of such thread. This angle varies with the coefficient of friction of the materials used and is, for example, with steel parts about 14°.

It will thus be seen that there is provided apparatus in which the several objects of this invention are achieved.

As many changes might be made in the above construction, and as many apparently different embodiments might be made of this invention without departing from the scope thereof, it is intended that all features herein described or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. In apparatus of the class described, in combination, an internal combustion engine, a motor, a threaded shaft driven from said motor, a gear threaded upon said shaft, a gear connected with said engine, said gears being positioned to come into mesh as said shaft is driven from said motor, and means adapted for endwise movement of said threaded shaft comprising a disc spring surrounding said shaft.

2. In apparatus of the class described, in combination, an internal combustion engine, a motor, a threaded shaft driven from said motor, a gear threaded upon said shaft, a gear connected with said engine, said gears being positioned to come into mesh as said shaft is driven from said motor, and a disc spring surrounding said shaft and positioned to permit an endwise movement of said threaded shaft and tending to return it to normal position.

3. In apparatus of the class described, in combination, a rotatable shaft, a driving member mounted thereon for longitudinal movement thereon for engaging with a member of the engine to be started, and for rotary movement therewith, a part loosely mounted on the shaft for independent rotary and longitudinal movement and adapted to be operatively connected with the driving member in the driving operation, and a yielding connection between said part and the shaft.

4. In apparatus of the class described, in combination, a rotatable shaft, a driving member mounted thereon for longitudinal movement thereon for engagement with a member of the engine to be started, and for rotary movement therewith, a part loosely mounted on the shaft for independent rotary and longitudinal movement and adapted to have clutch connection with the driving member in the driving operation, and a yielding connection between said part and the shaft.

5. In apparatus of the class described, in combination, a rotatable shaft, a driving member mounted thereon for longitudinal movement thereon for engagement with a member of the engine to be started, and for rotary movement therewith, a part loosely mounted on the shaft for independent rotary and longitudinal movement, said part and said member having cooperating clutch jaws

which engage in the driving operation, and a yielding connection between said part and the shaft.

6. In apparatus of the class described, in combination, a rotatable shaft, a driving member mounted thereon for longitudinal movement thereon for engagement with a member of the engine to be started, and for rotary movement therewith, a part loosely mounted on the shaft for independent rotary and longitudinal movement, said member having an extension provided with an end clutch jaw, and said part having a cooperating end clutch jaw engaging the other jaw in the driving operation, and a yielding connection between said part and the shaft.

7. In apparatus of the class described, in combination, a rotatable shaft, a driving member mounted thereon for longitudinal movement thereon for engagement with a member of the engine to be started, and for rotary movement therewith, a part loosely mounted on the shaft for independent rotary and longitudinal movement and adapted to be operatively connected with the driving member in the driving operation, and a torsion spring between said part and the shaft.

8. In apparatus of the class described, in combination, a rotatable shaft, a driving member mounted thereon for longitudinal movement thereon for engagement with a member of the engine to be started and for rotary movement therewith, a collar loosely mounted on the shaft for independent rotary and longitudinal movements and adapted to be operatively connected with the driving member in the driving operation, and a torsion spring connected with the collar and the shaft respectively.

9. In apparatus of the class described, in combination, a rotatable shaft, a driving member mounted thereon for longitudinal movement thereon for engagement with a member of the engine to be started and for rotary movement therewith, a collar loosely mounted on the shaft and adapted to be operatively connected with the driving member in the driving operation, a second collar secured to said shaft, and a torsion spring encircling and fastened to the two collars respectively.

10. In apparatus of the class described, in combination, a rotatable screw shaft, a pinion threaded thereon for longitudinal movement thereon for engagement with a member of the engine to be started and for rotary movement therewith, a collar loosely mounted on the shaft, for independent rotary and longitudinal movements, said collar and pinion having cooperating end clutch jaws which engage during the driving operation, and a torsion spring between the collar and the shaft.

11. In apparatus of the class described, in combination, a rotatable shaft, a driving member mounted thereon for longitudinal movement thereon for engagement with a member of the engine to be started and for rotary movement therewith, a collar loosely mounted on the shaft adjacent the normal position of the driving member and adapted to be engaged thereby for rotarial movement when the driving member is returned to its normal position, and a yielding connection between such collar and shaft.

12. In apparatus of the class described, in combination, a rotatable shaft, a driving member mounted thereon for longitudinal movement thereon for engagement with a member of the engine to be started and for rotary movement therewith, a collar loosely mounted on the shaft adjacent the normal position of the driving member and adapted to be engaged thereby for rotarial movement when the driving member is returned to its normal position, and a torsion spring between such collar and shaft.

13. In apparatus of the class described, in combination, a rotatable shaft, a driving member mounted thereon for longitudinal movement thereon for engagement with a member of the engine to be started and for rotary movement therewith, a collar loosely mounted on the shaft adjacent the normal position of the driving member and adapted to be engaged thereby for rotarial movement when the driving member is returned to its normal position, said driving member and collar having cooperating jaws which engage when the driving member is returned to normal position, and a yielding driving connection between such collar and shaft.

14. In apparatus of the class described, in combination, a rotatable shaft, a driving member mounted thereon for longitudinal movement thereon for engagement with a member of the engine to be started and for rotary movement therewith, a collar loosely mounted on the shaft adjacent the normal position of the driving member and adapted to be engaged thereby for rotarial movement when the driving member is returned to its normal position, said driving member and collar having cooperating jaws which engage when the driving member is returned to normal position, a second collar secured to the shaft and adjacent to the first collar, and a torsion spring secured to the two collars respectively.

15. In apparatus of the class described, in combination, a rotatable shaft, a driving member mounted thereon for longitudinal movement thereon for engagement with a member of the engine to be started and for rotary movement therewith, a collar loosely mounted on the shaft adjacent the normal position of the driving member and adapted to be engaged thereby for rotarial movement when the driving member is returned

to its normal position, said driving member and collar having cooperating jaws which engage when the driving member is returned to normal position, a second collar secured to the shaft and adjacent the first collar, a yielding connection between the two collars, a bearing for the end of the shaft adjacent such collars, and a spring interposed between the bearing and the second collar to permit of yielding endwise movement of the shaft,

In witness whereof, I hereunto subscribe my name.

JOSEPH BIJUR.