Nov. 28, 1939. O. R. FRITZ 2,181,805

STARTING DEVICE FOR INTERNAL COMBUSTION MOTORS AND SIMILAR ENGINES

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Fig.1

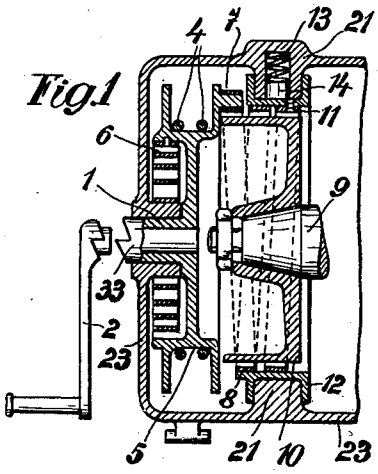


Fig.2

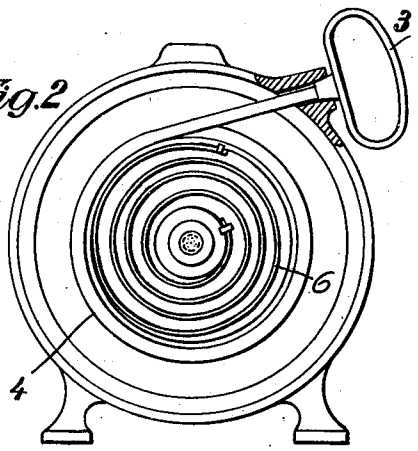


Fig.3

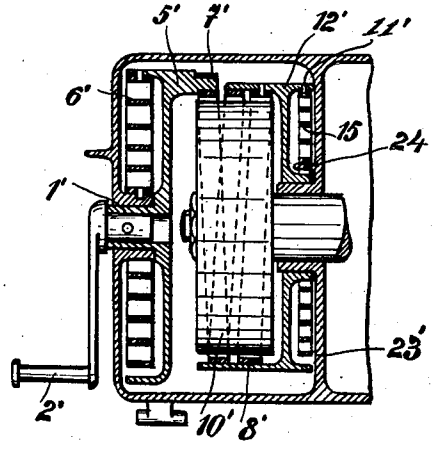


Fig.4

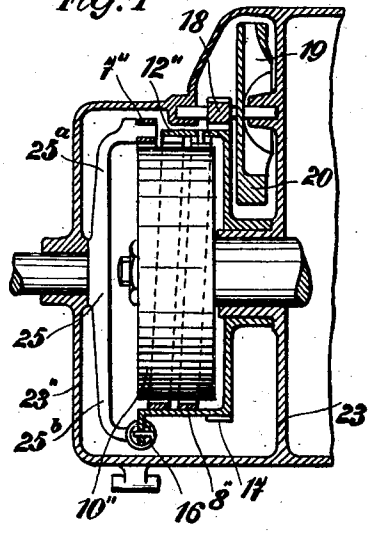
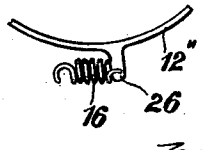


Fig.5



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STARTING DEVICE FOR INTERNAL COMBUSTION MOTORS AND SIMILAR ENGINES

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8 Claims. (Cl. 185—41)

The invention refers to a starting device for internal combustion and similar engines, in which a loop shaped steel band is inserted between a driving and a driven part, the steel band surrounding the latter helically and acting as a friction coupling when starting the engine. The arrangement hitherto known consisting in the band being joined with one end to the driving part and resting with the other end against a sleeve, freely rotatable on that part to be maintained on the sleeve by means of frictional force, is not safe in view of the fact that the friction between the steel band end and the sleeve is too small for warranting in starting a firm embrace of the driven parts. Furthermore, the accumulated energy in the steel band under tension is not sufficient for instantly releasing the starting device in case of return shocks.

The subject matter of the invention is a starting device in which the above disadvantages are eliminated by the one end of the steel band being joined in the manner known to the driving part whilst the other end is connected by means of a braking arrangement to a fixed part of the engine, particularly the casing. The braking effect between the fixed part and the band end is far greater than that between the steel band and a sleeve rotatable on the driving part so that the steel band, according to the invention, is put under the necessary tension in starting, and is released immediately in case of return shocks. The effect is still heightened by an elastic member being inserted between the end joined to the driving part and the casing wall, whilst a separate braking device is provided between the other end and another point of the casing wall. The braking device is advantageously formed e. g. as a drum-shaped braking disc joined to the one end of the steel band and guided on an annular projection of the starter casing in connection with a friction member arranged on or in the casing and touching the braking disc, which member may e. g. consist of a loaded piston or bolt guided in the casing. The friction member may also be formed by a spring which, according to its frictional effect, may be made to tally with the spring placed between the driving member and the steel band. Finally an air propeller brake may be used instead of a friction brake for establishing the connection between the steel band and the driven part.

In order, that the invention may be clearly understood and readily carried into effect, the same will now be more fully described with reference to the accompanying drawing which shows, by way of example, various embodiments of the invention.

Fig. 1 is a section through a starter in which the brake is formed by a drum-shaped disc and a piston or bolt pressed against same.

Fig. 2 is a front elevation of the starter according to Fig. 1 with the front casing wall removed.

Fig. 3 is a section through a starter with a spring brake.

Fig. 4 a section through a starter with air propeller brake whereby the driving and the driven parts are connected by means of a spring and

Fig. 5 is a detail showing this spring connection in side elevation.

In the embodiment shown in the Figs. 1 and 2 a driving shaft 1 is provided to be actuated by means of a hand crank 2 or a handle 3. For the crank the usual claw coupling 33 is used whilst the handle 3 is connected to a pulling member, e. g. a cable or a chain 4 wound round a drum connected to the driving shaft 1. On one side the drum 5 is fastened to a return spring 6 whilst, the other end is connected to the one end 7 of a steel band. The steel band 8 is looped or wound helically and is made to surround the starter disc 10 fixed to the driven shaft 9 without, however, touching that disc. On the other end, the steel band 8 is fastened at point 11 to a drum shaped disc 12 where by the tension inherent, the proper elasticity and the return spring 6 press it against the inner walls of the drum-shaped disc. This disc 12 is guided by an annular projection 21 of the casing 23 on the engine body. In the projection a braking piston or bolt 14 is housed, which rests on the disc 12 and is operated by a pressure spring 13.

The device operates as follows: The driving shaft 1 being turned against the action of the spring 6, by the crank 2 or by the handle 3, the end 7 of the spring steel band 8 which is connected to the cable disc 5 is put into motion. If the direction of motion corresponds to the helical line of the band 8 the end 11 of same will oppose a resistance to this motion considering that the band end 11 is connected to the disc 12 and the disc 12 is acted upon by the braking parts 13 and 14. In consequence thereof, the steel band 8 will contract around and embrace the driven parts i. e. the starter disc 10. By the friction occasioned thereby between the steel band contracted and the starter disc 10 the driving shaft 1 is coupled to the driven shaft 9. If the torque or moment of torsion of the driving shaft 1 is suddenly reduced owing

to a decrease or cessation of the force acting on the crank or the handle and if, in consequence thereof, a power excess is created in the starter disc 10 of the driven shaft 9, the steel band is loosened and the coupling is disengaged. Under the continuous action of the spring 6 which operates in the opposite direction of the hitherto forces the helical spring steel band is expanded so as to perfectly release the disc 10 and return to the disc 12. Besides the braking force at 14 changes its direction which likewise facilitates the expanding of the steel band. Therefore, a co-operation takes place between the proper elasticity of the spring steel band 8, the return spring 6 and the brake 12, 13, 14 resulting in a sudden expanding of the steel band and in an instantaneous release of the starter drum in the moment the tractive force, acting on the crank or the handle, is reduced.

Similar conditions are met with in case of return shocks of the motor. The starter disc 10 is then moved in the direction opposite to the starting motion. However, the steel band wound round the disc 10 is not entrained as might be supposed, but it is expanded as the braking power formed at 12, 14 prevents this movement. It results therefrom, that in this case too, a sudden release of the starting disc is obtained. In other words, the return shock can not be transmitted to the crank or the handle.

The embodiment as per Fig. 3 is in fundamental conformity with the design as per Figs. 1 and 2. Consequently the corresponding parts have been designated accordingly There is a crank 2' connected to the driven shaft 1', and a return spring 6' acting on the disc 5'. The difference over the first mentioned embodiment consists in the braking of the drum 12' being taken care of by a brake spring 15 concording in its capacity with the return spring 6' The brake spring is joined e. g. by riveting with its one end at 11' to the drum 12' and is connected with its other end to a projection 24 of the casing 23'.

Fig. 4 shows the subject matter of the invention applied to an embodiment as may be used for coupling a driving and a driven part, considering that the invention also comprises measures of this kind.

The design is similar to that of the other embodiments with the exception that the braking of the drum 12'' is arranged in a different manner. The drum 12'' carries a toothed rim 17 which registers with a spur gear wheel 18 of an air propeller brake. Furthermore, the air propeller brake is provided with blocks 20 acting as weights and serving to increase the inertia of the masses. The helically wound steel band 8'' is connected with its one end 7'' to one arm 25*a* of a bow 25, adapted on the driving shaft 1, whilst the other end 37'' is riveted to the drum 12''.

To assure the steel band 8'' expanding in all cases, also in the case of the steel band being thin and of a low proper elasticity, a spring 16 is adapted between a second arm 25*b* of the bow 25 and a projection 26 of the drum 12'', which spring has the tendency to turn the two parts connected by it against one another, opening thereby the steel band and freeing the disc 10'' of same. In operating the starting or coupling device, having such supporting spring, the tension of this spring and of the steel band 8'' must be overcome for contracting the latter so that it embraces the disc 10'' with friction.

The invention is not confined to the above mentioned embodiments. The braking of the drum 12 may be done by fluid brakes, electric brakes and the like.

Having thus described my invention, I claim:

1. A starting device for internal combustion and similar engines consisting of a casing, a driving part, a braking device, a loop-shaped steel band connected with one end to the driving part and with the other end to the braking device, a driven part for connection to the engine shaft, said band serving as a frictional coupling between the driving part and driven part, the steel band, the driving part, the braking device and the driven part being rotatably mounted in the casing.

2. A starting device for internal combustion and similar engines consisting of a casing, a driving part, a loop-shaped steel band connected to it, a braking device one member of which being fastened to the steel band and rotatably guided on an annular projection of the casing, and a driven part for connection to the engine shaft, and steel band acting as a frictional coupling between the driving and driven parts, the driving and the driven part being rotatably mounted in the casing, the braking device being composed of a drum on whose inner side the steel band is fixed and a braking bolt lodged in the annular projection in contact with said drum.

3. A starting device for internal combustion and similar engines consisting of a casing, a driving part, a loop-shaped steel band connected to it, a braking device one member of which being fastened to the steel band and rotatably guided on an annular projection of the casing, and a driven part for connection to the engine shaft, the steel band encircling the driven part and serving when under the influence of the driving part to act as a frictional coupling between said driving and driven parts, the driving and the driven parts being rotatably mounted in the casing, the braking device being composed of a drum on whose inner side the steel band is fixed and a helical spring united with its one end to the drum and with its other end to the casing.

4. A starting device for internal combustion and similar engines consisting of a casing, a driving part, a loop-shaped steel band connected to it, a braking device one member of which being fastened to the steel band and rotatably gu ded on an annular projection of the casing, and a driven part for connection to the engine shaft, the steel band encircling the driven part and serving when under the influence of the driving part to act as a frictional coupling between said driving and driven parts, the driving and the driven parts rotatably mounted in the casing, the braking device being composed of a drum on whose inner side the steel band is fixed, the drum being provided with a toothed crown engaging in a gear of a propeller brake, supported in the casing.

5. A starting device for internal combustion and similar engines consisting of a casing, a driving part, a braking device, a loop-shaped steel band connected with one end to the driving part and with the other end to the braking device, a driven part for connection to the engine shaft, the steel band encircling the driven part and serving when under the influence of the driving part to act as a frictional coupling between said driving and driven parts, the driving part, the braking device and the driven part being rotatably mounted in the casing; further an elastic

member inserted between the end joined to the driving part and the casing.

6. A starting device for internal combustion and similar engines consisting of a casing, a driving part, a braking device, a loop-shaped steel band connected with one end to the driving part and with the other end to the braking device, a driven part for connection to the engine shaft, the steel band encircling the driven part and serving when under the influence of the driving part to act as a frictional coupling between said driving and driven parts, the driving part, the braking device and the driven part being rotatably mounted to the casing; further an elastic member inserted between the end joined to the driving part and the casing, the starting member consisting of a spring of the helical type connected with its one end to the driving part and with its other end to the casing.

7. A starting device for internal combustion and similar engines consisting of a casing, a driving part, a braking device, a loop-shaped steel band connected with one end to the driving part and with the other end to the braking device, a driven part for connection to the engine shaft, the steel band encircling the driven part and serving when under the influence of the driving part to act as a frictional coupling between said driving and driven parts, the driving part, the braking device and the driven part being rotatably mounted in the casing, further an auxiliary traction spring connected with its one end to the driving part and with its other end to the braking device.

8. A starting device for internal combustion and similar engines consisting of a casing, a driving part, a braking device, a loop-shaped steel band connected with one end to the driving part and with the other end to the braking device, a driven part for connection to the engine shaft, the steel band encircling the driven part and serving when under the influence of the driving part to act as a frictional coupling between said driving and driven parts, the driving part, the braking device and the driven part being rotatably mounted to the casing, the driving part being composed of a shaft supported in the casing and a drum surrounded by a pulling member protruding from the casing.

OSWALD R. FRITZ.