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APPARATUS FOR STARTING MOTORS, MORE PARTICULARLY HEAT MOTORS.

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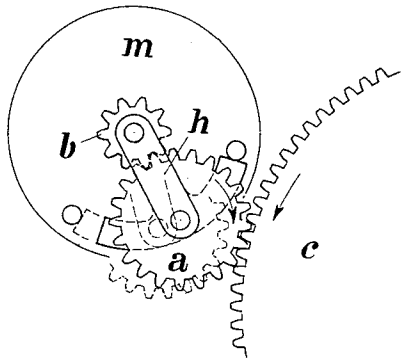


Fig. 1

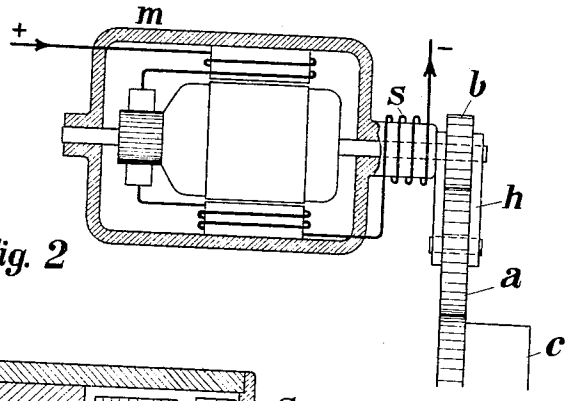


Fig. 2

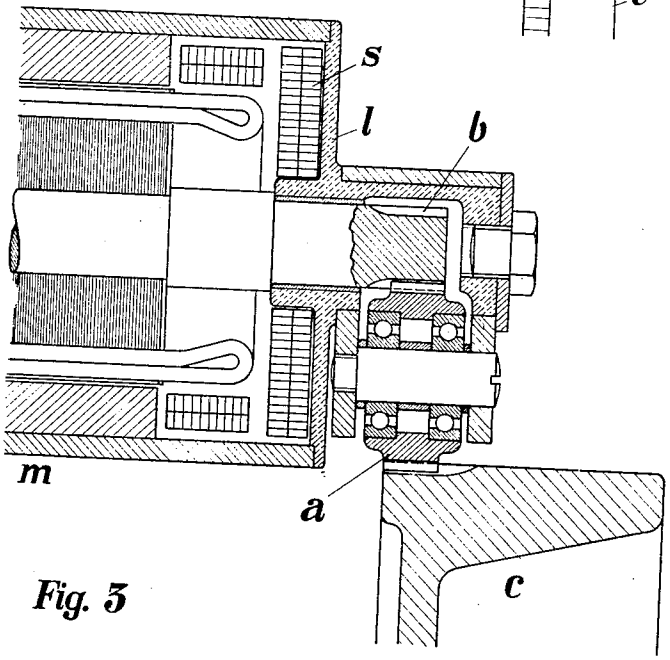


Fig. 3

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APPARATUS FOR STARTING MOTORS, MORE PARTICULARLY HEAT-MOTORS.

1,373,558. Specification of Letters Patent. Patented Apr. 5, 1921.

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To all whom it may concern:

Be it known that I, HEINRICH GÜTTINGER, a citizen of the Swiss Republic, residing at No. 7 Brunnmattstrasse, Baden, Switzerland, have made certain new and useful Improvements in Apparatus for Starting Motors, More Particularly Heat-Motors, of which the following is a specification.

Numerous different devices have already been proposed for starting heat motors; such devices however have been either too complicated or not sufficiently reliable in their operation.

The present invention has now for its object to provide an improved apparatus for starting motors which combines almost a maximum simplicity of construction and certainty in operation. In motorcar work, it is particularly desirable that the starting electric motor shall be as light as possible and yet sufficiently powerful to bring the internal combustion motor to a sufficiently high speed at which ignition is possible under all circumstances. This speed is approximately 10% of the maximum speed of the motor.

It is therefor advisable to construct the starting motor in those dimensions which are favorable only for the said low speed, and as soon as this maximum permissible speed of the starting motor is exceeded by the internal combustion motor, it is required that the starting motor shall be disconnected and stopped.

It has already been proposed to solve this problem by providing an intermediate toothed wheel which is permanently in engagement with the pinion of the starting motor, and mounting said intermediate toothed wheel in such a manner that it can be swung about the axis of the starting motor, so that in starting, the said intermediate wheel will move automatically in between the pinion and the toothed wheel of the motor to be started, and will bring the latter to the desired speed. As soon as the motor to be started begins to work, the toothed wheel is automatically pushed away from the main motor to be started, to such an extent as to bring the teeth of the said intermediate wheel out of engagement with the toothed wheel of the main motor. This method of coupling has the drawback that so long as the starting motor, after it has been uncoupled, continues to run until it is stopped, the teeth of the wheels will roll over each other with different speeds and produce a noise. It has also been proposed to effect the engagement of the intermediate toothed wheel by means of an electromagnet.

According to the present invention the intermediate toothed wheel is magnetized so as to convert it into a movable armature, and in fact so powerfully that it will be caused by magnetic attraction to move into engagement with the two wheels to be coupled together.

The accompanying drawings illustrate by way of example two embodiments of this invention.

According to this invention as shown in the drawings, an electromagnet winding s, which is traversed preferably by the main current of the motor, is arranged around the shaft of the starting motor pinion b. This arrangement is shown diagrammatically in Figures 1 and 2, and in practical construction in Fig. 3.

For the purpose of coupling the pinion b of the starting motor m to the driving wheel c of the internal combustion motor, the intermediate wheel a which is suspended on an arm h from the starting motor shaft, and is always in engagement with the pinion b, is magnetized in starting by means of the winding s, and is thereby drawn into engagement with the wheels b and c to drive the latter and start the internal combustion engine.

If the coil s has a sufficiently powerful action, a sufficiently large magnetic attraction will be produced between a and c, to draw the former into engagement with the latter, the quadrant arm h swinging about the motor shaft, its movement being limited by suitable stops h', on the motor casing m Fig. 1.

As soon as the engine is started in this manner, it has the tendency to drive the starting motor and to increase the latter's speed. As the starting motor however is constructed only for comparatively low speeds, and as the opening of its circuit to throw it out of action is dependent on the discretion of the driver, provision must be made for automatically disconnecting the engine and motor in good time, namely, before the speed of the starting motor has attained a dangerous degree. This automatic disconnection according to this invention is effected

due to current diminuation in coil *s*. The latter is connected in series to the starting motor, and therefore the current will diminish as the motor speed increases and will no longer suffice to magnetize effectively the wheel *a*, so that the latter will move out of engagement with the wheel *c*, partly due to diminution of the magnetic attraction between the toothed wheels in consequence of the resulting increased speed and number of reversals of the magnetism, and also partly to the mechanical action of the wheel *c* driving the toothed wheel *a* in the direction of the arrow (Fig. 1), and partly of course to gravity.

In the construction shown in Fig. 3, the electromagnet winding *s* is located inside the starting motor casing, and therefore the end flange *l* on the starting motor bearing must be made of non-magnetic material.

The engagement by means of a magnetized auxiliary toothed wheel has a further important advantage over what has been hitherto proposed, in that the air gap between the auxiliary toothed wheel *a* and the main wheel *c* can be reduced to a minimum when they are disconnected from each other. In consequence of this a comparatively few magnetizing ampere turns will be sufficient in starting, to cause contact between the two wheels. When such contact is effected, the further engagement of the toothed wheels *a* and *c* until they are in complete driving contact, is effected without any consumption of power due to the rotation of the auxiliary toothed wheel *a* in a clockwise direction by the pinion *b*, pressure of the teeth of the wheel *a* against the teeth of the wheel *c*, tending to move the wheel *a* toward the stop *h'*, which limits the movement of the wheel and arm *h*. As soon as the engagement of the teeth of the wheels is complete, which is the case when arm *h* bears against the upper stop *h'*, the wheel *c* is rotated and the engine started. The starting electric motor will work at full power only when the teeth of the wheels are in proper driving engagement with each other. Consequently the watt consumption in the magnetizing winding is very small so that it can be left out of consideration compared to the total consumption. It is not necessary to provide special means for cutting off the current from the magnetizing winding after the wheels have come into engagement with each other.

What I claim is:—

1. An apparatus for starting an engine, comprising in combination an electric starting motor, a toothed wheel on the engine shaft, a toothed pinion rotated by said motor, an intermediate toothed wheel in mesh with said pinion, means supporting said intermediate wheel for swinging movements about the axis of the pinion to carry said wheel into and out of engagement with the first mentioned wheel, and means for magnetizing said intermediate wheel to a degree sufficient to convert it into an electromagnet armature attracted toward said first-mentioned wheel and into driving engagement therewith.

2. An apparatus as claimed in claim 1, wherein the intermediate toothed wheel and the first-mentioned toothed wheel are relatively arranged so that the driving of the latter wheel by the intermediate wheel tends to retain the latter in driving engagement and the driving of the intermediate wheel by the other wheel tends to move the former out of driving engagement, the position of said wheel being limited by stops, substantially as described.

3. An apparatus as claimed in claim 1, wherein the magnetizing means comprises a magnetizing winding arranged around the shaft of the toothed pinion.

In testimony whereof I have signed my name to this specification.

HEINRICH GÜTTINGER