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B. STORSAND
STARTING DEVICE OR SYSTEM
FOR SQUIRREL CAGE MOTORS
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2,542,296

Fig.1

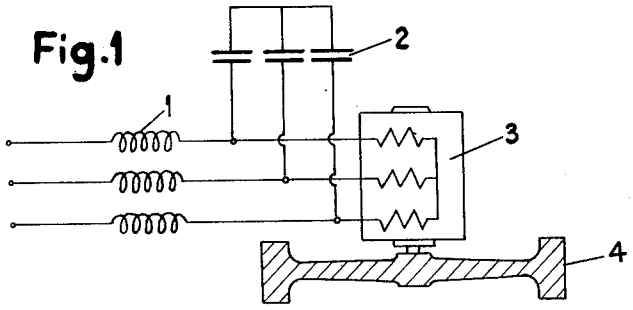


Fig. 2

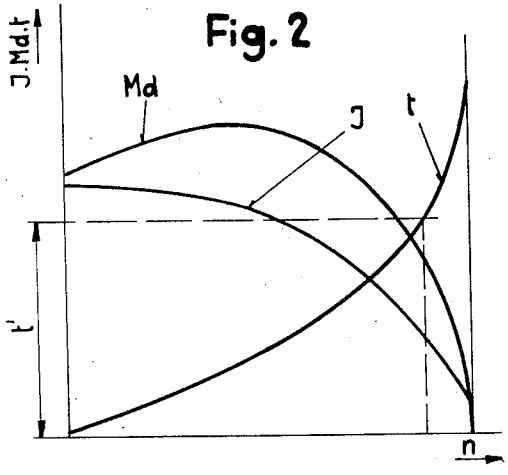
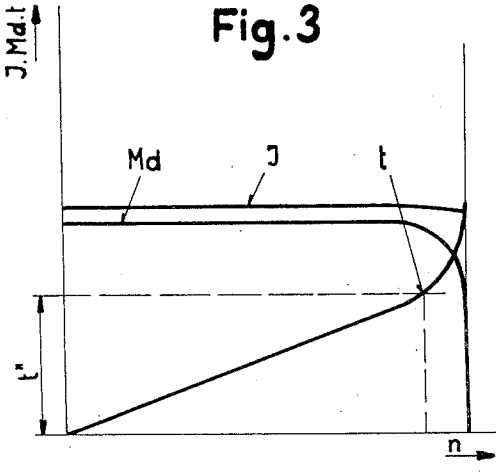


Fig.3



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STARTING DEVICE OR SYSTEM FOR SQUIRREL-CAGE MOTORS

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2 Claims. (Cl. 318—228)

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The present invention relates to improvements in starting devices or systems for squirrel cage motors and especially for such motors as are used with fly-wheel drives. The advantages of the squirrel cage motor in reference to simplicity and rigidity are obtained at the expense of disadvantages in regard to the large starting current, which, for heavy, long-period starting, occurs with drives with large fly-wheels and produces considerable heating of the rotor and stator. Special types of construction, like deep-slot armatures and double cage armatures can somewhat ameliorate but not remove these disadvantages. Since with fly-wheel drives, the rotor losses produced during the starting phase are equal to the energy stored in the fly-wheel at full speed, it is necessary to construct the armatures of such motors with a great heat capacity in the rotor winding. Since, further, the stator losses are smaller for given rotor losses, the larger is the rotor resistance, a simple resistive construction with rod of large section of a poorly conducting material, provides the arrangement suitable for heavy fly-wheel drives.

For example for the electric drive of a vehicle with rotary energy storage it is of importance that the network shall not be too heavily loaded by the starting current of the motor and the torque of the motor at the higher speeds should not fall so low as is the case with simple resistive construction for otherwise the time of starting and running to nearly synchronous speed is too long.

An ideal solution for these conditions can be obtained according to the invention in such a manner that, at least at starting, condensers are connected in parallel with the stator of the motor, which over-compensate the no-load current of the motor, in such a way that the motor-condenser group at the higher speed range shows capacitative characteristics, and that a choke coil is connected in series with the group, which limits a starting current at the lower speeds, while at higher speeds, as a result of the capacitative characteristics of the group, it produces an increase in the motor voltage and thereby of the torque. By correspondingly choosing the value of the capacity and the series inductance the result can be obtained that the current drawn by the motor-condenser group during the whole starting procedure up to the idling speed remains practically constant, while only the phase angle of the current varies. It is even possible to make the short circuit current of such an assembly in the stationary condition, smaller than the

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running current in the middle speed range which permits an extremely easy and yet rapid starting procedure. Such a favourable loading at starting permits the squirrel cage motor to be used, connected directly to the network even for the largest loads.

The reactance of the series choke coil preferably has about the same magnitude as the short circuit reactance of the motor and the condenser current has about the same magnitude as the normal current of the motor. Changes above or below these values permit the conditions of individual cases to be met whereby values from about one-half to about double the above values may be envisaged.

In order to avoid additional losses the condensers or the choke coil may be disconnected after starting. With centrifuge drives the condensers may be used for energising the stator for braking with resistances.

The annexed diagrammatic drawing illustrates one preferred embodiment according to the present invention. In this drawing

Fig. 1 is a diagrammatic representation of the device.

Figs. 2 and 3 show the starting characteristics of a known motor with a resistance rotor and of a motor according to this invention.

In these drawings 1 designates the choke coil, 2 the condenser, 3 the motor and 4 the fly-wheel. In the Figures 2 and 3 Md is the torque, J the primary current and t the time. n is the number of revolutions per minute. It results from these figures that

$$t'' \cong \frac{1}{2} t'$$

What I claim is:

1. In a motor starting system, the combination with an alternating current motor having a polyphase stator winding and a squirrel cage rotor driving a flywheel, of current supply lines one for each phase winding of the stator, an inductance in each said supply lines and in series with the respective phase windings, and a capacitator for each phase winding and connected to said supply lines to be in parallel to said motor, said capacitators being of a size to draw a current which is greater than the no load current of the motor but is smaller than the inductive component of the motor current at blocked rotor, so that the motor and capacitators combined draw in the lower speed range a lagging current and in the upper speed range draw a leading current, which conditions in the lower speed range owing

to the inductive voltage drop in said serially arranged inductances produces a terminal voltage which is smaller than the supply voltage and in the upper speed range owing to the capacitative voltage rise in said serially arranged inductances produces a terminal voltage which is higher than the supply voltage.

2. A motor starting system according to claim 1, in which inductances in the form of choke coils are arranged in said supply lines in advance of said parallel arranged capacitators, said choke coils have an inductance which is greater than one-half of the inductance of the motor when the rotor is blocked, but is smaller than twice the inductance of the motor when the rotor is blocked.

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