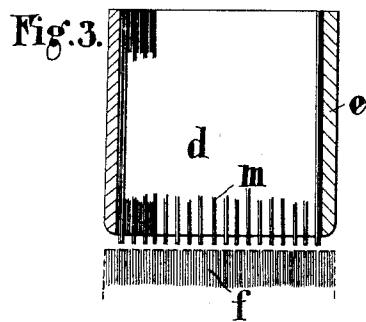
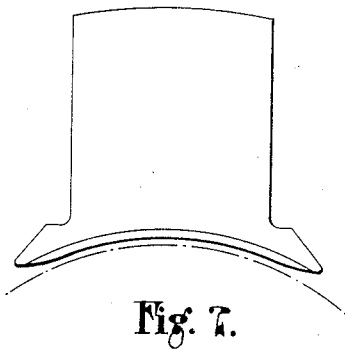
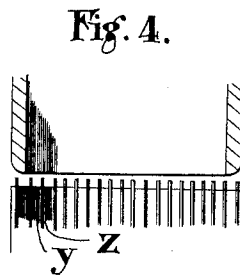
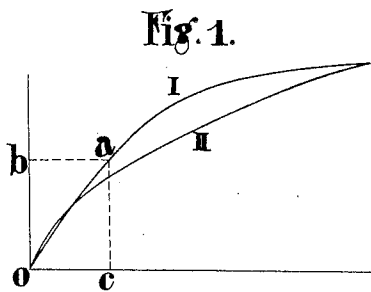


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 SELF EXCITED DIRECT CURRENT DYNAMO ELECTRIC MACHINERY.
 APPLICATION FILED FEB. 12, 1912.

1,220,486.

Patented Mar. 27, 1917.



Witnesses.
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SELF-EXCITED DIRECT-CURRENT DYNAMO-ELECTRIC MACHINERY.

1,220,486.

Specification of Letters Patent.

Patented Mar. 27, 1917.

Application filed February 12, 1912. Serial No. 677,103.

To all whom it may concern:

Be it known that I, PAUL AMSLER, a citizen of the Swiss Republic, residing at Baden, Switzerland, have invented certain new and useful Improvements in and Relating to Self-Excited Direct-Current Dynamo-Electric Machinery, of which the following is a specification.

This invention relates to the stabilization of self-excited direct current dynamo electric machinery.

It is practically impossible to regulate the potential of such machinery along the straight part of the characteristic curve, *i. e.*, the part below the knee. This will be clear by considering the starting operation from a practical point of view. The dynamo is first brought to the desired constant number of revolutions, with the main switch open and the exciting winding unconnected. There is then at its terminals a potential e_0 corresponding to the remanence flux of its magnet poles. If now the circuit of the exciting winding, which may have the resistance r , be connected to the dynamo terminals, an exciting current $i_0 = e_0 : r$ will flow in the said winding. This current will increase the magnetization of the poles and, consequently the terminal voltage e of the dynamo will increase in a similar measure, for instance to the value e_1 which again corresponds to the exciting current of the amount $i_1 = e_1 : r$. It will be perceived that in spite of the resistance of the exciting winding, there is at first no reason for arresting the increase in the voltage e . Such a reason occurs only when the voltage is no longer proportional to the exciting current, because then it has a value e which not only satisfies the equation $e_g = i_g : r$, but also corresponds to the magnetic flux that is generated by the exciting current i_g in the field poles of the dynamo. From this it follows that in self-excited dynamos the voltage cannot be regulated up to the beginning of the sharp bend in the characteristic.

It is already known that it has been proposed to cause the saturation curve to bend at a flux value lower than that at which the bend would normally occur, by operatively introducing an air gap into the magnetic circuit at a predetermined flux, *i. e.*, by contracting the cross-section of the pole body at about its center. This has the great drawback that what is called the "cross field"

of the armature finds an excellent iron path for itself between the armature and this contraction.

According to the present invention the knee of the curve is lower, and the above disadvantage overcome by causing part of the pole to project into the air gap and to secure the desired effect the proportion which projects must be small, namely the cross-section must be between about $\frac{1}{10}$ th and $\frac{1}{12}$ th or even $\frac{1}{12}$ th.

Now it has been proposed to stiffen the flux of a pole of a dynamo electric machine by making some laminae longer than others, the spaces between the long laminae preferably being filled with non-magnetizable material. In this case the proportion of long laminae was one-half the total area of the pole. With such a proportion the knee in a self-excited machine would not be lowered as we have found by experiment. Doubtless the prior arrangement would fulfil its object, *viz.*, stiffening the flux but it is not surprising it would not lower the knee of the curve, because that problem was not attacked and the machine was not a self-excited dynamo electric machine.

In the accompanying drawings Figure 1 shows an excitation curve for ordinary machines and also for a machine according to the present invention.

Figs. 2 and 3 show in elevation and section respectively one form of carrying the invention into effect, and

Fig. 4 shows a modified arrangement in which the saturation occurs in the armature.

In Fig. 1 the relation between exciting current and terminal voltage is shown by the curve *oI* having its knee just above the point *a*. The ratio *ac:ab* being practically constant for all points below the point *a*, regulation below the point *a* cannot be obtained as explained above.

According to the present invention the knee of the curve is lowered and a curve of the order *oII* is obtained. In the form illustrated for effecting this, in Figs. 2 and 3 the pole *d* is formed of laminae suitably inclosed by cheeks *e*. A certain proportion of the laminae *m* forming the pole are of greater length than the remainder and project into the air gap formed between the pole and the armature *f*. By this means it results that the flux-density is much greater in the project-

ing teeth than in the pole body and may be magnetically saturated at comparatively low voltages. It is of course, not necessary that the highly saturated iron parts of small cross section shall be placed in the pole shoe. They may, if desired, be placed in the armature core.

An arrangement of this kind is shown in Fig. 4 in which the core is built of laminæ y with other laminæ z extending further into the air gap.

In both cases thin teeth are produced, the thickness of which is comparatively a small fraction of the width of the slots as calculations have shown that the teeth must be very thin and fine.

Instead of providing projecting laminæ the armature or poles may be solid and provided with turned grooves to obtain the same effect.

In order to obtain the desired effect, it is necessary for the parts of iron projecting into the air gap to have a very slight cross section so far as iron is concerned, so that the ratio of the thickness of the teeth projecting into the air gap to the whole body of the pole must amount to from about 1:4 to about 1:10. A ratio of 1:1 would for instance not be sufficient.

Arrangements of the kind described above may be provided both on the armature and on the pole shoes.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:—

1. In self excited direct current dynamo electric machines including a pole and an

armature separated by an air gap, thin magnetic projections in the air gap, the relation of the thin iron section to the total iron section being between 1:4 and 1:10; as set forth.

2. In dynamo electric machinery in combination a pole and an armature separated by an air gap, magnetic projections in the air gap, the width of each being between about one third and about one ninth of the width of the air space between two adjacent projections, said projections being arranged to form grooves concentric with the armature; as set forth.

3. In dynamo electric machinery in combination a pole and an armature separated by an air gap, magnetic projections in the air gap, the width of each being between about one third and about one ninth of the width of the adjacent air space; as set forth.

4. In dynamo electric machinery in combination a pole, magnetic projections thereon whose area of cross section compared with that of the whole pole area of cross section bears a ratio of between about 1:4 and 1:10; as set forth.

5. In dynamo electric machinery in combination a stator and a rotor magnetic projections on at least one thereof whose cross sectional area is between about one fourth and one tenth of the magnetic path's area of cross section; as set forth.

In testimony whereof, I affix my signature in presence of two witnesses.

PAUL AMSLER.

Witnesses:

HARRY A. McBRIDE,
CARL GUBLER.