

(No Model.)

W. B. POTTER.

RUNNING COMPOUND WOUND DYNAMO ELECTRIC MACHINES IN MULTIPLE.

No. 527,075.

Patented Oct. 9, 1894.

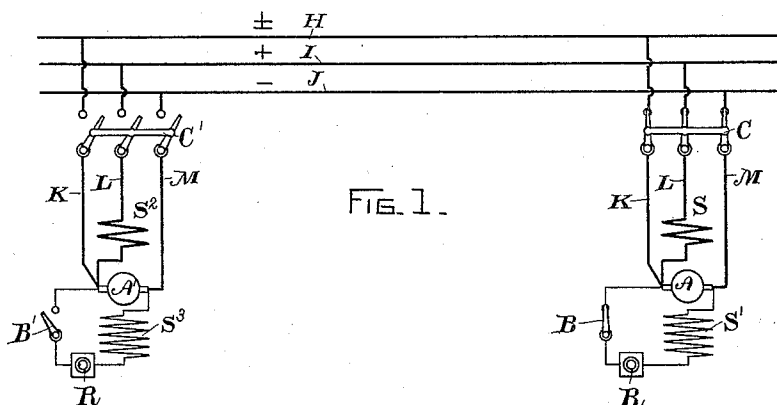


FIG. 1.

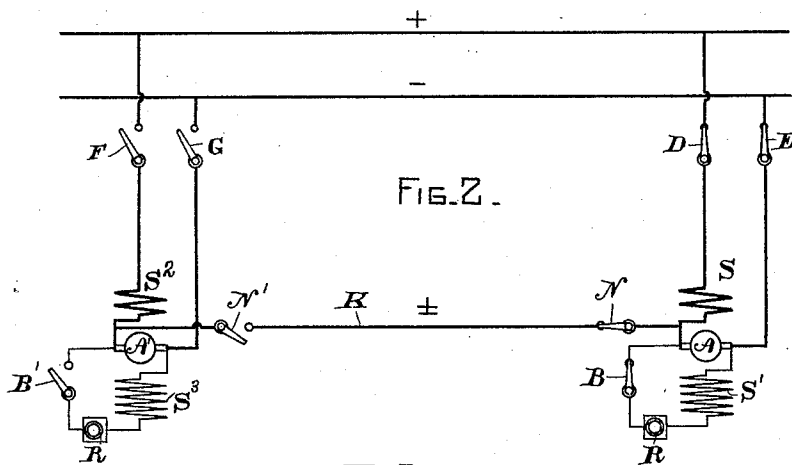


FIG. 2.

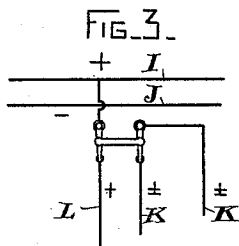


FIG. 3.

WITNESSES.

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RUNNING COMPOUND-WOUND DYNAMO-ELECTRIC MACHINES IN MULTIPLE.

SPECIFICATION forming part of Letters Patent No. 527,075, dated October 9, 1894.

Application filed June 2, 1894. Serial No. 513,338. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. POTTER, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Running Compound-Wound Dynamo-Electric Machines in Multiple, of which the following is a specification.

My invention relates to running continuous-current dynamo-electric machines in multiple; and has for its object to provide a method of starting up one or more machines after the other machines are running, without the difficulty attendant upon this operation in methods ordinarily practiced and without the danger from excessive sparking and from the great rush of currents caused by ordinary methods.

The common method of running continuous-current machines in parallel is to start them all at once and allow the potential to rise gradually, and this, when the machines are thus started simultaneously, is simple and effective; but when, in a large station, several generators are already running, and a load comes on suddenly, it is not an effective method of starting a single generator, or one or more generators to run in unison with those already supplying the circuit. In starting up the station there is generally sufficient time before the load begins to come on, to enable the engineer to avail himself of the residual magnetism of the machines, and by the use of a shunt field, build up one or more of the generators to proper potential, after which they may be thrown into the work circuit, and the effect of the series coil and the shunt coil adjusted to a proper balance. This however is a somewhat slow process, the saturation curve of the field-magnets when energized by the shunt alone, running almost in a straight line at first for a considerable time and then rising quite suddenly to the full magnetization obtainable by the use of the shunt alone. When the station is started, however, under light load, and a heavy load comes on, it is imperative that no time be lost in switching in more machines, and therefore it is impracticable to run the generators

which are to be switched in for a sufficient length of time to attain this degree of magnetization by the shunt alone. It is also objectionable to get the entire magnetization from the shunt-field, because when the equalizing connection is made or when the series coil is thrown into operation by connecting the machine in circuit, its effect is so great as to very greatly over-compound the machine, and as a result the machine just thrown in takes practically the entire load, and it becomes a matter of difficulty to distribute the load between the different machines, the indexes of the ammeters varying back and forth and rendering the adjustment of the shunt coil to bring the machines into accord a matter of judgment and skill. It has been proposed to avoid this difficulty by employing a separate excitation for the machines as they are thrown in, but this is undesirable and introduces unnecessary complication in the switch-boards and other apparatus; while by my method and apparatus I avoid the difficulties above pointed out and also dispense with the cost and complication of the separate excitation.

The accompanying drawings show my invention diagrammatically, Figure 1 being a diagram illustrating the former methods as commonly practiced, Fig. 2 being a similar diagram showing my invention, and Fig. 3 being a modification.

In Fig. 1, A, A' are the generators; S', S² are their shunt coils; S, S², the series coils; B, B', the field switches; R, R', the resistances to adjust the shunt coils. L, M are the leads to the plus and minus bus-bars I, J respectively, K, K' being the leads to the equalizer H, and C, C' being three-pole switches. The former method of operating the apparatus thus illustrated was by closing the switch B' and allowing the shunt coil S² to become as fully energized as necessary, and then to throw the three-pole switch C', coupling the machine in circuit, at the same time making the circuit through the equalizing connection K and energizing the series coil S². The resistance in the shunt coil circuit S² was then increased, and the magnetizing effect of the coil cut

down until the machines finally adjusted their loads to the proper amount, all this being attended with difficulties above pointed out.

5 In Fig. 2 I show apparatus constructed to carry out my improved method, wherein similar letters refer to like parts, as in Fig. 1, but there is no equalizing bus-bar illustrated, although it may be employed in practice. It
10 however has separate switches for each machine indicated at N, N', and single pole switches are employed in the leads to the plus and minus bus-bars, these switches being indicated at D, E, F, G. The method which I
15 employ is practiced with the combination of machine here illustrated as follows: The machine A already supplying the circuit and it being desired to start the idle wheel A', it is done as follows: Its equalizing switch N' is closed, and the plus switch F is also closed. Thus the current from the main machine A or from any number of such machines already in action, passes through the series coil S² of the machine A' and energizes the
20 field-magnets of the machine A', which is then started. After attaining the maximum excitation possible from the current in the work circuit alone, the field switch B' is closed, and the shunt coil builds up the magnetization until the potential of the two machines is approximately equal. No current however is delivered to the circuit by the machine A' at this time, but whatever current is generated by the armature passes
25 through the shunt field and its resistance R, the potential thus being built up very rapidly. The minus switch G is then closed, throwing the two machines into parallel, and the resistances R, R, with their respective shunts, being properly adjusted, the load is distributed
30 between them. This latter adjustment is readily and easily made, for I have found in practice that by the method above described the ammeter indexes swing together, instead of at random, the excitation of the machine A'' varying with the total electro-motive force of the machines in circuit, and not being dependent, as in the former methods, solely upon its own shunt coil.

35 In Fig. 3 I show that the switches for the equalizing connection and the plus bus bar of each machine may be consolidated into a two-pole switch. This however will ordinarily not be desirable, inasmuch as it necessitates leading the equalizing connector to the
40 switch-board for each machine, and these leads being necessarily very large to get the requisite low resistance, are a source of considerable expense.

45 It is apparent that when only two machines are thus thrown into operation together, at the moment of closing the positive switches the current in each series coil will be one-half of that which flowed in the series coil of the running machine; while when a number
50 of machines are running, the current in the

series coil of the idle machine will be an aliquot part of the total current flowing in all of the machines already running, so that, the more machines there are running, the more readily can be thrown in another idle machine, this being just the reverse of the ordinary operation in station management, where the more machines there are running, the more difficult it is to introduce a new element into the circuit.

I have illustrated only two machines, but it is of course apparent that I do not mean to limit myself to that number, as, the more machines there are in the station, the better adapted is my method to their management. I have found the above method exceedingly efficient in practice, and have even found it possible by its use to throw into parallel without difficulty machines of no less than
55 two thousand horse power each, the ammeter needles moving in practical parallelism during the operation, and the division of the load between the machines being accomplished in a few seconds without excessive sparking or rush of current from one to the other.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The method of throwing compound dynamo-electric machines into multiple relation, which consists in energizing the series coil of the idle machine with current from the other machines, to acquire a preliminary magnetization.

2. The method of throwing compound dynamo-electric machines into multiple relation, which consists in energizing the series coil of the idle machine with current from the other machines, and then adjusting its shunt coil to attain the requisite magnetization for the proper operation of the machine.

3. The method of throwing compound dynamo-electric machines into multiple relation, which consists in energizing the series coil of the idle machine with current from the machines already in operation, then building up its magnetization by its shunt coil, throwing the machine into circuit, and then adjusting the load between the different machines.

4. The method of throwing compound dynamo-electric machines into multiple, which consists in connecting the series coil of the idle machine between the positive bus-bar and the machines already in operation, then closing the field switch of the idle machine and building up its magnetization by its own shunt coil, then connecting the negative terminal to the negative bus-bar, and then distributing the load between the machines, as herein set out.

5. The method of throwing compound dynamo-electric machines into multiple relation, which consists in closing the equalizing connection between the idle machine and the others, closing the connection to the positive bus-bar, thus throwing in its series coil, then

closing its field-switch and adjusting the
shunt so that the machine generates current
of approximately full potential, then throw-
ing the machine into circuit by closing the
5 connection to the negative bus-bar, and then
adjusting the machines till their loads are
equalized.

In witness whereof I have hereunto set my
hand this 25th day of May, 1894.

WILLIAM B. POTTER.

Witnesses:

B. B. HULL,

A. F. MACDONALD.

Corrections in Letters Patent No. 527,075.

It is hereby certified that in Letters Patent No. 527,075, granted October 9, 1894, upon the application of William B. Potter, of Schenectady, New York, for an improvement in "Running Compound-Wound Dynamo-Electric Machines in Multiple," errors appear in the printed specification requiring correction, as follows: In line 18, page 2, the word "wheel" should read *machine*; and in line 46, same page, the reference letter "A" should *A'*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 12th day of November, A. D. 1895.

[SEAL.]

JNO. M. REYNOLDS,
Assistant Secretary of the Interior.

Countersigned:

S. T. FISHER,
Acting Commissioner of Patents.