THE ELECTRICAL MANUFACTURE OF PEAT-FUEL.

The coal strike has brought us face to face with one of the most difficult economic problems of recent years. Compelled to pay about $25 per ton for anthracite and outrageously exorbitant prices for soft coal, the fact has been forced home that we have relied too much upon one kind of fuel. Texas is just now producing unlimited quantities of oil, but there is no way of shipping it cheaply at present to the Eastern States. Artificial fuel cannot be produced in sufficient quantities to meet the sudden large demand. We must perforce grudgingly burn either dearly bought hard coal or install smoke-consumers and burn soft coal. Coal and oil are not the only fuels in the world. The boglands of Europe and North America contain a wealth of good peat, practically untouched. The great moors of Austria-Hungary, France, Germany, Great Britain and Ireland could easily be made to supply a larger contingent of fuel than they do at present.

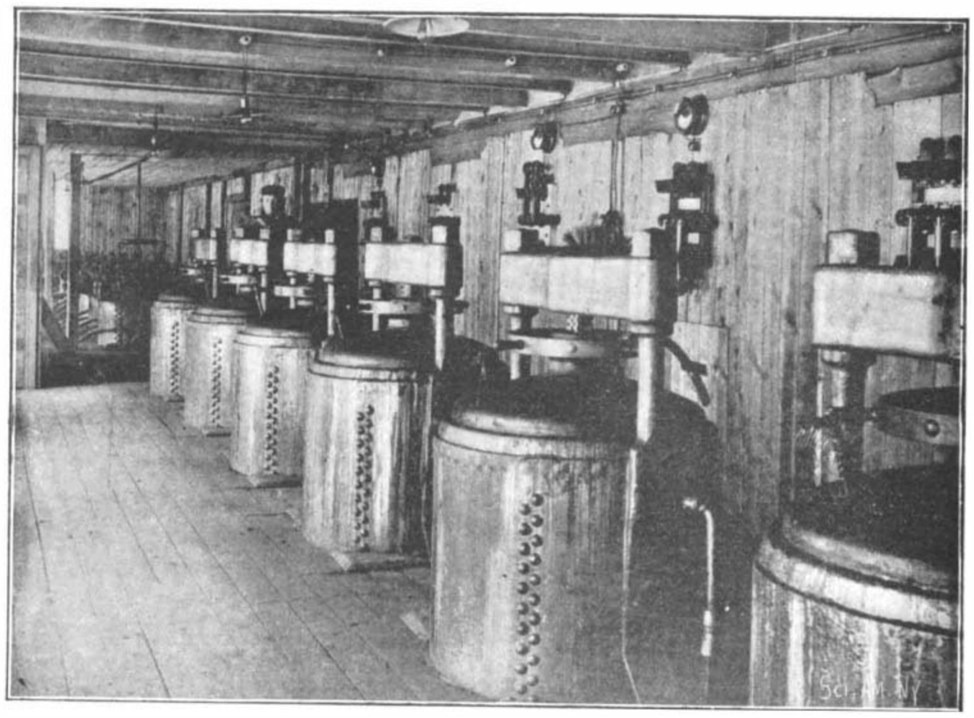
It is quite natural that technical experts make ever-increasing efforts to bring about the utilization of such immense natural supplies. The manufacture of peat-moss litter and of turf-dust has already been developed to a very remarkable extent, and the use of suitable kinds of peat for making textiles and hygienic articles, as well as the production of peat-molasses feed, etc., promises an increasing importance of the peat industry. However, the significance of all these efforts and of the successes which have been attained is placed far in the background, if compared with the importance of the peat after it has been worked into peat-fuel, and, above all, after it has been transferred into peat charcoal.

It is generally known that pressed peat has been in use for many years as a fuel. It is true that the heating efficiency thus obtained has been small, since the crude peat itself contains but from 30 to 50 per cent of carbonaceous matter and about 160 kilogrammes of machine-made peat have to be used for producing the heating effect of 100 kilogrammes of coal, while the space required for storing 160 kilogrammes of peat is three and one-half times larger than that occupied by 100 kilogrammes of coal. However, by transforming the raw material into peat-charcoal a heating efficiency is obtained equal to that of coal, and nobody can foretell as yet the various purposes, especially the technical purposes, for which the fuel thus produced may be utilized.

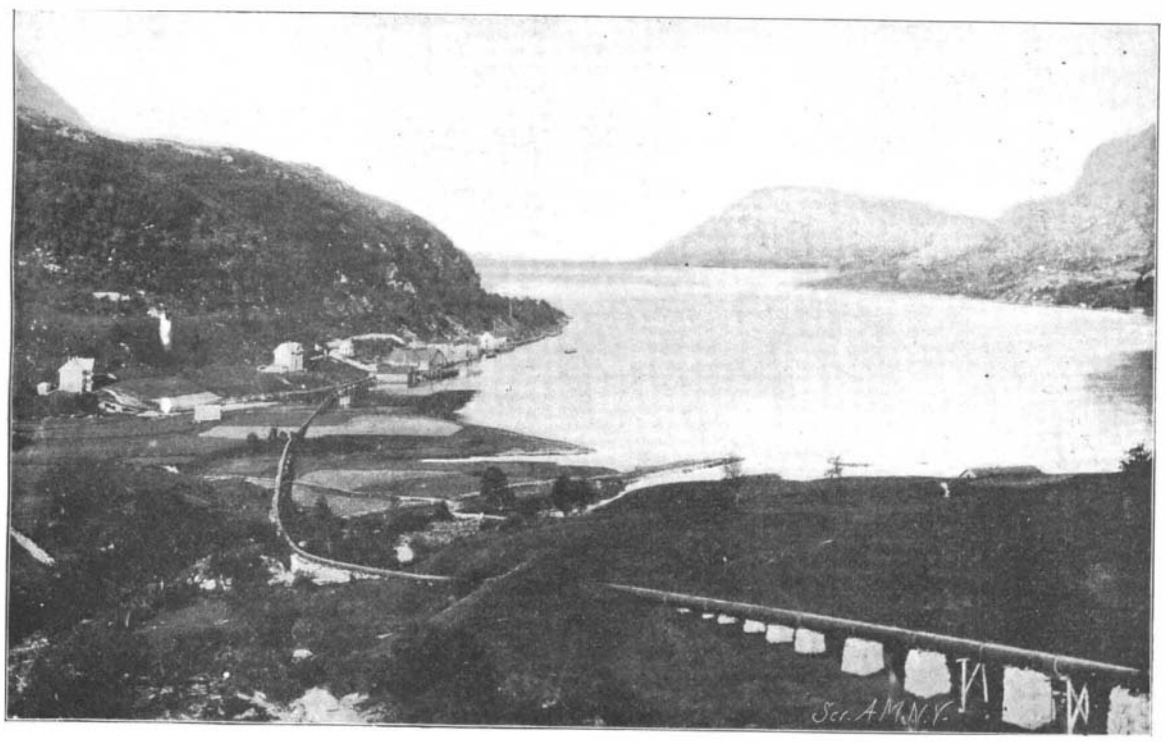
It must be admitted that not all kinds of peat are equally well adapted for the manufacture of a valuable peat-charcoal capable of proving a successful competitor. The latter possibility depends entirely on the one hand, upon the situation of the moor intended for the manufacture of peat-charcoal, and on the other, upon the physical and chemical qualities of the bog-peat which has to be carbonized. If a peat-bog is remote from means of transportation by rail or water, the expenses of bringing the peat from the moor and of shipping the coal will render the price of the peat-charcoal higher than that of the article obtained from peat-bogs which are more advantageously situated. A peat-bog, the situation of which allows the peat to be freed from water by a more thorough, as well as natural, and consequently inexpensive method, will offer better prospects of profit than peat-bogs having no outlet for the water; the latter yield very moist peat, so that more expensive drying plants have to be erected if the protracted air-drying process which would hinder the development of the works to a very considerable extent were not employed. It will readily be understood that the question as to the physical and chemical quality of the peat, which has to be used, is of the same importance.

Notwithstanding all the favorable chances for utilizing and selling peat-charcoal and in spite of the fact that the high price of bituminous coal, and above all of charcoal, increases from year to year, the rational utilization of the peat-bogs is as yet in an embryonic condition. This remarkable state of affairs is explained by the fact that the methods for carbonizing peat, which have been hitherto in use were far too expensive. All kinds of drying apparatus and a large variety of oven constructions have been used without, however, increasing considerably and permanently the output of the plant. This increase is the more indispensable for rendering the peat-carbonizing works profitable, as the period during which they may be operated, without interruption, can be estimated at from 200 to 240 days per year at the most. A new process for carbonizing peat yields better results. It is the invention of P. Jebsen, of Dale, Norway. The process has been in actual operation for three years in the peat-charcoal works of the inventor at Stangfjorden, Norway, with entirely satisfactory results. According to the invention, the partially dried peat-briquettes are carbonized in hermetically closed retorts by electrical heat, it being possible to heat several retorts at the same time with one dynamo machine. The dynamos are driven by water power with the aid of turbines. The process allows the peat blocks to be carbonized within a proportionately much shorter time and with much more uniformity, while the peat-charcoal produced consists of a dense, very compact black mass showing the structure of peat. The specific gravity of the carbonized fuel in the broken condition is about 0.3, and the theoretical calorific value about 7,000 to 7,500 thermal units. The peat-charcoal produced according to the Jebsen process burns well. It ignites readily throughout, spreads rapidly an intensive heat and yields but little soot. The ash is similar to that of bituminous coal; it does not affect, to any considerable extent, the fuel which is not yet consumed, neither will it cover the fire and prevent it from burning, like the ash of ordinary coal and of lignite. The analysis of Jebsen's peat-charcoal, made by the Royal Norwegian High School in Christiania, gave the following mean composition:

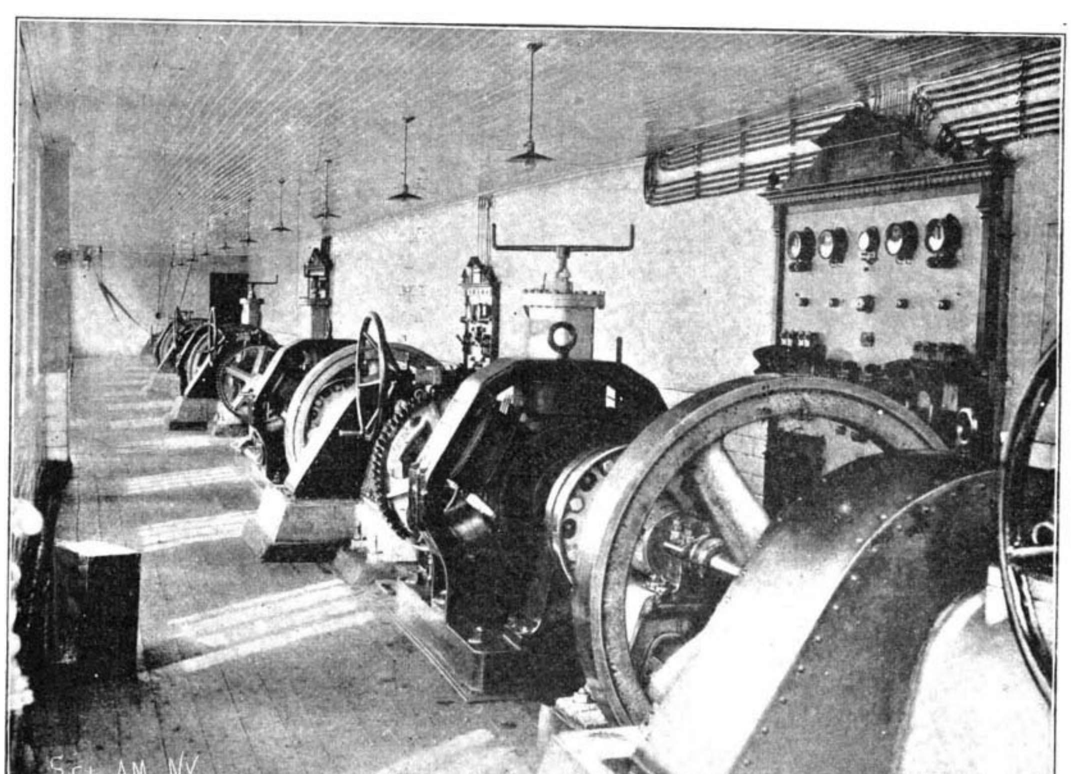
	Per cent.
Carbon	76.91
Hydrogen	4.64
Oxygen	8.15
Nitrogen	1.78
Sulphur	0.70
Ash	3.00
Moisture	4.82
	100.00



THE RETORT-ROOM IN THE STANGFJORDEN PLANT.



THE PLANT AT STANGFJORDEN, SHOWING THE PIPE-LINE.



TURBINES AND GENERATORS AT STANGFJORDEN.

The power required for carrying out the Jebsen treatment at Stangfjorden is derived from five 80-kilowatt dynamos direct coupled to five turbines of equivalent—128 horse power. The power generating installation was provided by Schuckert and Co., of Nuremberg. The wet peat is brought to the factory direct from the bog by water, in lighters of about 100 tons capacity. The boats are discharged by aid of mechanical power, and the peat is submitted to the first drying and pressing operation. This is carried out in a 5 horse power press which can turn out 2,500 pressed blocks of peat, each measuring 80 by 8 by 8 centimeters, per hour. The average weight of dried peat in each of these blocks is 2 kilos.

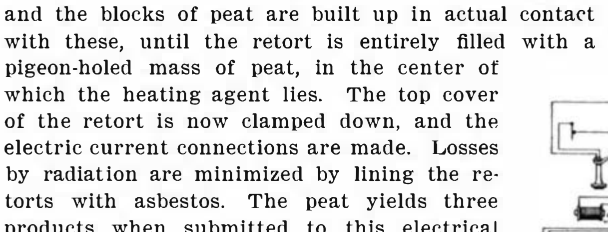
The briquettes of pressed and partially dried peat are next loaded into trolley shelf wagons specially designed for tunnel drying by an American company. Each wagon carries, when fully loaded, 140 of the wet briquettes arranged on ten shelves. The trolley wagons are pushed, when loaded, into the cooler end of the drying tunnel. The air draught which passes through the tunnel is set in motion by fans electrically operated, and is heated by the waste gases from the retorts. The air has a temperature of 90 to 100 deg. C. at the top end of the tunnel where the wagons emerge, and one of 40 to 50 deg. C. at the lower end where they enter. As the wagons pass up the tunnel, the peat is, therefore, submitted to a gradually increasing temperature. The drying plant at Stangfjorden comprises one hot air stove, three electric fans, two tunnels, and 102 shelf wagons; 1,000 of air-dried peat blocks can be produced per day. The wagons with their charges of dried peat are next taken on tram rails direct into the retort house and are emptied directly into the retorts.

The retorts are upright cylindrical vessels of iron, about 2 meters in height and 1 meter in diameter. Each retort has a removable cover, and a discharging hole below, and is in addition provided with gas exit pipes and a pressure gage. The retorts are provided with spiral resistance coils of special construction, and the blocks of peat are built up in actual contact with these, until the retort is entirely filled with a pigeon-holed mass of peat, in the center of which the heating agent lies. The top cover of the retort is now clamped down, and the electric current connections are made. Losses by radiation are minimized by lining the retorts with asbestos. The peat yields three products when submitted to this electrical heating in closed retorts. The gaseous products pass away by openings in the retort cover, and after scrubbing are employed for heating the air used in the drying tunnels. The tarry liquid condensed in the gas pipes and in the scrubbers contains tar oils, ammonia and other compounds, and if the plant and technical skill are available, may be worked up for these products on the spot.

The peat fuel remaining in the retort after the carbonizing operation is completed is allowed to cool down to 130 deg. C. before opening the retort, and is then discharged direct into wagons running beneath the retorts. The peat-fuel produced at the Stangfjorden factory is shipped direct to Bergen, where it is said to meet with a ready sale. The average yield of 100 kilos of the air-dried peat at Stangfjorden is as follows:

	Per cent.
Peat-fuel	33
Peat tar	4
Tar water	40
Gaseous products	23

The diagram below shows the products which are obtained from the peat by dry distillation:



A Scotch Antarctic Expedition.

Although Peary and Sverdrup have returned without having found the pole, and report that nothing unusual is to be discovered in the frozen regions of the earth, the Scotch Antarctic Expedition, under the leadership of William S. Bruce, is to proceed to the Antarctic regions. The province to be explored is situated between the regions now under investigation by the Swedish and German expeditions. The chief object of the expedition is to specialize in oceanography, meteorology and zoology. Six thousand fathoms of sounding line will be carried, chiefly for the purpose of ascertaining whether there is any bottom in the region where Ross reported "no bottom." Aeroplanes and kites are also to be used for the purpose of gathering meteorological data.

FALLER AUTOMATIC TELEPHONE EXCHANGE.

A step into one of the busy New York telephone exchanges is enough to suggest to the inventive mind a great field for invention, and such has evidently been the effect on many a witness of these buzzing centrals, for no small number of patents have been granted on this subject of automatic telephone exchange. In most cases the systems are too complicated to be practicable and comprise a great maze of wires, magnets and contacts which entail a considerable expense for installation and repairs. One man, however, has branched off from his fellow inventors in a very important detail. His system, instead of being electrically actuated throughout, makes use of mechanical means almost entirely in its operations, so that a great many of the contacts and wires necessary even in a manual exchange can be entirely dispensed with in this system. Furthermore, this system can be installed without disturbing the subscriber's telephone or materially interfering with the business of the exchange, and it is a straight, central energy system throughout. An important feature of this machine, and one that distinguishes it from all others, is that the central terminal of each subscriber serves both for calling and for being called. All the subscribers' lines terminate at central in similar terminals which are connected by cord circuits just as in the manual system. This is obviously a great improvement on systems which use separate terminals for the calling and for the called subscriber.

A better understanding of the system can be obtained from the following description. The machine illustrated is designed for a hundred subscribers. The subscriber's outfit consists of the usual apparatus, to which is added an instrument termed the "sender." This consists of a small case in which are a couple of dials, each bearing figures from 1 to 10 along its periphery. The dial on the right is the units dial, and that on the left is the tens dial, so that any number up to a hundred can be made to appear through the window in the casing. For larger exchanges dials are added, so that any desired combination of numerals can be made. To illustrate the operation of the system, we will suppose, throughout the following description, that subscriber No. 55 desires to call up subscriber No. 54. The first act of the calling subscriber is to turn the right thumb nut until the figure 5 appears, and the left until the figure 4 is shown through the window. The operator then turns the central knob, shown in our illustration, to the right. This winds up a coil spring which provides the motive power for sending over the subscriber's wires a series of impulses corresponding in number to the figures on the dials. This is more clearly illustrated by reference to the diagram. The tens and units dials are secured to disks *a* and *b* respectively. These disks are reduced in diameter over a portion of their circumference, so as to clear a number of contacts arranged radially about each disk. In turning the number dials to 54, the tens disk, as shown, is brought into engagement with five of these contacts, and the units disk with four, so that when the motor spring is released the brushes *c* and *d* are operated under control of the escapement mechanism to sweep over a series of contact pins, thus successively grounding the two subscribers' wires. The longer arm, *c*. in passing over the tens contact pins will send five electric impulses over the wire, *e*, and similarly the brush, *d*, will send four impulses over the wire, *f*. On winding up the motor spring, however, it is necessary to delay the sending of these impulses until such time as the machine at central is ready to receive them. For this purpose the escapement is normally held in check by the armature of a magnet, *g*, until central is ready for the signal, when the magnet, *g*, is energized, and its armature withdrawn from engagement with the escapement. When the motor spring of the sender is wound up, the contact at *h* and *i* is automatically made, which grounds the line wire, *e*, and permits a flow of current.

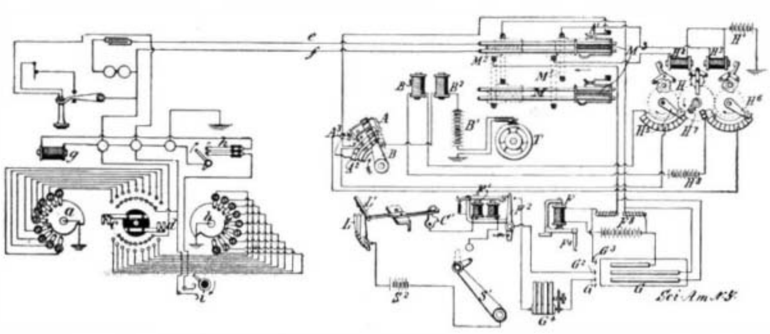


DIAGRAM OF THE CIRCUITS OF THE AUTOMATIC TELEPHONE EXCHANGE.

The machine at central is provided with a series of rods, *M*, a pair for each subscribers' pair of wires. A carriage, M^3, is adapted to travel over each pair of rods, and carries the subscriber's terminal springs, which are insulated from each other, but are each in electrical contact with their respective legs of the subscriber's line. Normally these carriages are in the position shown in full lines, so that an unbroken circuit is formed over a wire, *e*. through the carriage and connection, *A'*, to the subscriber's contact or pin 55 on the rotary contact-maker, *A*. This contact-make consists of two sets of circularly disposed contact-pins, each set containing as many pins as there are subscribers. The trailer, *B*, which is normally rotating, sweeps over these contact-pins and connects them successively with two contact-rings. As soon then as the trailer comes into contact with pin 55 of the inner circle of pins, the circuit is closed through ring, A^2, magnet, B^2, battery, B^1, and resetting wheel, *T*, to the ground. The magnet, B^2, being thus energized attracts an armature which stops the rotation of the contact-trailer and trips a clutch which starts the power mechanism. The resetting wheel, *T*, of the power mechanism prevents the call from some other subscriber from being sent in while a switching operation is going on, for the circuit is broken at all times except when the power mechanism is idle. Rotating with the contact-maker is the "busy wheel," *L*, which is very clearly illustrated in one of our views. It consists of a series of resilient, radial fingers, mounted on and disposed about a shaft to form a helix of one turn. These fingers, corresponding in number to that of the subscribers, are so arranged that when the contact-maker stops at pin 55 the finger which is in line with the carriage, M^3, of subscriber 55 will be in vertical position. Parallel with the axis of the busy wheel, and placed just above it, is a rack, *L'*, whose teeth normally lie between the paths of the busy wheel fingers. Now when the busy wheel stops and the power mechanism is started, this rack is moved laterally under action of a cam, thereby bending finger 55 with which it will come in contact. On account of the spiral arrangement of the busy wheel, only a single finger—that in the vertical position—will be engaged by the rack. Adjacent to the path of each finger is a latch which locks a corresponding shuttle in the position of rest. Springing the finger No. 55 axially results in a release of this latch and in the dropping of shuttle No. 55 to its operating position, thus bringing the carriage with which it is connected into the selective position shown in dotted lines in the diagram; the shuttles are shown at *C* in our illustrations. In this position the line spring terminals are brought into contact with the power bars, *M'*, at the same time breaking connection with the rotary contact maker. This done, the power mechanism, having made a partial rotation, automatically throws itself out of operation and restarts the busy wheel. All this is the work of a few seconds. Current now flows over line, *f*, of the calling subscriber, through the magnet, *g*, and springs, *h*, to the ground. Magnet *g* attracts its armature and permits the contact-maker of the sender to rotate, thus sending the series of impulses over wire, *f*, as previously described. This rotation completed, the parts are restored to their normal positions and the circuit through the sender is broken.

The electric impulses sent by the contact-maker are generated in battery, *H'*, and in passing over both legs of the metallic circuit energize the magnets, H^2 and H^3, causing them to oscillate their armatures. These armatures, as shown in the diagram are connected to an escapement mechanism which permits the selector brushes, H^5 and H^6, being operated by a coil spring, to sweep over and short-circuit their respective series of contacts. We will remember that the number of the called subscriber was 54, therefore the tens impulses passing over line, *e*, will cause the armature of the magnet, H^2, to oscillate five times, bringing the brush, H^5, over contact 5 of the tens selector, and similarly the units impulses will permit the brush, H^6, to travel as far as contact 4 of the unit selector. Between these selector brushes is a timing-train, controlled by an escapement, which is released when the brushes begin to move, and rotates the brush, H^7, until it short-circuits the contacts of battery, H^8. The contacts of the tens selector are connected respectively with ten ring segments, A^2, while the units contacts are connected with the outer row of pins, A^3, of the rotary contact-maker, *A*. These pins, A^3, are divided into ten sections corresponding in position to the sections of A^2. The pins in each section, however, which represent the same numbers, are connected with each other, i. e., every first pin of the tens sections is connected to one circuit, every second pin to another, every third pin to still another, etc. Contact 1 of the unit selector is therefore connected to every pin 1, contact 4 to every pin 4, etc. Now as the trailer, *B*, sweeps over these pins it will engage successively several pins, 4, but no current will flow until it enters that section of A^2 which is in connection with contact 5 of the tens selector, and then when pin 4 is reached, the circuit of battery, H^8, is completed. Following out the diagram, it will be seen that the magnet, B^3, is now