THE SCIENTIFIC AMERICAN DYNAMO.

According to a promise given several times in the Notes and Queries columns of the SCIENTIFIC AMERICAN, we now present our readers with an illustrated description of a plain shunt-wound dynamo of simple construction, capable of supplying a current to from 60 to 75 110-volt incandescent lamps, or of being used as a 5-horse power motor.

This machine was constructed especially for the benefit of the readers of the SCIENTIFIC AMERICAN, by Mr. W. S. Bishop, of New Haven, Conn. It was designed to meet the wants of mechanics and amateurs who desire to construct a simple dynamo or motor for their own use, but who do not care to enter into the matter scientifically.

Now, although this course may enable many to make a fairly practical machine, while possibly a few may chance to build machines equal to those from the best makers, we recommend a thorough study of the principles involved in the construction and operation of dynamos and motors, before proceeding with the mechanical work. There are many good books on this subject, and there is now no excuse for ignorance in electrical matters.

The machine, as will be seen in the perspective view, is vertical, the polar extremities of the field magnet being uppermost, the journals of the armature being supported by arms thrown out from the sides of the field magnet.

The yoke is a single casting, which is planed on its upper surface to receive the squared ends of the arms of the field magnet; these arms being fastened to the yoke by tap bolts passing through the yoke into the ends of the arms.

The waists of the field magnet are slightly thicker at the middle than at the edges; this form being given to facilitate the winding. To the arms of the field magnets are fitted oblong spools of heavy paper or pasteboard, and to these spools is fitted a hardwood mandrel, which is able to resist the pressure of the wire wound upon the spools. The winding is done in a lathe, the mandrel being revolved slowly to admit of careful work.

The dimensions of the field magnet are tabulated below:

Total height of field magnet	20$\frac{5}{16}$	inches.
Width	12	"
Height of polar extremity above winding	6¼	"
Height of waist	9½	"
Thickness at the center	4½	"
Thickness of yoke	4½	"
Diameter of bore of polar extremities	5⅛	"
Diameter of armature about	5	"
Length of arms for supporting the journal boxes of armature shaft, commutator end	9½	"
Pulley end	5¼	"

The principal dimensions of the armature are tabulated below:

Length of armature shaft	36½	inches.
Largest diameter of shaft	1⅜	"
Diameter of portion inclosed in armature core	1¼	"
Diameter of bearings	1$\frac{1}{32}$	"
Length of armature core	11	"
Diameter of armature core	4¼	"
Diameter of pulley	6	"
Face of pulley	5	"
Length of journal boxes	4⅝	"

The details of the winding are given below:

The field magnet is wound with No. 18 Brown & Sharpe gauge single-covered magnet wire 12 layers deep, the inner ends of the two coils being connected with each other, the outer ends being connected with the commutator brushes. The armature is wound with No. 12 Brown & Sharpe gauge double-covered magnet wire, 32 coils, with 8 convolutions in each coil. There are approximately 22 feet of wire in each coil. Weight of wire on armature 17 pounds, on field magnet 52 pounds. The machine, when run at 1,450 revolutions a minute, generates a current of 35 amperes, the electromotive force being 110 volts. When the machine is used as a motor, 1½ amperes are consumed in the field magnet, and when the machine is running light only 1 ampere is consumed in the armature.

The armature core is built up of sheet iron disks 4¼ inches in diameter, with a central aperture 1½ inches in diameter. These disks are separated by sheets of tissue paper, and clamped between end plates. They are insulated from the armature shaft by a vulcanized fiber tube ⅛ of an inch thick. The end plates which clamp the soft iron disks, and also a central thick plate located at the mid-length of the armature core, have 32 radial slits in their peripheries for receiving the wedges which separate the different armature cores. One of the end plates rests against a shoulder on the armature shaft, and is prevented from turning by a key. The other end plate is also prevented from turning on the shaft by a key, and is pressed against the disks by a nut turned on the threaded portion of the shaft. The thick disk at the center of the armature core is prevented from turning by a pin driven in a hole drilled diagonally through the armature core, the central disk and the shaft.

The armature winding is done according to the system illustrated in Figs. 2 and 3. In this case the winding of the first coil begins in space 1, is carried around through space 1a until the coil is complete. The armature is turned half way over, and beginning in space 2 for the second coil, the winding is carried around in the same manner, leaving the beginning and the ending of the coil in the same place and upon the same side of the armature. The armature is again reversed and the third coil is begun in space 3, leaving the intermediate space 2a. When coil 3 is complete, the fourth coil is begun in space 4, on the opposite side of the armature, and carried through space 2a. The armature is again reversed and the operation of winding is carried on in the same order, leaving a space between alternate coils upon one side of the armature. It is advisable to place mica between the different coils where they cross at opposite ends of the armature, to prevent the possibility of a cross or short circuit.

The commutator, which is of ordinary construction, has thirty-two bars and is made according to the plan already given in the SCIENTIFIC AMERICAN, also in SUPPLEMENT 600. The terminals of the coils are connected with the commutator bars in the same manner as those of the Siemens machine several times described in these columns, that is to say, the beginning of one coil and the end of the preceding coil are connected to the same bar of the commutator. This order is preserved throughout.

The journal boxes of the armature shaft are supported between arms projecting from the sides of the field magnet. They consist of an outer brass shell and an inner bronze portion fitted to the journal box by means of a ball and socket joint, the inner portion being provided with a spherical central boss, which is babbitted in the cast iron outer part held by the arms. A ring of vulcanized fiber slipped over the commutator bars is provided in its outer edge with a groove in which is tied one end of the conical sleeve of canvas forming the covering of the armature, the sleeve at this time lying outwardly. The sleeve is then reversed and the free end is stretched over the terminals of the coils, and is secured to the armature by a binding of wire surrounding the canvas and clamping it tightly to the face of the armature. Six of these bands of wire are provided for confining the winding and preventing the armature from being destroyed by centrifugal force. A slate plate on the top of the dynamo is provided with binding posts, which receive the wire supplying the current and also the wires connecting with the brushes, the safety fuses and also the shunt connections of the field magnet. The field magnet is furnished with ears at its ends, which are bored to receive rods inserted in castings designed for supporting the machine. In one of these castings is journaled one end of a screw, the other end of which enters a nut formed on the field magnet, the object being to provide means for shifting the dynamo or motor on its support to give proper tension to the belt running on its pulley.

A slate slab secured to the top of the field magnet serves as a cover for closing the gap between the polar extremities of the field magnet. To this slab are secured six binding posts, *a*, *a'*, *b*, *b'*, *c*, *c'*; the binding posts *a*, *a'*, are connected with the brushes by means of flexible cords, the binding posts, *b*, *b'*, are connected with the posts, *a*, *a'*, by fusible wires, the binding posts, *c*, *c'*, are connected with the terminals of the field magnet. When the machine is used as a motor, the connections are arranged as shown in Fig. 4. The leads, *d*, *d'*, through which the current is supplied, are connected with the wires, *e*, *e'*, through the double switch, A; they are also connected with the wires, *f*, *f'*. The wire, *e*, connects with one terminal of a rheostat, B, having a total resistance of 10 or 12 ohms. The other terminal of the rheostat is connected with the binding post, *b'*. The wire, *e'*, is connected with the binding post, *b*. The wire, *f*, is connected with the binding post *c'*, and the wire, *f'*, is connected with the binding post, *c*.

To start the motor, the switch arm of the rheostat, B, is placed on the point, which introduces its full resistance into the circuit of the armature. When the switch, A, is closed, the current remains constant in the field magnet independent of the current flowing through the armature.

Another portion of the current flows through the wires, *e*, *e'*, the rheostat, B, the fusible wires and the binding posts, *a*, *a'*, to the armature, so that in starting the motor a minimum of current passes through the armature. As soon as the armature acquires considerable velocity, the switch arm of the rheostat is moved gradually forward, the rheostat being finally cut out, so that the full current flows through the armature. The speed of the motor is then automatically regulated by counter-electromotive force.

When the machine is to be used as a dynamo, the connections are made as shown in Fig. 5, that is to say, the leads, *d*, *d'*, are connected with the binding posts, *b*, *b'*. Here the current divides. The rheostat, B, in this case is inserted in the circuit of the field magnet. The current generated in the armature passes through the binding posts, *a*, *a'*, the fusible wires, and the binding posts, *b*, *b'*, where it divides, a portion going out through the leads, *d*, *d'*, another portion passing through the field magnet, in which is inserted the rheostat, B. The current is controlled by introducing more or less resistance into the field magnet circuit by means of the rheostat.

In SUPPLEMENT 865 will be found an amplified description of the SCIENTIFIC AMERICAN dynamo and motor, together with detail scale drawings of their various parts, also a full description of the rheostat used in connection with the machine.

How to Reproduce and Improve a Faded Photograph.

Having before me several finished pellicular negatives, and supposing erroneously that the image on one of them was larger than the image on the other, I placed one negative over the other, and, looking at them by transparence, I immediately perceived that it is by the superposition of two identical images that is to be found the answer to the question: Reproduction of a faded and weak photograph. In fact, if we wish to strengthen a negative, because this negative has been obtained, as in the present example, by photographing a poor portrait on a yellow ground, the strengthening is general, and not local, portrait and background gain in intensity, but both in the same proportion, so that the advantages are null. The negative thus treated will require an exposure to the light longer than before when a positive is to be made. Contrary to what may be supposed, the superposition of the pellicles does not produce the same effect as the strengthening, this being said to reply beforehand to the objections that might be made by those who depend on theory and not on practice—two words which do not always agree. Therefore, if we wish to reproduce a weak photographic print, impression two pellicles whose sensitive surfaces have a tendency to give hardness, without seeking intensity, which, in fact, does not exist in the original; develop normally these two pellicles in a reducing bath rather rich in bromide, fix and dry in the ordinary manner. Reduce the dimensions of one of the negatives by cutting, on its four sides, a strip of a few millimeters in width. Carefully adjust the two images—which is easily done by placing the pellicular negatives on a retouching frame, or on a window pane—then fix, with small pieces of gummed paper, the two images so that they cannot be displaced from their respective positions; print in the shade under ground glass. I need not recommend that the apparatus should not have its position changed during the interval separating the two operations for printing the image, and that the focusing point should not be altered, inasmuch as this point has not varied if the camera has not been displaced. Moreover, this new method of reproduction, owing to the thickness, which has no practical importance, of the two superposed pellicles, has the advantage of giving extraordinary softness without the least blurring, and of not reproducing the grain of the paper forming the support of the image. Gain is obtained in everything—in relief, in intensity—and I may say that the copy is finer than the original, and is worth more.

Advantage may be taken of this method by applying it to other purposes. It cannot be used for portraits from life, nor for animated views, but I purpose to have recourse to it for landscapes, being convinced that the relief and softness of the image will be better rendered than by the usual process, and it seems to me that, in certain cases, by the superposition of a *time* pellicle and an *instantaneous* pellicle of the same subject, we would obtain a positive print by *addition*, which the process that I have just described is alone capable of giving, as if there were question of but a single negative and a single impression. This is to be looked into, and I advise my colleagues to make some experiments in this direction, and would be grateful if they would furnish me with the results.—*E. Forestier in L'Amateur Photographe; Photo. News.*

Cold Bathing in the Morning.

Cold bathing in the early morning is beneficial only to those persons who have sufficient vital energy and nervous force to insure good reaction with no subsequent languor or lassitude. Many persons who are greatly refreshed by their morning bath, feel tired or languid two or three hours after it. When this occurs, it is conclusive evidence against the practice. Persons who have an abundance of blood and flesh, who are lymphatic or sluggish in temperament, and whose nervous force is not depleted, can take the cold morning bath to advantage. Others who are inclined to be thin in flesh, whose hands and feet become cold and clammy on slight provocation, who digest food slowly, and assimilate it with difficulty, who are nervous and who carry large mental burdens, should avoid early morning bathing. For all such, the bath at noonday or before retiring at night is far more desirable, and it should be followed by rest of body and brain till equable conditions of circulation are re-established. Some individuals who are weak in nervous power have such excitable peripheral nerves that they get at once a perfect reaction from cool bathing, but lose in after-effects more than the value of the bath. This class of persons should not bathe too often, and should always use tepid water, choosing the time preferably before retiring.—*Jenness Miller.*