Armatures weighing over 500 pounds should be handled by means of a differential block and tackle.

An armature should not be lifted by its commutator.

Some soft material, such as cotton waste or felting, should be put between the armature and the support.

When put in place in the dynamo the armature must not touch the pole pieces and must turn easily. There should be at least from 1-16 to ⅛ inch play between its bearings. This play or lengthways motion can generally be regulated by adjusting the collar on the shaft.

It must be borne in mind that the armature will warm and expand not only diametrically but also lengthways. If there should be no play, the armature might get wedged between its two bearings and cause hot boxes and stoppage of the dynamo. A swinging motion of the armature will cause the bearing to wear evenly, distribute the oil from end to end of the bearings, and prevent heating of the boxes. An armature can be caused to play only when the dynamo is in proper alignment and the belt not too tight.

All connections through which the current has to pass should be cleaned with fine emery cloth and should not touch any part of the iron frame or field-coils of the dynamo.

It is advisable to run a new dynamo a few hours or even a day, without any load, in order to test the lubrication, etc., not only of the dynamo, but of the engine, if it should be a new one. If everything is in good condition the load should be put on gradually. This can be done, either by running the dynamo below normal speed and gradually increasing the speed, or by using the resistance boxes and starting with very little current and gradually increasing it.

The latter is especially advisable for incandescent lamp installations. The testing should be made during the day. It will require for small plants a few hours; for plants of greater importance a few days; only when everything operates in good order should the regular running of the installation commence.

Every day before starting the dynamo, the dynamo tender should examine the binding posts, commutator and brushes. If the brushes are allowed to rest against the commutator, the engineer should be careful not to reverse the motion of his engine when starting, as he would spoil the brushes.

Iron nails, bolts and small tools should be kept away from the dynamo, as they may be attracted to the machine and damage it.

Oil cans for filling the oil cups of the dynamo should be of non-magnetic material (brass or zinc).

The dynamo must be kept scrupulously clean, like any other expensive machine. Any good engineer or dynamo tender will do that without being told.

Copper dust, which will be caused by the friction of the copper brushes against the commutator, should never show; it should be cleaned off the armature and fields by means of a paint brush and a pair of bellows every day. Shafts and pulleys running near the dynamo must be prevented, by means of shields, from throwing oil on the dynamo, especially on the commutator.

A brush should never be lifted off the commutator while the dynamo is running.

Binding posts and other contacts should always be tight. A slight vibration of the dynamo, which will occur even when it is properly set, will loosen these connections in time. Every binding screw should be examined, and, if necessary, tightened every day.

The setting of the brushes is one of the most important duties of the dynamo tender. The brushes should rest against the commutator with a slight pressure. They should not be rigid, but the brush holder springs should allow a certain amount of spring; this will prevent excessive sparking of the brushes, even if the commutator should be a little uneven.

The contact points for the brushes in the commutator are in most dynamos diametrically opposite each other. In order to find these points quickly it is advisable to cut a little strip of tin, the length of which is just one-half the circumference of the commutator, and use this strip as a gauge when setting the brushes. The brush holders should be carefully kept clean, and should be wiped off every time before the brushes are put in. The brushes must extend from each brush holder at equal lengths. The insulation between the brush holder pins and the quadrant must be in good condition; oil and dirt must be kept out.

Fig. 5 shows the proper position of the brushes. The point where the brushes are resting on the commutator when the greatest current strength is obtained are called the maximum

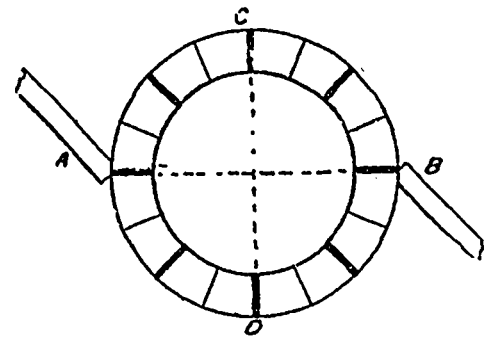

FIG. 5—PROPER POSITION OF BRUSHES.

points, *A*, *B*. When the brushes touch the points *C*, *D*, at right angles to *A*, *B*, called the neutral points, no current is obtained.

If the brush is nearly worn through to the middle of its thickness, it should be turned over and the other side used on the commutator. When both sides are worn off, as shown in the upper part of Fig. 6, the brushes should be trimmed. In larger stations, little brush cutting machines are used for this purpose; in smaller installations, two blocks of hard wood, lower part of Fig. 6, are used. The brush is put between the two blocks and the whole put in a vise. The end of the brush projecting beyond the wooden blocks is then removed by means of a file.

The brushes should also be in such a position on the commutator that the least sparking will be set up. In some dynamos it is necessary to move the brushes in proportion to the load in order to get little sparking. In other systems, the brushes need not be removed at all, no matter how many lights are turned on or off. In some dynamos, the moving of the quadrant, or, in other words, the moving of the contact points of the brushes on the commutator, is used for increasing or decreasing the strength of the current.

The commutator is the most sensitive part of the dynamo, and

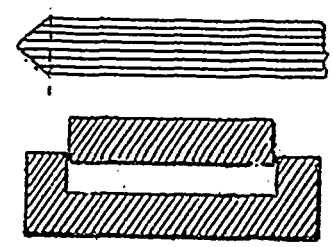

FIG. 6—WORN BRUSH AND BLOCKS FOR TRIMMING.

should be especially cared for. It must always be kept smooth. If it should get rough from the electric spark, it is necessary to smooth it by pressing a block of wood covered with fine emery cloth against it, after having set the dynamo in motion with the brushes lifted off. If the commutator is so rough that a smooth surface cannot be obtained by the use of emery cloth, it should be filed. In order to do that, it is necessary to take out the brush holders, pins and brushes. After a straight surface has been obtained, the commutator should be smoothed with fine emery cloth.

The disadvantages of using a file on a commutator are the liability of pressing small chips of copper into the insulation between the copper segments, and the impossibility of getting the commutator true. The best way is to turn the commutator off by means of a little lathe, which can be attached to the dynamo, or by taking the armature out of the dynamo and having the commutator turned off in a lathe in a machine shop. This will not only make the commutator smooth but perfectly true. In filing or turning off the commutator while the armature is rotating in the dynamo, it is necessary to reduce the normal speed of the dynamo considerably, as too high a speed would spoil commutator and turning tools.

In new commutators for which fibre is used as insulation between the copper segments it is very often found that the thin sheets of fibre have absorbed moisture, and extend above the surface of the commutator. If a few days exposure in a dry warm room does not cause the fibre to shrink and go back to its