compression and not subjected to shear along the surface of contact between steel and concrete, so that failure here is extremely improbable. The only places where trouble is to be expected due to grounding of power wires directly on the concrete inside of a building is in the region close to the point of ground.

If, however, the power wire be grounded directly on a portion of the reinforcing material, the condition will be more serious and the extent of the danger will be greater if there is a large quantity of the reinforcing material in metallic contact with the electric circuit. If this comprises a large part of the total reinforcement of

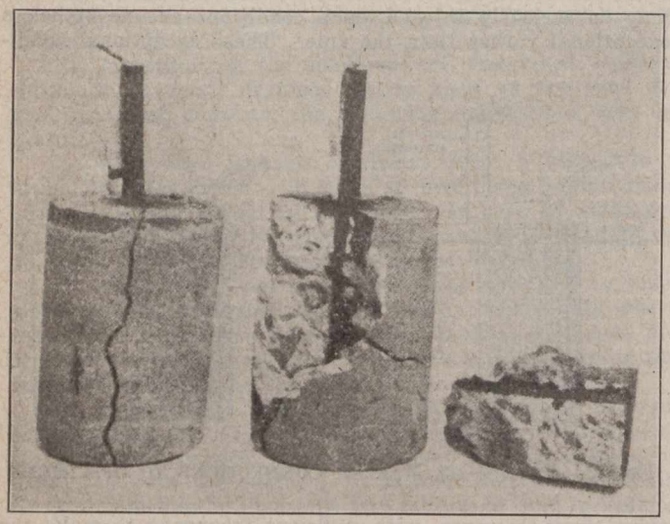

FIG. 3—HIGH VOLTAGE ANODE SPECIMENS

the building, the condition might be serious irrespective of whether the positive or negative side of the line is grounded. If the ground is on the positive side the potential gradient near the reinforcement may become high enough to cause rapid corrosion and consequent destruction of the reinforcing material. If, on the other hand, the reinforcing material be negative, there would develop a softened condition of the concrete near the surface of the iron which would practically destroy the bond, and this would probably be the more serious condition of the two, since the latter would not manifest itself by producing local cracks in the concrete, and might not become known until a large portion of the building has become weakened. However, while such a condition as this might occur, and if neglected become very serious, it is nevertheless a trouble that can be readily guarded against, as will be pointed out below.

Trouble from Ground Return of Railways

The other source of current that might possibly give rise to trouble under certain circumstances is the ground return of railways. The current may enter a building in two different ways. First, if the foundations under the two opposite sides of the building are at different potentials, there would be a tendency for a certain amount of current to flow up through the foundation on the one side, through the walls and floors of the building and out through the foundation on the other side. This condition may be said to exist to a very small extent in practically all concrete buildings, but it is not one that need cause any alarm.

The second way in which stray currents may enter a building is through water or gas pipes, lead cable sheaths, and similar, structures. The low differences of potential that these usually bring about, would cause damage very slowly, however, but where differences of five to fifteen volts exist between the reinforcing material and the earth, it should be regarded as a dangerous condition, and "should be remedied at once."

The above statements in regard to the liability of damage under low or moderate differences of potential are intended to apply only to concrete which contains no appreciable quantities of salt. The data show that if a small quantity of sodium chloride (salt) or calcium chloride be added to the concrete the rate of deterioration proceeds many times faster, and under such circumstances much lower voltages should be regarded as dangerous.

Specific Cases of Trouble

In the course of the investigations a considerable number of cases were examined in which damage to concrete structures has been attributed to electric currents. Some of these have been reinforced structures and some have been without reinforcement. Among these not any non-reinforced structures were found in which the conditions indicated that electric currents could in any way be responsible for the damage. Among the reinforced structures there are some in which electrolysis has been at least a contributing cause of the damage. The investigators, however, have seen no case in which serious damage has occurred in which there was not also present a considerable quantity of salt in the concrete, either from having been put there during construction or from contact with salt water in service.

Protective Measures

Recommended protective measures mentioned are briefly, (1) the exclusion of salt (an addition of even a fraction of 1% of chlorine is sufficient to increase the rate of damage a hundredfold), (2) waterproofing below grade, (3) proper selection of materials for the foundations (of secondary importance however), (4) inclosure of electric wiring in continuous metal conduit, (5) introduction of insulating joints into pipes and leadl cable sheaths before they enter the building, (6) improvement in the negative return of railways, (7) the abolishment of the practice of grounding metallic conduits in contact with concrete. Waterproofing

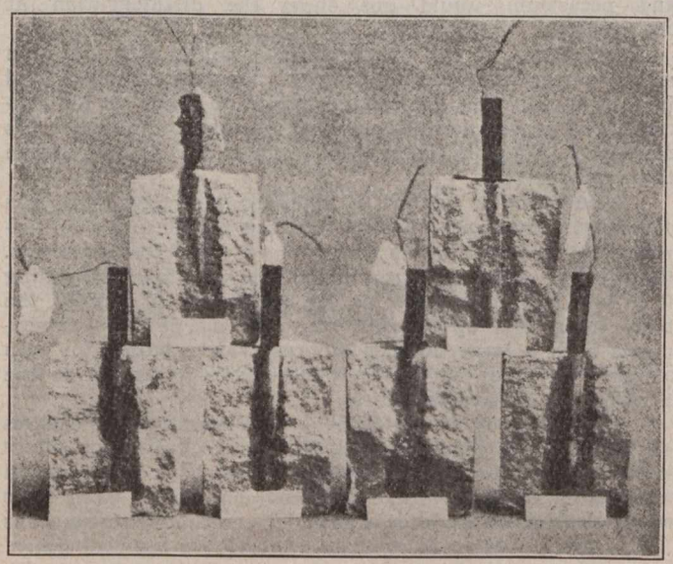

FIG. 4—CATHODE SPECIMENS SHOWING DISINTEGRATED MORTAR ABOUT ELECTRODE

compounds, and the making of reinforcing material negative by means of a low-voltage generator are of little value and are not recommended.

Copper-clad steel or aluminum for reinforcing material is impracticable, since the copper coating is readily destroyed and aluminum is attacked by alkali in the concrete.

In connection with the Calgary house building plan it is likely that the cement gum method of construction will be used.

The following is a list of Canadian patents recently issued through the agency of Messrs. Ridout and Maybee, Toronto: Henry C. Mimms, testing device for the ignition systems of internal combustion motors; Fred. D. S. Robertson, process of extracting potassium from its insoluble compounds; Alfred T. Kwajel, magneto-electric machines for engine ignition purposes; Philip T. Jackson, fluid control apparatus.