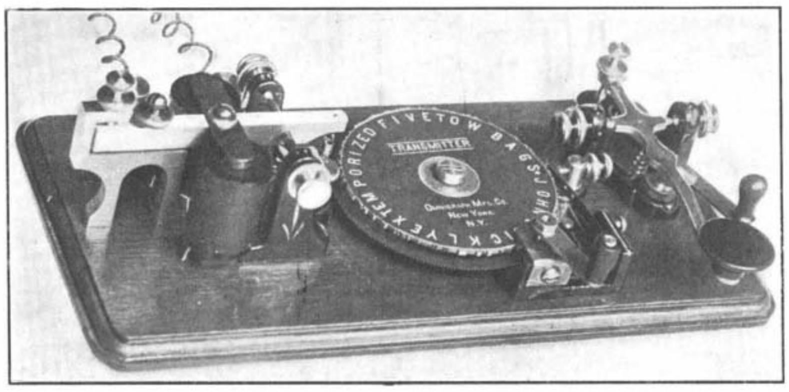
THE OMNIGRAPH—AN INSTRUMENT FOR TEACHING TELEGRAPHY.

Old telegraph operators will still remember how messages were once received on a tape driven by a clock train. The skill acquired soon rendered it possible to dispense with the tape and to translate the message directly from the sounder. But the acquisition of that skill came only with long practice; for which reason the modern novice must spend hours and hours before the ticking of a sounder becomes instantly intelligible to him. An instrument which is designed to simplify instruction in telegraphy, and to impart in a comparatively short time a complete knowledge of the Morse alphabet, has recently been introduced by the Omnigraph Manufacturing Company, of 39 Cortlandt Street, New York city. Patents have been applied for.

The Omnigraph, as the instrument is called, consists of a baseboard on which are secured an ordinary key and sounder, between which a disk is mounted, formed on its periphery with teeth. A spring contact adjacent to the wheel engages the peripheral teeth of the disk. Although irregular, the arrangement of the teeth is arbitrary. For if the disk be rotated by means of a small crank-shaft geared with the disk-shaft, the spring contact is forced outwardly by the teeth, but drops back by its own elasticity, and thus makes and breaks the circuit. The experienced telegraph operator detecting these makes and breaks at the sounder, recognizes them as the dots and dashes of the Morse alphabet. A close inspection of the disk would reveal to him that the teeth are so arranged as to spell the sentence, "John quickly extemporized five tow bags." If the disk be rotated forwardly, this sentence, thus oddly worded to include every letter in the alphabet, is ticked off at the sounder; if rotated in the opposite direction, the sentence will be telegraphed backward.

The disk is completely under the control of the student. It can be rotated as slowly as desired; or it can be so rapidly turned that its curious sentence will be received at the sounder with a speed that would open the eyes of a good operator. Moreover, the message on the desk is transmitted with a distinctness and faultlessness which the most perfect operator can never hope to attain. At first blush it might seem that the student simply learns one sentence forward and backward, and that the instrument is a good teacher only within very narrow limits. But this disk can be partially rotated forward and backward any number of times, in any place, so that the letter to be transmitted cannot possibly be anticipated. Thus the student learns how to receive a cipher message, the meaning of which he cannot know.

When sufficient proficiency has been obtained in receiving messages from the sounder, the student can learn to transmit messages in the regular method by means of the key which forms part of the apparatus.



THE OMNIGRAPH.

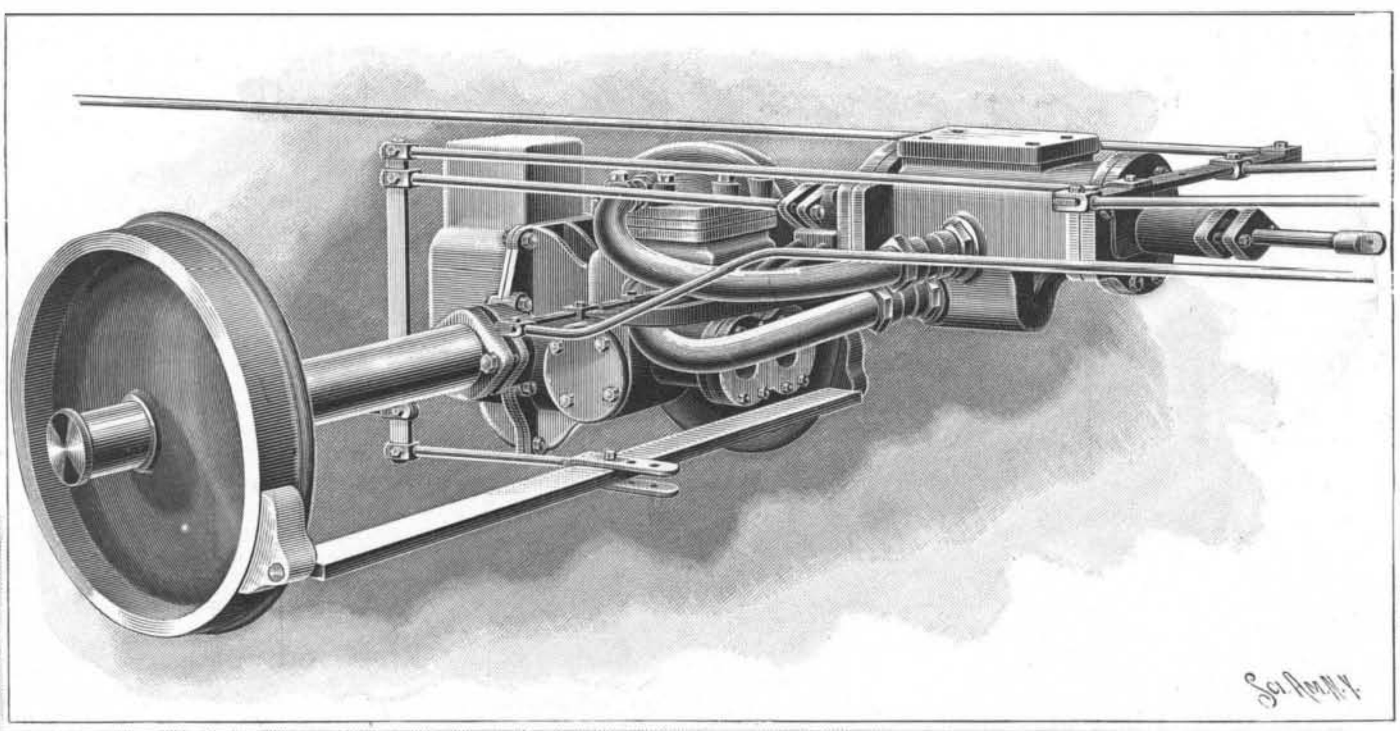
HYDRAULIC ELECTRIC-CAR BRAKE.

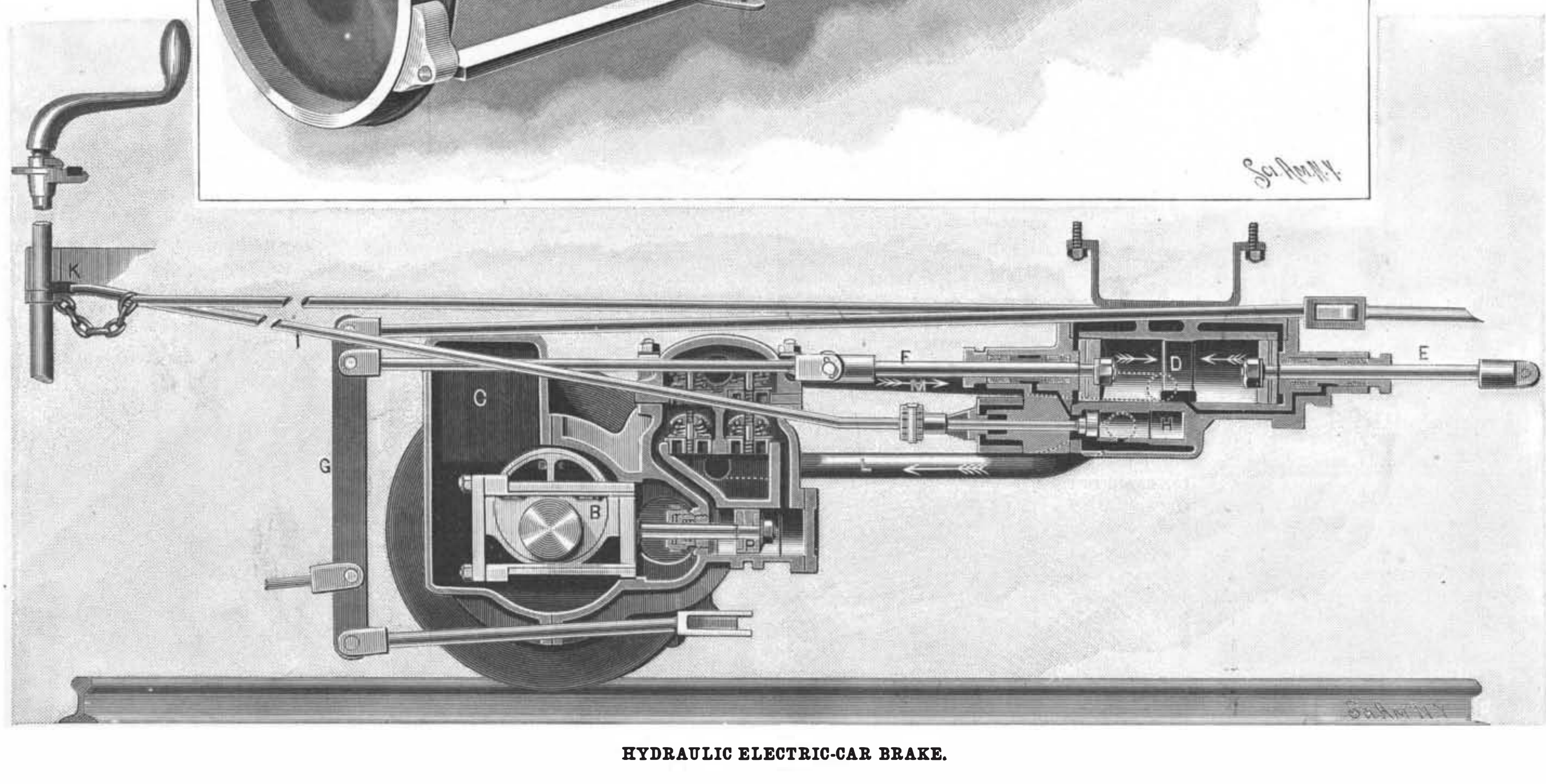
The extraordinary development of city and suburban electric car service is making the question of a proper control of the cars of increasing importance. Not only is the average running speed increasing, but the headway between cars is growing less. Coupled with the growing number of cars and the higher speed, there is the fact that traffic is becoming denser, all of which conditions render it imperative that the cars should be provided with a brake system which will be powerful, and instantaneous in its application, and safe-guarded against any possibility of failure at the critical moment. Although many forms of mechanically-operated brakes, showing more or less ingenuity, have been devised, it is a fact that a great majority of the cars are still controlled by the old hand-brake; and while this is fairly efficient, it has the drawback of being slow in its application, whereas in cases of emergency, the gain of a fraction of a second in the action of the brake may be of the most vital importance.

We present two engravings, one a perspective and the other a sectional view, showing what is known as the Neal-Duplex brake, which is operated on the hydraulic principle, and has the advantage of being applicable to any standard car, and of being operated by the same brake handle to which the ordinary chain-brake is attached, and available for use at any time. The device consists essentially of a pump carried upon and operated from the axle, and a hydraulic-brake cylinder, which is fastened to the bottom of the car and supplied directly from the pump with a non-freezable oil under hydraulic pressure.

The oil reservoir, with the pump and its valves, is contained in a casting which is made, for convenience, in three separate sections, which are bolted together, and completely shut in the working parts to the exclusion of all dust and dirt. It incloses and is carried directly upon the axle, the escape of oil being prevented by means of stuffing boxes, one of which is clearly seen in the perspective view.

The pump piston, *P*, is driven by means of an eccentric, *B*, which is mounted on the axle, and, of course, is in constant operation when the car is running. The brake cylinder, *D*, contains two pistons, whose piston rods, *E* and *F*, projecting through opposite ends of the cylinder, are connected directly with the ordinary brake levers, *G*. This cylinder is provided with a piston valve, *H*, which is connected directly through the rod, *I*, with an eccentric, *K*, carried on the lower end of the brake-staff, the turning of the brake-handle from a quarter to a third of a revolution by the motorman serving to open or close this valve. The brake cylinder is connected with the pump by means of two pieces of steel hose, *M* and *L*. Normally, when the brake is not in operation, the piston valve in the brake cylinder remains open, and the oil is driven through the hose, *M*, to the brake cylinder and thence back to the suction pump valves, the flow of oil being continuous and perfectly free. By a quarter turn of the brake-handle, however, the piston valve is closed and the full hydraulic pressure of oil is exerted upon the pistons of the brake cylinder, driving them to the center of the cylinder, as indicated by the arrows, and thereby setting the brake shoes. When the piston is opened by the motorman the free circulation of oil takes place as before. This brake, which was invented by J. H. Neal, and is manufactured by the United States Steel Company, 145 Oliver Street, Boston, Mass., is the outcome of considerable experience in the operation of the Boston Elevated Railway Company's system, and it has many advantages





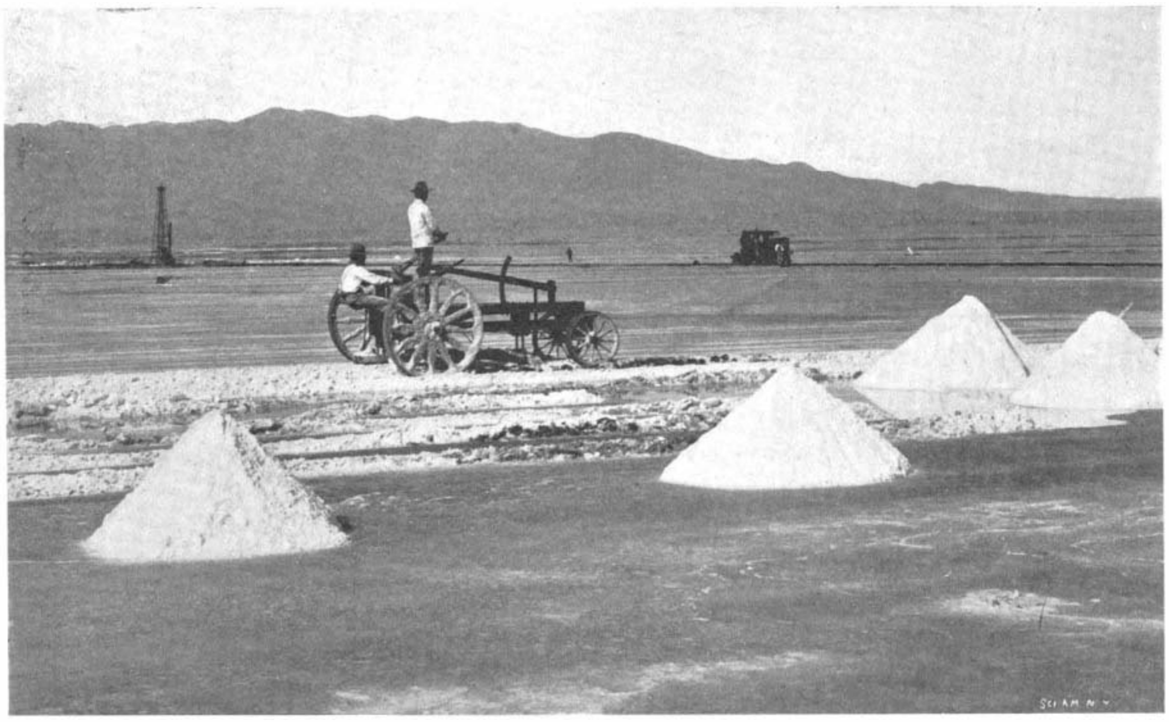
HYDRAULIC ELECTRIC-CAR BRAKE.

which have been proved by the test of actual service. In the first place, it is instantaneous in its action, the brake being set, as we have said, by a quarter turn of the brake handle, and the appreciable delay which occurs in the winding up of an ordinary hand-operated chain-brake avoided. Another most important advantage, which will be appreciated by the repair shop, is that the actual locking or "skidding" of the wheels is impossible, the brake being under automatic control; for should the wheel, and, therefore, the pump, stop, the pressure on the brake cylinder piston heads is lowered, and the braking effect removed. At the same time the motorman has at command the full efficiency of the ordinary chain-brake. The mechanism is adjustable to any brake that allows 6 inches or more of axle space. Its total weight is less than 500 pounds, and the cost of power for its operation is, practically, nothing at all. The whole brake being carried in an air-tight casing filled with oil, the mechanism is self-lubricating, and repairs, as proved by actual operation, are very light.

A REMARKABLE SALT DEPOSIT.

BY CHARLES F. HOLDER.

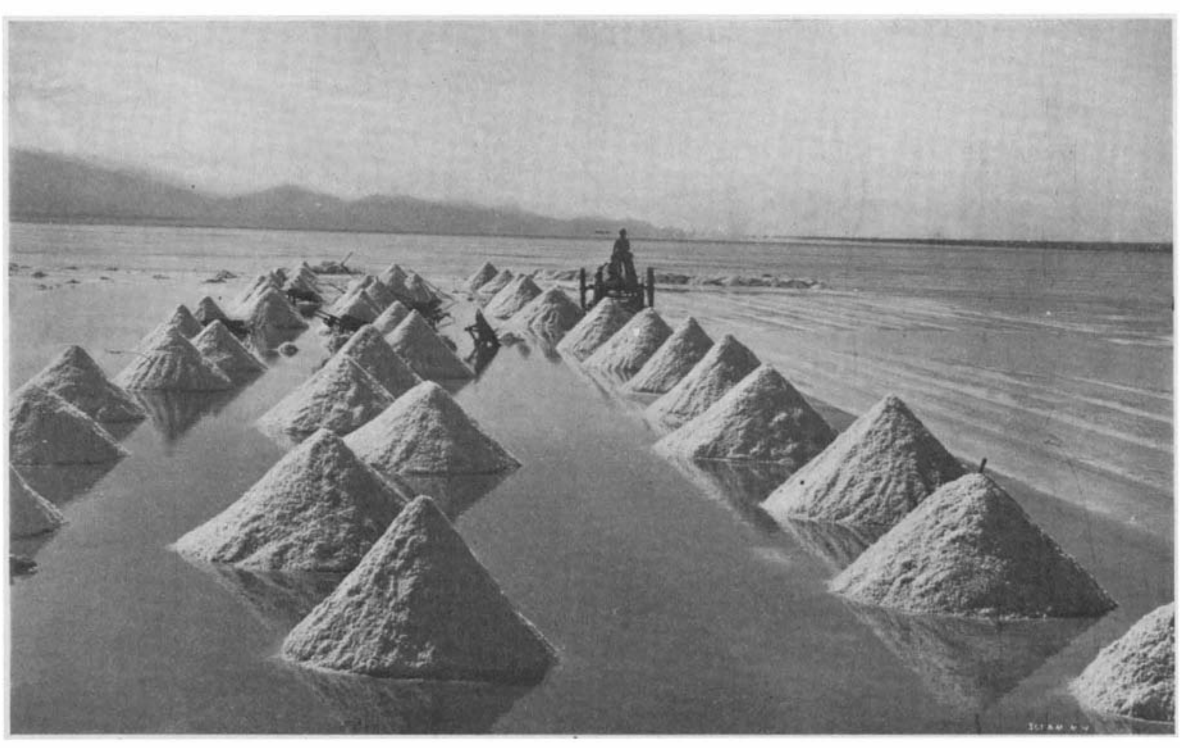
Few readers of the SCIENTIFIC AMERICAN had heard of the Sea of Salton up to 1892. At this time the Colorado River broke its barriers and flowed into the desert of California, flooding it to an extent of hundreds of square miles. In the vicinity of Salton was one of the largest salt deposits in America; the water encroached upon it, and for a time threatened the industry, but after creating an excitement which spread over the entire West, it receded. The rumor was to the effect that the new sea was so vast that it would change the climate of Southern California.



SALT DEPOSITS AT SALTON, CAL.—SIDE VIEW OF SALT PLOW.

The deposit of salt at Salton is one of the sights of California. It lies in a depression almost three hundred feet below the sea level, and was at some time in the past the bed of a sea, or extension of the Gulf of California. From the train, which passes nearby, the tract looks like a vast snow field, and in the early morning is frequently the scene of beautiful mirage effects. The salt deposit, which is essentially rock salt, covers about one thousand acres, and is at present the center of interest on account of the dispute of rival companies over the possession of the property. The company in possession has shipped from this place annually about two thousand tons of salt, valued at from $6 to $34 per ton, according to quality. The outfit of the salt mine consists mainly of a crusher, a drying building, and a dummy line from the salt beds to the Southern Pacific Railroad, not far distant. The work is carried on mainly by Indians, who can withstand the intense heat of the desert—150 deg. in June—and the glare better than white men. The work is interesting and novel. The drying house is a building six hundred feet in length, about which hundreds of thousands of tons of salt are heaped, having all the appearance of snow. Here the salt is dried and milled. The salt is collected at first with a plow—a singular machine with four wheels, in the center of which sits an Indian guiding it; the motive power is a dummy engine some distance away, which hauls the plow along by cables. As it passes, the steel breaker is seen to cut a broad but shallow furrow, eight feet wide and three feet long, throwing up the ridges on either side. Indians now follow along, and with hoes pile up the salt in pyramidal forms, which later is transported to the mill. Each plow harvests seven hundred tons of salt per day. A singular feature of this bed is that the salt is being deposited daily by springs which run into the basin, and as the water evaporates it leaves a crust of almost pure chloride of sodium, which ranges from ten to twenty inches in thickness, over the lake. It will be seen that there is no danger of exhausting the supply, which is forming all the time; and, in point of fact, the plows have in the past years worked almost continuously over the same area, only about ten acres having been plowed.

The salt, when delivered at the plant, is hoisted to the upper floor and placed in a bulkhead breaker, where it is reduced to particles of the same size. It then passes through a burr mill and is well ground. After this it is sifted and is finally passed through an aspirator, which cleanses it of all foreign material, when it is ready for packing in bags. The salt is used for a variety of purposes, and is of several different grades, the lowest being unrefined—a product called hide salt, used in manufactories. Large quantities are sold for sea-bathing purposes, a certain amount producing a very similar chemical equivalent to sea water. Other grades are prepared for the table, dairy and for the use of druggists.



PILING THE SALT AT SALTON, CAL.—280 FEET BELOW THE LEVEL OF THE SEA.

Copper Casting.

For some purposes, such as valve seating and the like, states Walter J. May, in The Practical Engineer, copper has considerable advantages, but there is usually some trouble in getting them sound; in fact, many brass-foundry people say that sound castings cannot be made in copper, and probably such has been their experience, using ordinary brass-foundry moulding and cheap brands of copper; but all the same for that, under proper conditions, copper can be cast as readily and as soundly as gun metal if you go the right way to work. In the first place, you require good metal, and probably you cannot do better than use good new sheet scrap, as this would give the highest grade of tough metal at a moderate price, and such metal as would probably give the best castings. At the same time, old sheet scrap, when carefully cleaned from tin and solder, gives very good castings, but the waste is greater, this often more than balancing the difference in price.

Having your copper, it should be melted in crucibles kept for copper only, and it is well to use the best non-sulphurous coke for melting. Gas coke holds too much sulphur to be useful, and some of the hard cokes are not to be recommended for the best work, as some of the impurities get into the metal at times. Clean melting is essential to obtaining good results, and must not be overlooked.

In preparing the moulds care must be taken to ram fairly hard, and to vent well, giving large runners, and, where required, risers, but the gates should be only of ordinary size as for iron. Thin sprues are not desirable, as it is policy to keep the connection between the runner and casting fluid until the latter has set, so that metal can keep drawing in until contraction ceases; in fact, the writer has found that a large head of metal and moderate feeding is of great assistance; therefore, in making moulds this should be provided for. The moulds should be coated—sleeked—over with plumbago, and dried, and, needless to say, the boxes should fit well. So far as possible a slight inclination from the pouring gate should be allowed when setting the boxes for pouring; but due attention to the shape of the castings must be paid in arranging this part of the business. The metal should be poured hot, and the feeding rod should be kept at work longer than for iron, and the castings should not be opened out before they are black hot or even cold. In every case it will be necessary to flux the metal, and for this purpose either muriate of ammonia and chalk, well ground together in equal proportions, or roughly-crushed chloride of manganese, should be used, from 4 ounces to 12 ounces to the hundredweight of metal being necessary, according to local requirements; but the writer finds that either of these is effective. In applying these fluxes, they may only be put into the metal after it is melted, the best time being soon before the crucible is taken from the furnace, throwing the flux on the metal and well stirring in, not taking the crucible from the fire until the fumes have ceased. It is no earthly use putting chloride fluxes into the pot before the metal is melted, as you only destroy the pot and make a stink by so doing, without affecting the metal. You are not using glass or other hard material that has to be melted, it must be remembered, and if you want to obtain the due effect from any flux which you are using you must add it when it will be effective.

There is no reason why copper should not be cast as soundly as brass, although it needs more care, and copper can be hardened, if necessary, to the hardness of mild steel; but alone, copper would not make a good bearing metal. The small amount of manganese added in using the chloride mentioned above does not seriously affect the copper, if it is of good quality to start with.

The difference between the specific heats of cobalt and nickel increases as the temperature rises. According to the results obtained by Pionchon the specific heat of nickel is at first a little greater than that of cobalt, and becomes very much less at higher temperatures. The electrical conductivity is very different for the two metals. Taking silver as 100, cobalt equals 17.22, and nickel 13.11.