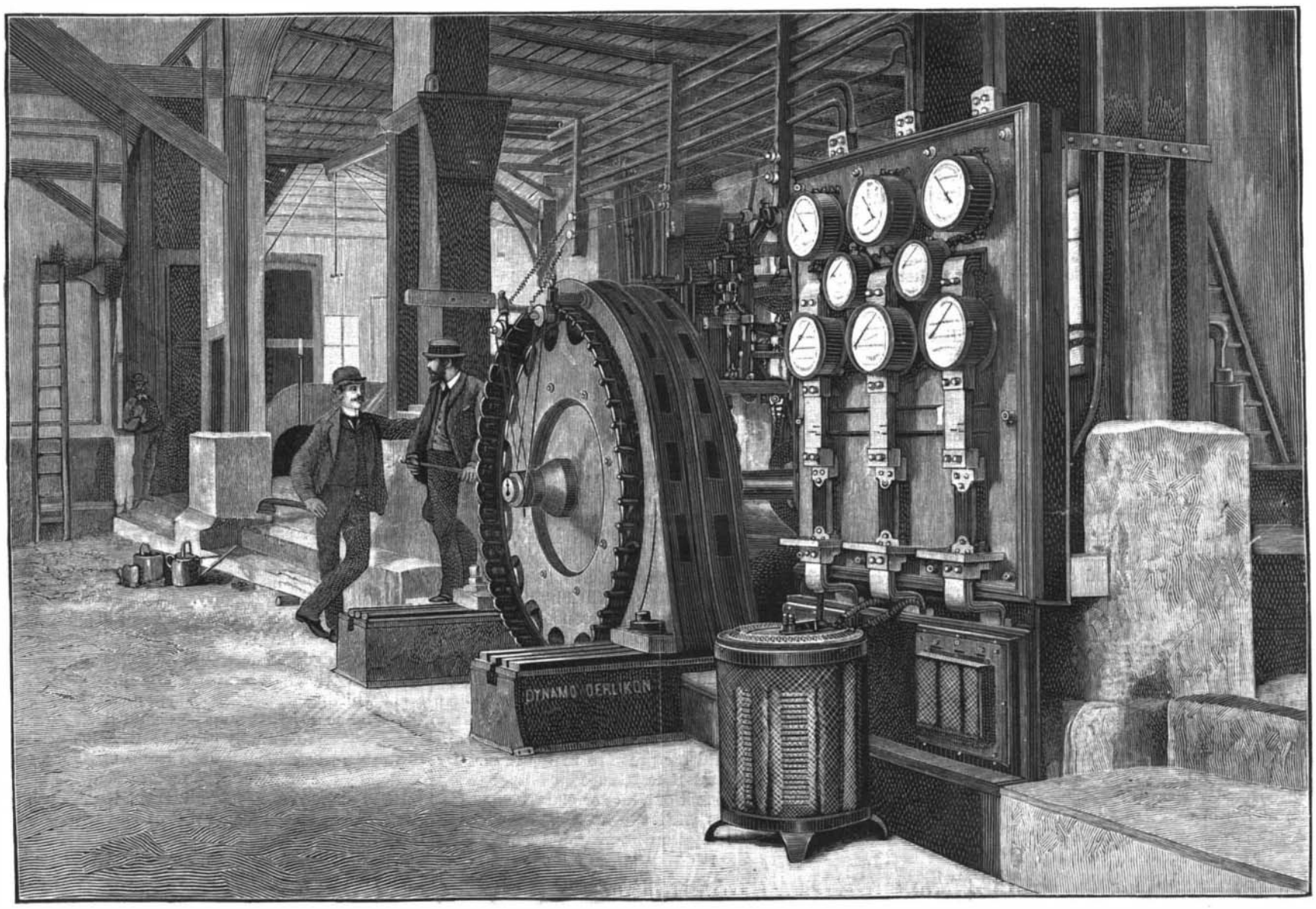
THE ELECTRICAL TRANSMISSION OF POWER BETWEEN LAUFFEN ON THE NECKAR AND FRANKFORT ON THE MAIN.

Among the many important exhibits at the recent Frankfort Electrical Exposition, a prominent place was given to the arrangements for the transmission of power between Frankfort and Lauffen. It formed the main feature of the exhibition, and is an important step in the development of electricity.

As is well known, we understand transmission of power to mean the methods which utilize the electric current for carrying any energy—whether derived from coal, from falling water, from the force of the wind, or from the ebb and flow of the tide—any required distance.

If, for instance, the energy of great waterfalls is to be transmitted, the following arrangement is usually employed: By means of turbines the falling water is made to drive the queen of all mechanisms, the dynamo; the latter generates electricity, which is carried to a distant station by wire conductors. There it enters a second dynamo, causing the movable part, the armature, to operate. In this way machinery can be driven or the electric current can be used for lighting, etc.



ELECTRICAL TRANSMISSION OF POWER—PRIMARY STATION AT LAUFFEN ON THE NECKAR—ROTARY CURRENT DYNAMO FROM THE OERLIKON WORKS.

The transmission of power over such long distances is a new thing for the electrician, and from it he has gained the idea of utilizing the water power which is supplied so abundantly by nature in some countries—as, for instance, in Switzerland—throughout whole districts, and at great distances from the source. A notable instance of this was the transmission of the energy of Niagara Falls to Buffalo, a distance of nineteen miles. The last obstacles to work of this kind have been removed by the achievements of the Frankfort Exposition, by which a force of falling water equal to 300 h. p. is transmitted a distance of about 108 miles to Frankfort, and the experiment has proved a brilliant success.

Connected with the realization of this plan there are a great number of important innovations, to which we will briefly refer.

Dynamo machines generate two different kinds of currents according to their construction: the continuous current and the alternating current. The continuous current machine, which generates a current that flows continuously in one direction, has surpassed, in many respects, its sister, the alternating current machine, the impulses of which change their direction many times in a minute. When the direct current is used for the transmission of power a conductor having a special cross section is required, but, although the alternating current is much more economical in this respect, it has not been possible heretofore to utilize it for driving motors. To the direct and alternating current already described has lately been added the rotary current, which is generated by a dynamo in which the field magnet rotates. Its discoverer is the Italian Professor Ferraris, of Turin, and among the constructors who have brought it into notice by building practical machines, we will mention the following engineers: Tesla, Hasselwander, and Von Dobrowolsky.

The rotary current may be described as a system of connected alternating currents of different phases. The invention of the rotary current motors makes it possible to use also the economical alternating current for driving motors. On the Lauffen-Frankfort line about 300 h. p. have been effectively transmitted by means of an alternating current of very high tension (30,000 volts), and this energy is applied by means of the new rotary current motors. This striking experiment can scarcely have been tried before. The entire cost is about $20,000. The three conductors which carry the current to Frankfort have a total length of about 310 miles, and about 13,200 lb. of copper were used in their manufacture; 1,500 lb. of oil are used for filling the insulators over which the conductors pass. All this goes to prove that the technologist is now prepared to transmit strong currents over great distances, bringing the power which is now wasted in regions remote from the channels of trade to the machinery which is busy in the service of man in the large cities. —*Ueber Land und Meer.*

Areas for Chimneys.

The old rule about chimneys was that they ought to have the flue tapered to the top, on the theory that, as the hot gases in them ascended, they cooled, and, in cooling, contracted; and that it was important to reduce the size of the flue in proportion to the reduction in volume of the gases, as otherwise cold air from the top would descend to fill the vacancy left by the contraction of the gases, and the draught would be checked. Reasonable as this theory seemed, practice has shown that cylindrical boiler or furnace flues are at least as good as the tapered ones, and within a few years practical engineers and architects of experience in such matters have inclined to make them slightly larger at the top than the bottom, the increase in diameter being, perhaps, half an inch to ten or twelve feet. Recently, a Swiss engineer has made experiments to see whether the facts bear out the old rule or support the more modern practice. To make the test, he built a chimney over a furnace grate, the stack having two flues. One flue tapered upward and the other downward, and the flues opened side by side over the grate, with openings of the same size. On lighting a fire on the grate, with unlimited access of air under it, the smoke was seen to issue nearly equally from the top of both the flues, but with an unmistakable preponderance in favor of the flue which enlarged toward the top. On partially shutting off the access of air to the fire, the difference became much more marked; the current in the flue tapering upward diminished, and finally stopped altogether, the smoke finding its way entirely through the flue with the wider top.—*The Builder and Decorator.*

The Ruling of Diffraction Gratings.

A word should be said as to the difficulties of ruling gratings which may explain why so many orders for gratings remain unfilled. It takes months to make a perfect screw for the ruling engine, but a year may easily be spent in search of a suitable diamond point. The patience and skill required can be imagined. Most points make more than one "furrow" at a time, thus giving a great deal of diffused light. Moreover, few diamond points rule with equal ease and accuracy up hill and down. This defect of unequal ruling is especially noticeable in small gratings, which should not be used for accurate work. Again, a grating never gives symmetrical spectra; and often one or two particular spectra take all the light. This is of course desirable if these bright spectra are the ones which are to be used. Generally it is not so. It is not easy to tell when a good ruling point is found, for a "scratchy" grating is often a good one, and a bright ruling point always gives a "scratchy" grating. When all goes well, it takes five days and nights to rule a 6 inch grating having 20,000 lines to the inch. Comparatively no difficulty is found in ruling 14,000 lines to the inch. It is much harder to rule a glass grating than a metallic one; for to all of the above difficulties is added the one of the diamond point continually breaking down. For this reason, Professor Rowland has ruled only three glass gratings. One of them has been lost, and the other two are kept in his own laboratory. These two were used by Dr. Bell in his determination of the absolute wave length of the *D* lines.—*Joseph Sweetman Ames, in Astronomy and Astro-Physics.*

ACCORDING to the report of the statistician of the Interstate Commerce Commission, the total number of persons reported killed on the railroads of the United States during the year ending June 30, 1890, was 6,334, of whom 2,451 were employes, 286 were passengers, and 3,597 were classed as "other persons," the last class including suicides. The total number reported injured was 29,025, of whom 22,394 were employes, 2,425 were passengers, and 4,206 were unclassified.

During the year 369 employes were killed and 7,842 injured in coupling and uncoupling cars. There can be no doubt that a large proportion of these fatalities and injuries would not have occurred if automatic couplers had been in universal use.