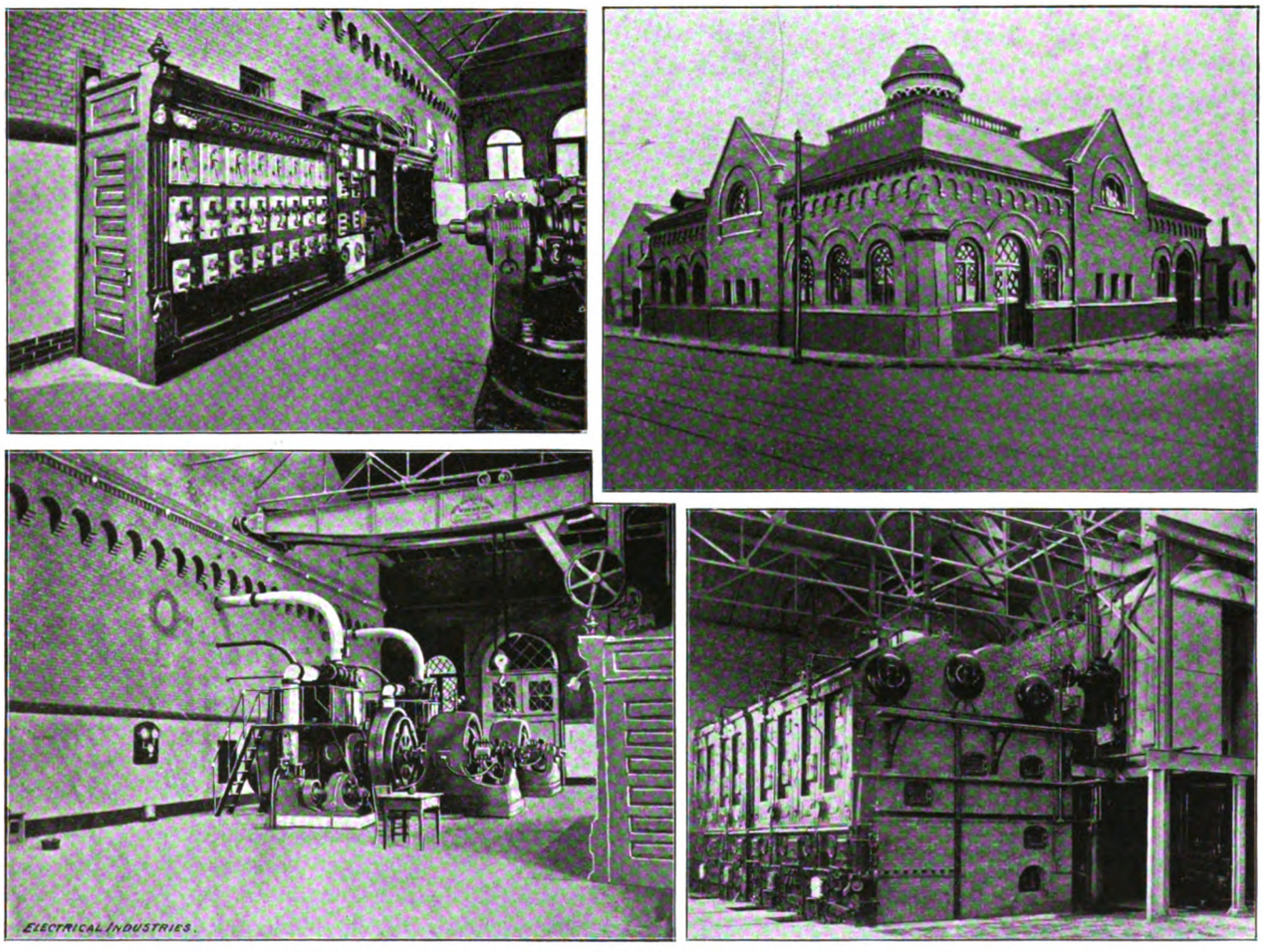
ELECTRICAL INDUSTRIES.

Vol. VI. CHICAGO. May, 1895. NEW YORK. No. 5.

The New Power House of the Columbus Central Railway Co.

The construction of a power house for an electric railway involves an experience and skill able to provide most intelligently not only for present but for future demands. The design of the building, the selection of the equipment and its arrangement require that the present knowledge on the various subjects shall be wisely used and also that future practice shall be in a measure anticipated and provided for. Thus in each new power house constructed we look for those features that will show the improvement in former and suggestions of what will be the future practice. In the power station and equipment of the Columbus Central Railway Co., of Columbus, Ohio, which is illustrated in the accompanying engravings, a number of novel features appear.

The exterior of the building has been so planned that there is no suggestion of shop, factory or power plant. Its style gives it the appearance of a public building and possesses a certain dignity appropriate to such a building. It is ornamental in appearance and possesses none of the features which usually make such buildings objectionable in a good residential district. The tall smoke stack is conspicuous by its absence. There is a stack, however, that has been cleverly concealed in the design of the building. Up through the ornamental dome that surmounts the building an eight foot stack rises in such a manner that no part is visible from without. This plan has not in any way been detrimental to the proper arrangement of the power equipment.



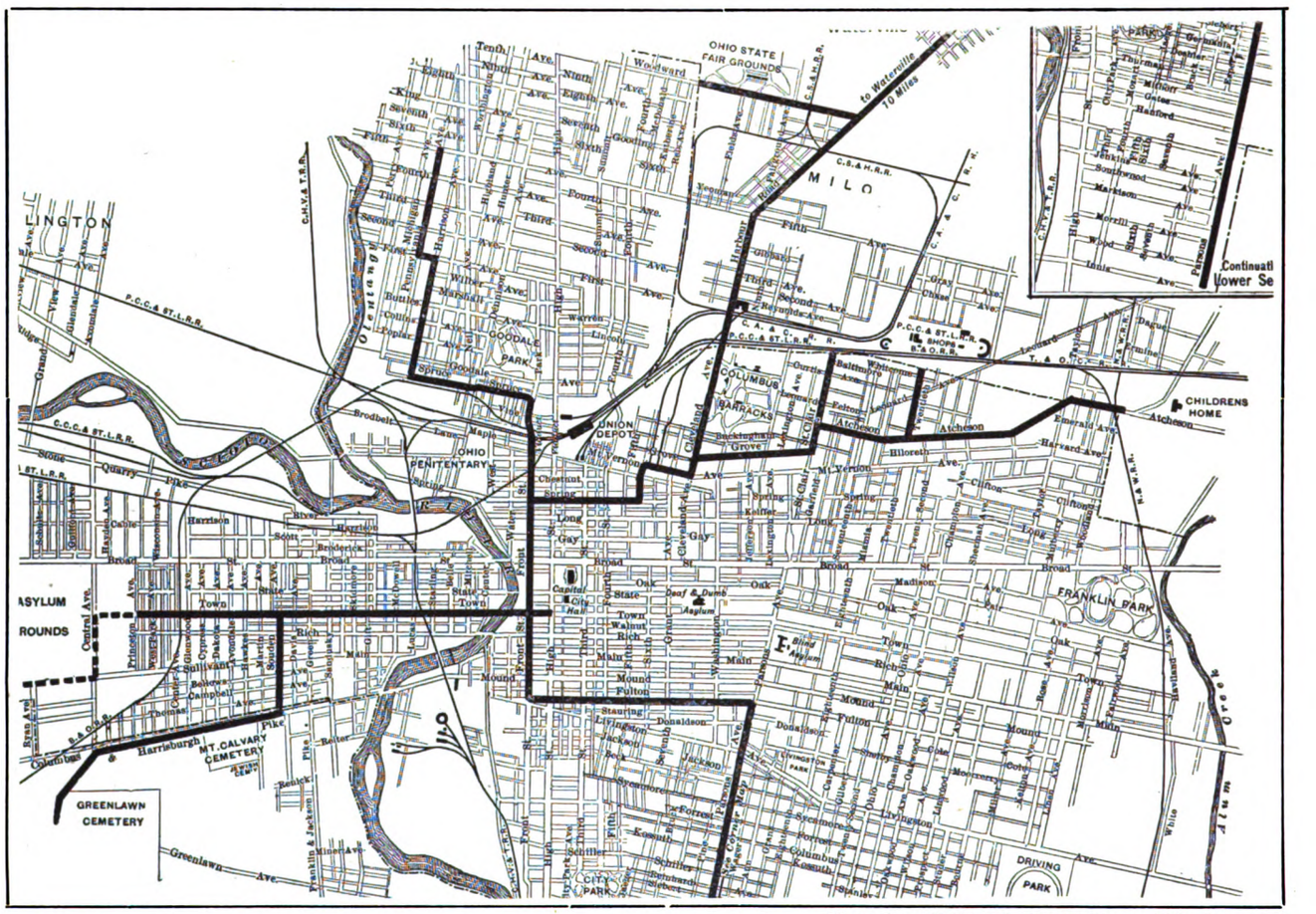
FIGS. 1, 2, 3 AND 4.—THE NEW POWER HOUSE OF THE COLUMBUS CENTRAL RAILWAY COMPANY.

The building is built of brick with stone trimmings. The floors are of concrete and the interior of the walls is finished in white and cream colored glazed brick. The roof is of Spanish tile supported on iron trusses. The building is therefore as near fireproof as it is possible to build. In size it is one hundred by one hundred feet. The stack which reaches the highest point of the dome is seventy feet in height. The ceiling is high and the interior is light and well ventilated.

The engines and generators of the power plant are direct connected Westinghouse compound engine and Westinghouse multipolar generators. They are both mounted on one bed plate and are connected by a universal flexible and insulated coupling, The details of this combination are shown in the outline cuts. The generators are each of 200 kilowatts capacity, compound wound and multipolar as shown. The general form of the generators is the same as that of nearly all the Westinghouse generators and motors and which is recognized at once by all familiar with electric power apparatus. The solid character of the yoke and pole pieces is shown in the cross section cut. The armature is entirely surrounded by the iron magnets. The space between the poles is only sufficient for the accommodation of the field coils.

to the back of the switchboard. A cluster of incandescent lamps on an ornamental fixture attached to the top of the generator gives a neat finish to the machine. An insulated base intervenes between the frame of machine and bed plate. The connection to the universal coupling is also insulated.

The engines as stated are of the Westinghouse compound type, run non-condensing. The cylinders are eighteen and thirty inches in diameter respectively, with a stroke of sixteen inches. A section of this engine is shown on Fig. 2. The single acting and the compound principles are both shown. The impulse is given to the pistons in but one direction. While in the double acting engine the pressure is first on one side of the piston and then on the other; the two cylinders in this engine perform the service. The



[From Street Railway Spplement Com. and Fin. Chronicle.]

FIG. 5.—COLUMBUS CENTRAL RAILWAY—MAP OF LINE.

The maximum efficiency is by this method secured in the fields of the machine. The field coils are wound on spools which slip over and are fastened to the pole pieces. The bearing supports are cast on the frame of the machine, a method that gives great rigidity and strength. The bearings are self-oiling and aligning, and require but little attention. The armature, one of the most important parts of the generator, has received a proportionate amount of attention. The heavy copper conductors that form the windings are well insulated and are placed in insulated forms that fit the slots in the armature core. The whole is firmly secured and so accurately balanced that the minimum amount of air space is left between the armature and pole pieces.

The brush holders are of an improved pattern and four are mounted on each rod. The conductors from the brush holders are carried to the side of the machine and then pass beneath the floor and by means of buried conductors

steam being used twice, first in one cylinder and then in the other must effect good economy. The Westinghouse Machine Co., the manufacturers of this engine, have been strong advocates of the single acting engine, and have shown the success of the principle in the thousands of engines in successful operation.

The engine is enclosed and the crank shaft runs in oil, a feature that is conducive to great durability and efficiency. The steam valve is actuated by a single eccentric controlled by a shaft governor. The parts of the governor, with the exception of the eccentric, are enclosed in an oil tight case. This case is filled with oil when the engine is set up and needs no attention for an indefinite period. The different parts of the engine are reached by a foot board at a sufficient elevation to make all parts easily accessible. Iron steps and railing lead up to the foot boards. It is arranged to form a neat gallery about the engine. The steam pipes pass from the boiler room through the wall and instead of

short elbows bends of large radius are made to the engine. The friction of the steam connections is reduced as much as possible.

The switchboard is conveniently located at the center of the side of the engine room. It was built by the Freeman

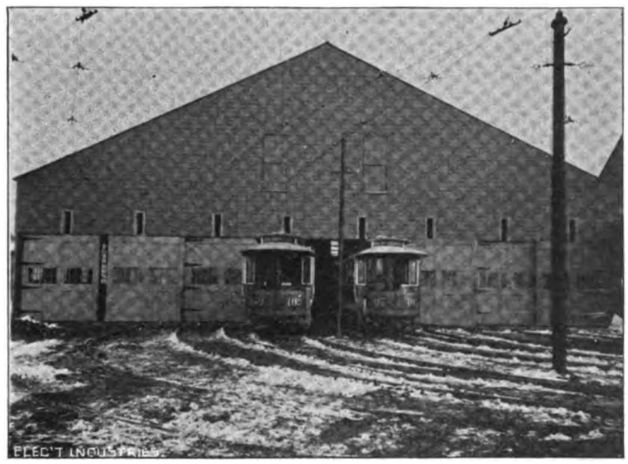


FIG. 6.—COLUMBUS CENTRAL RAILWAY—CAR BARNS.

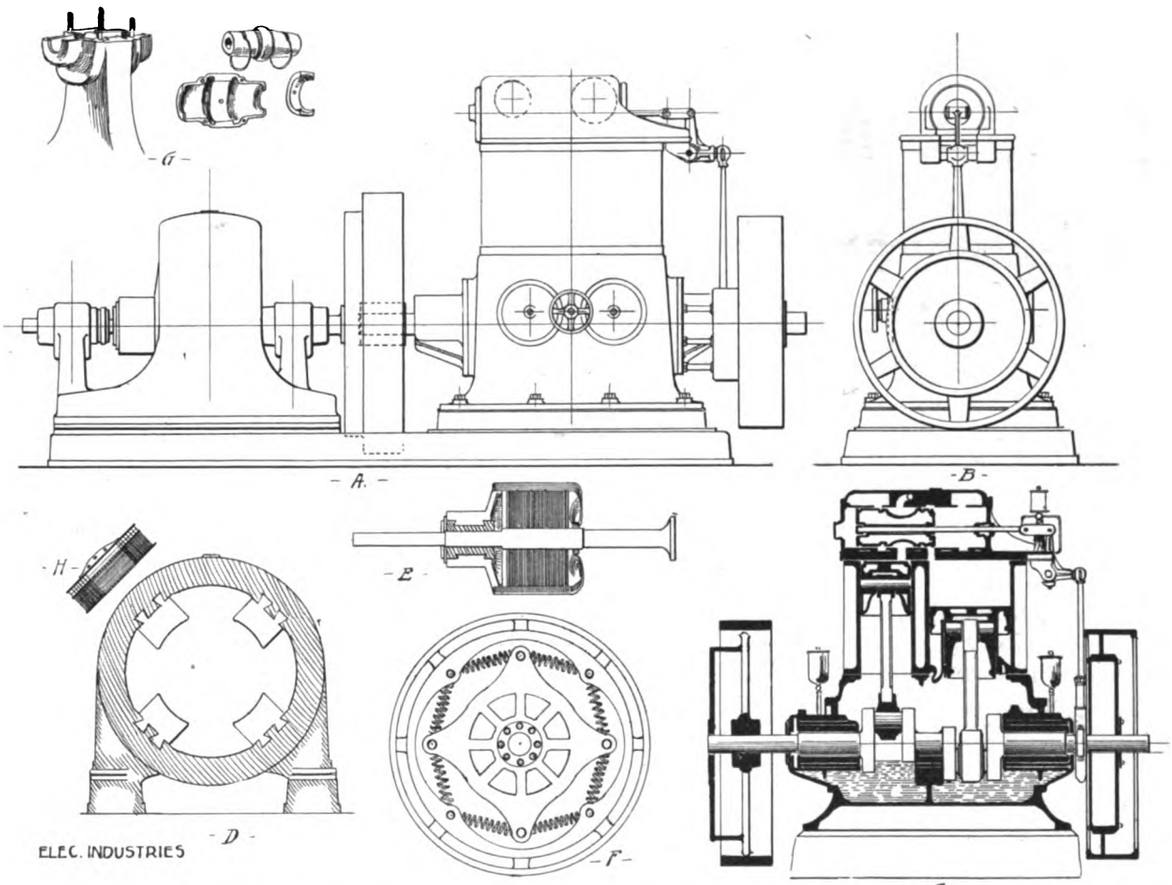
Mfg. Co., of Columbus, and is a very handsome board. The face of the board is slate of an extra thickness. The front is marbleized and the back shellaced. The board proper is enclosed in a heavy frame of polished mohagany. The top and columns are handsomely carved, and the board as a whole is one of the finest to be found. It is thirty-one feet long, ten and one-half feet high, and is placed three and one-half feet from the wall. It contains four generator panels and sixteen feeder panels, provision being made for future extensions of the plant.

The conductors from the generators come up back of the board from a pit which is easily accessible by raising the wooden gratings that form the floor. The instruments are all made for connection back of the board. The bus bars and equalizer bar are constructed of round copper rods supported in porcelain insulators through which they pass. Connection is made to these rods by clamp connectors that pass clear around the rod.

The generator panels are placed at the center of the board and contain ammeters, voltmeters, test instruments, rheostats, etc. The automatic circuit breakers of the feeder panels are connected to an alarm that sounds and continues to sound while it remains open. This arrangement has been found advantageous as the engineer may be called to boiler room or some other part of the building. The alarm can be heard anywhere about the building.

Traveling on a track on the engine room walls above the machinery of the room is a traveling crane of sufficient capacity to lift any piece of machinery in the plant. It carries a platform from which an operator by means of the levers placed there is able to control all movements of the crane. It was built for this power house by the Phoenix Iron Works Co. of Cleveland, Ohio. The value of the crane in placing the machinery and as a means always at hand for replacing parts of machines cannot be easily estimated. It runs the entire length of the room.

The steam generating apparatus consists of four Stirling boilers of 200 horse-power each. There is room for double this equipment when more power is required than the present plant affords. These boilers are of the well known Stirling type. They were erected on solid foundations of brick and concrete, and were built without the use of cast iron or cast steel, in their construction, which, together with the manner of the construction, make



A—Engine and generator. *B* and *C*—End and section of engine. *D*—Section through poles of generator. *E*—Armature. *F*—Universal coupling. *G*—Bearings of generator. *H*—Field coil of generator.

FIG. 7.—THE POWER HOUSE OF THE COLUMBUS CENTRAL RAILWAY.

them one of the safest of boilers. In construction, the boiler consists of a large drum placed back of the furnace from which the water tubes rise to the three drums placed above. The position of the tubes is noteworthy, for by it the tubes are kept free from all impurities which are precipitated by the heat into the mud drum placed back of the furnace grates. Where the tubes enter the drums they are so secured as not to be effected by expansion and contraction and the longitudinal expansion will not injure them owing to their peculiar shape. The boilers have a large draught area; the vertical position of the tubes and the arrangement of the brick baffle plates in the large tube chamber insures a good draught at all times. The special construction of the fire brick arch over the furnace with the wide draught area causes the gases and air to thoroughly mingle so that a perfect combustion is insured.

Thorough circulation takes place in the boiler due to the fact that each water tube being expanded directly into the circulation drums has a separate outlet equal to its own area. Although these boilers, owning to their peculiar construction, require little cleaning, abundant and ample openings are provided so that easy access can be had to any and all parts of the boiler.

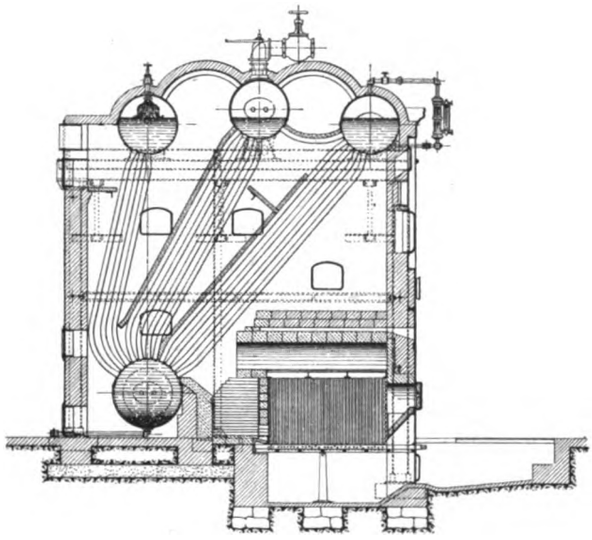


FIG. 8.—COLUMBUS CENTRAL RAILWAY—THE STERLING BOILER.

The gases of combustion pass through an improved form of fuel economizer before reaching the stack and cooled to such an extent that a mechanical draft system was necessary with a short stack. The system of Westinghouse, Church, Kerr & Co. is used. There are two slow running exhaust fans made by the Buffalo Forge Co. at the base of stack operated by small direct connected engines. National feet water heaters are also used and the exhaust steam escapes by way of the stack where the heat reduces it to an almost invisable vapor. Stokers are used for feeding the furnaces and the entire equipment has been arranged so as to require the least amount of manual labor and attention.

The power house and equipment have been carefully planned and skillfully constructed. The apparatus used is the most improved of the several kinds. But one-half of the power equipment is as yet installed, being 400 kilowatts capacity. The demands of the road it is expected will require the full equipment or 800 kilowatts capacity to be installed within a year. This, however, will allow them extra machines so that in case of accident to one there will be another ready to put in. The engineers in charge of the construction were: Messrs. Barry & McTighe of New York.

Factory Practice in the Design and Construction of Dynamos—I.

BY C. E. WOODS.

This subject, while not new, inasmuch as it has been treated by many able minds, is still as full of interest to the general class of electricians as ever, if not more so. The effort of most writers, however, has been strictly for the benefit of the experienced engineer, rather than for the artisan and public at large, and in the articles which the writer has undertaken to produce, an effort will be made to shape them expressly for the benefit of the latter class of people, and especially for those who operate electrical machinery. In the details presented, if anything is not thoroughly understood, the writer will be pleased to answer any inquiries which may be made thereon throught the medium of ELECTRICAL INDUSTRIES. There has always been a sort of chasm between the operators of dynamo electric machinery and its designers, and the actual scope of the following articles will be to bridge that chasm as well as possible, and form a bond of understanding which will be both mutual and lasting. Without a gradual leading up to the main points in dynamo design, an understanding of these points would never be reached, and in order to eliminate any confusion, we will take one dynamo of one particular type and remain with it until we have studied every detail and then take up other types in order.

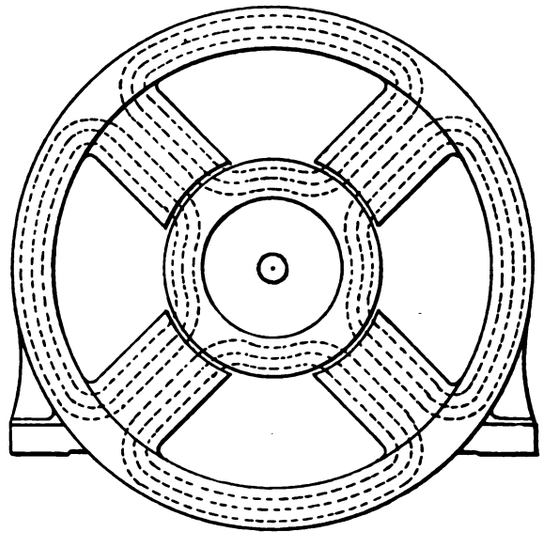


FIG 1

Probably the most interesting type that we can commence with will be a multipolar dynamo, with four poles. In explanation, the multipolar dynamo is a dynamo having more than one pair of poles, constructed in a circle equally distant apart, around an armature, the poles having one common outside ring to which they are all fastened, as illustrated in Fig. 1. The proportions of this cut will be set forth later on. The advantages obtained in this form of dynamo are many, and of great importance, which will be clearly illustrated in the final summary of this series of articles. We should first consider in preparing the design of a dynamo, its fundamental principles, and the first question that naturally comes to the mind of a layman is, by what and how is the current generated? Briefly, the reply would be, by a conductor passing through lines of force, or cutting lines of force, as ordinarily expressed. Of course the next inquiry will be, what is a *conductor*, and what are *lines of force*.