DOMESTIC PLUMBING HEATING LIGHTING VENTILATION ENGINEERING

This department is conducted for the benefit of all interested in Steam and Hot-Water Heating, Ventilation, Plumbing and House Drainage. For fifteen years these matters have been prominent features of THE ENGINEERING RECORD *(prior to 1887 The Sanitary Engineer), and they will be treated with such detail as the importance of the subject demands. The co-operation of our readers in sending discussions, notes and queries, drawn from practical experience in these branches of Building Engineering will be welcomed, and careful endeavor will be made to answer such questions when of general interest.*

HEATING AND LIGHTING PLANT OF THE COLUMBUS, O., UNION DEPOT.

THE Union Depot in Columbus, O., which has lately been completed by the Pennsylvania and Big Four Railroads, presents a number of features of interest to the architect and the engineer, conspicuous among them being the general arrangement of the station building and its surroundings, and the heating and lighting plant provided for it. As now completed the station building, lying on the south side of the trainshed, consists of a rectangular structure 300 feet long and of an average width of 78 feet. The building contains a basement, first and second story, shown by Figs. 1, 2 and 3. The basement is on a level with the railroad tracks. From the first floor the tracks are reached from a bridge 50 feet wide on a level with the first story and connected to the tracks by numerous stairways. The old trainshed has been extended some 75 feet, so that it now covers an area 675x150 feet. West of the trainshed by 800 feet and at right angles to it is High Street, which crosses the tracks on a viaduct. The side of this viaduct next to the station is lined with a row of stores two stories high this hiding the trains from view. The entrance to the station is through an imposing arcade, shown by Fig. 4, leading off High Street. From this a driveway and covered footpath lead to the station. The latter leads to the first floor of the station, while the driveway divides, one and branch continuing on the street level to the first floor of the station, while the other descends to the basement grade. East of the station building is a one-story express building and beyond it a power house. The basement of the station contains a general waiting-room, a waiting-room and lunch room for immigrants, baggage and express offices. Baggage and express packages are loaded and unloaded from cars that are run on a track that lies south of the station building. To reach the tracks from the basement an underground subway leads to stairways ascending to each track.

Figure 2 shows a plan of the first floor. The decorations are very handsome, as shown by Fig. 5, a view of the interior of the main hall. The floors are of mosaic, laid upon tile floors. The wainscoting is of marble with plaster walls. The ceiling decoration is of ornamental plaster work.

The station contains a heating system which is in many ways unique, especially in that it comprises the most extreme use of the vacuum principle of heating that has as yet been installed, as the condensation from one-third of the radiation in the entire building is lifted vertically in the return pipes from 3 to 15 feet. The Webster system of steam heating is used throughout, with all the appliances which appertain to it. The plan of the building is such as to make the distribution to the heating system rather difficult, as it is very long and narrow on the "basement floor" or track level with the boiler room at the extreme eastern end. The entire building contains about 977,000 cubic feet and is heated by 10,500 square feet of direct radiation.

The distribution of steam to the radiators is effected by a system of main pipes run on the ceiling of the basement just below the girders. There are two lines of main supply pipes running along the side walls of the building. These mains are each 5 inches at the boiler room and reduce to 2 inches at the extreme end. They are on an absolute horizontal level, having no pitch in either direction. They are connected together at both ends and also at two intermediate points by bypasses, which serve not only to equalize the pressure, but are also valved in such a way as to divide the mains into six sections, any one of which can be shut out independently of the others. The main return pipes run through the building, adjacent and parallel to the main supplies and also on exactly the same level, which arrangement presents an unusually uniform and finished appearance. The connections to all the radiators and coils are taken off from these mains, and the distribution of the radiators is such that in most cases there are separate connections to the mains for each radiator. The supply connection to each is valved with an ordinary radiator valve, while the return connection has the Webster automatic water and air valve, there being no separate air valves on the radiators. These valves open automatically when cold, and close when the temperature of the steam reaches them. Several of these valves are also set on the supply mains and connected into the returns to keep the former free from water of condensation.

As before stated, the distinguishing feature of this plant is that the condensation from all the radiation in the basement, which is considerably below the level of the return mains, is lifted out of the radiators by the vacuum which is maintained in the returns. There is a total of 3,700 square feet of radiation in the basement, of which 1,900 square feet is in the coils which heats the express, baggage and mail rooms and the remainder is in radiators. The former are wall coils placed near the ceiling and extend about 3

feet below the level of the return mains, but the radiators are all placed on the floor level 15 feet below the mains. Many of them are 25-loop radiators containing 100 square feet and the return risers are uniformly one-half inch in size.

Exhaust steam is used exclusively for heating, except when in the very coldest weather it may have to be supplemented by a small amount of live steam through the reducing valve. The exhaust from the engines of the electric light plant is conducted in an underground trench to a Webster vacuum heater. The main exhaust pipe passes up through the roof with but a single connection to the heater and another to the heating system with a back-pressure valve on the free exhaust for use when the heating system is turned on. The vacuum maintained in the heater is sufficient to make it take as much of the exhaust steam as is required to heat the feed water without the usual inlet and outlet connection and by-pass.

The return mains are connected to two Webster vacuum pumps by a 3-inch pipe. These pump water and air from the returns and maintain a slight vacuum. The water of condensation is delivered by these pumps back into the heater, but the entrained air is released by an automatic contrivance before reaching the feed water.

The steam piping for the electric lighting plant of the depot also contains some novel features. Figures 6 and 7 show a plan and sections of the power-house. The plant itself consists of three 100-kilowatt direct current Westinghouse generators, each direct connected to Westinghouse compound engines, for which steam is furnished by three Edge Moor water-tube boilers of 150 horse-power each. The boilers are equipped with the American automatic stokers, and a Sturtevant

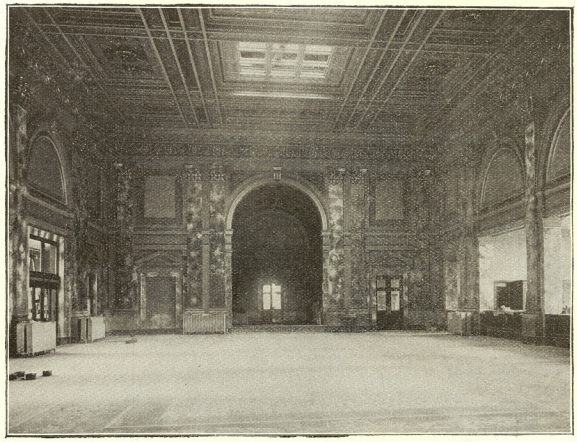


FIG. 5.

tween, suggested a peculiar arrangement of the piping, which was at once carried out. The boilers are connected into a 12-inch steam header with a 6-inch tee and a valve between the header and the tee. From the other outlet of these three tees are taken the connections to the three engines, with a valve on each at the tee besides the throttle valve at the engine. By this arrangement each engine and its corresponding boiler can be shut off entirely from the rest of the plant by closing the valve between the 12-inch header and the tee. The principal object of this is that any engine can be thoroughly tested for steam economy at any time. To further add to the ease and convenience of testing the boilers and engines, the two feed pumps deliver into two separate feed headers, each one of which has a separate connection to the pipe supplying each boiler. One of these pumps is further provided with a suction outlet which can be connected to a tank which is used with a weighing tank.

FIG. 4.

fan with 6x6-inch upright engine is used to supply the forced draft required for the stokers. The engine-room contains besides the electric units a 12x12-inch air compressor furnished by the Ingersoll-Sergeant Drill Company, which is used to supply air brooms for cleaning cars. All auxiliary apparatus, such as heater, feed pumps and vacuum pumps, is located in the boiler-room.

In designing the steam piping for this plant the correspondence between the three engines and the three boilers, which are placed almost opposite each other with the boiler-room wall be-

To provide complete immunity from accident, an auxiliary steam header of 3 inches diameter is connected to each boiler by a 1½-inch pipe. The steam for the boiler feed pumps, vacuum pumps, stokers, fan engine, etc., is taken from this header, which also has a connection to the main header at either end. This arrangement of piping renders it impossible that an accident to one part of the machinery, apparatus or piping should interfere with the use of anything other than that on which the accident occurs. The steam pressure carried is 150 pounds, and all the live steam piping is put up with extra heavy pipe, valves and fittings, and the high-pressure drips which are connected to all low points in the high-pressure connections are run to a Worthington receiver, from which the water is automatically pumped back to the boilers.

It is a rare thing in steam plant construction to equip a station so that any of the boilers or engines can be tested for steam or coal economy with perfect convenience at any time and without interfering in the slightest degree with the operation of the plant, but the demands of competition, which call for the strictest attention to economy at every point, will rapidly require the introduction of such an arrangement into most stations of any magnitude.

The electric lighting system to which current is furnished from the engine-room comprises the lighting for the depot building, colonnade trainshed and approaches to the depot from the High Street viaduct and also for a long row of small shops on the viaduct which are owned by the Depot Company. There are in all about 105 2,000 candle-power arc lamps and 1,800 16-candle-power incandescent lamps. The arcs are all constant potential 100-hour "enclosed" lamps. About 56 lamps are distributed through the trainshed, which is 675 feet long and contains 8 tracks; 23 lamps are on the basement and first floor corridors and the remainder are on the approaches. Of the 1,800 incandescent lights there are about 850 in the depot building and the remainder are in the stores on the viaduct. These are, as a rule, distributed in the method usual for inside lighting. There is, however, in each of the stores a 10-light circuit, which is used exclusively for the illumination of the show window. The general waiting room is illuminated by eight 16-light clusters set in the panels of the ceiling and 28 single lights on the walls. The main corridors off this waiting-room, which have a cylindrically vaulted ceiling, have rows of lights in the vault which are artistically worked into the design.

The entire system is supplied with a 125-volt current from the three Westinghouse generators

and is divided into eight sections, each of which has a separate pair of feeders from the switchboard in the engine-room. There are two circuits for the depot building, one for the viaduct stores, one for the arc lights in the trainshed, and three for the remaining arc lights. There is also a circuit to a motor for the baggage elevator, and provision is made for a circuit for arc lights in the freight yard. The circuits from the switchboard are, for the most part, run on the ceiling of the "basement colonnade," which is adjacent to the trainshed. They are of weather-proof wire and are hung on glass insulators. The feeders to the viaduct stores, which are about 1,000 feet from the engine-room, contain 1,700,000 circular mils of copper wire. The wiring in the buildings is all rubber-covered braided wire laid in iron conduit. There are four cutout centers on each floor of the depot building. These are arranged over one another, and each tier is connected to the main circuits with a knife-switch. Each one of the stores has a separate cut-out box, and provision is made in these so that meters can be inserted. All ceiling outlets have separate wall switches, except in the large waiting-rooms, in which a set of switches control all the ceiling lights. The cut-outs and switches are set in marble boxes, the covers of which are made to harmonize with the finish of the walls in which they are placed.

The station was designed by Messrs. D. H. Burnham & Co., architects, of Chicago, Ill., and was constructed by the Moulton Starrett Company. The architects were represented by their mechanical engineer, Mr. C. M. Wilkes, and the railroads by Messrs. D. Crawford and E. C. Hazard of the engineering staffs of the Pennsylvania and Big Four Roads, respectively. In the design of the mechanical and electrical features, Mr. W. S. Monroe, of Chicago, represented the contractors, and to this gentleman we are indebted for data and blue prints from which the above description was prepared.

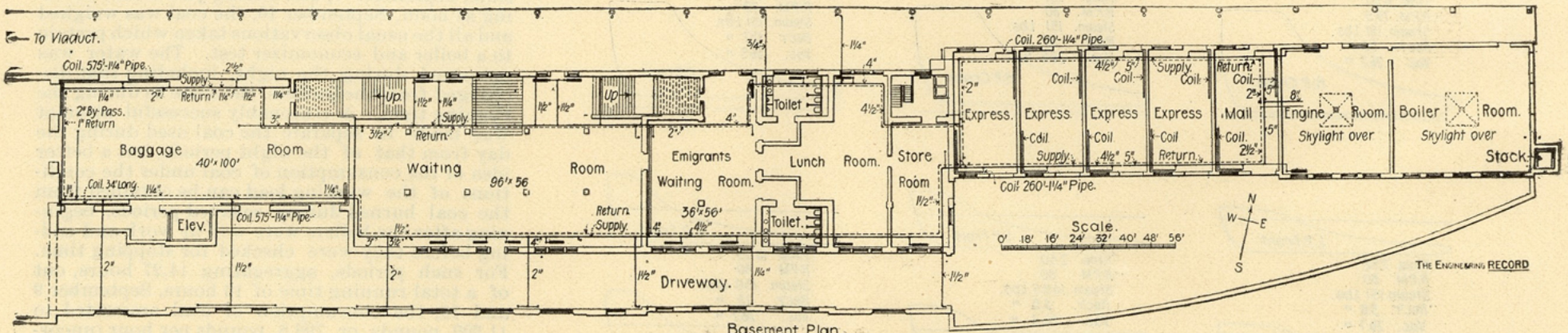
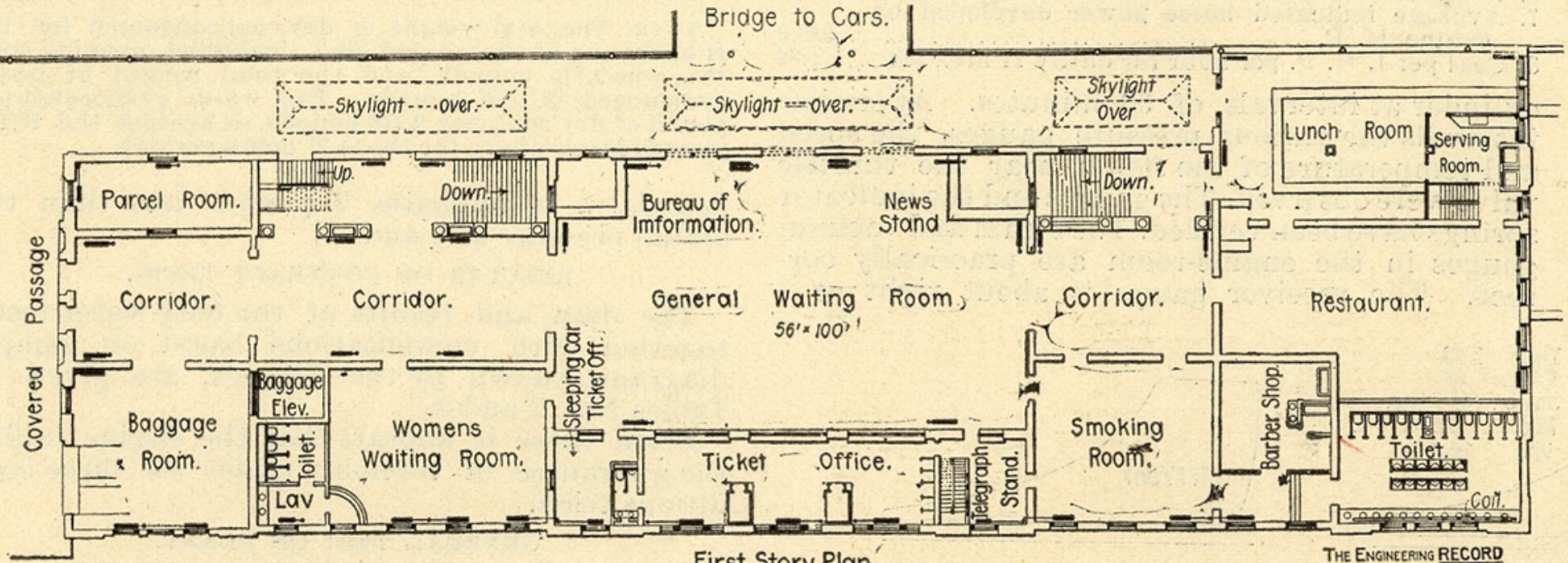


FIG. I

HEATING AND LIGHTING PLANT OF THE COLUMBUS, O., UNION DEPOT.

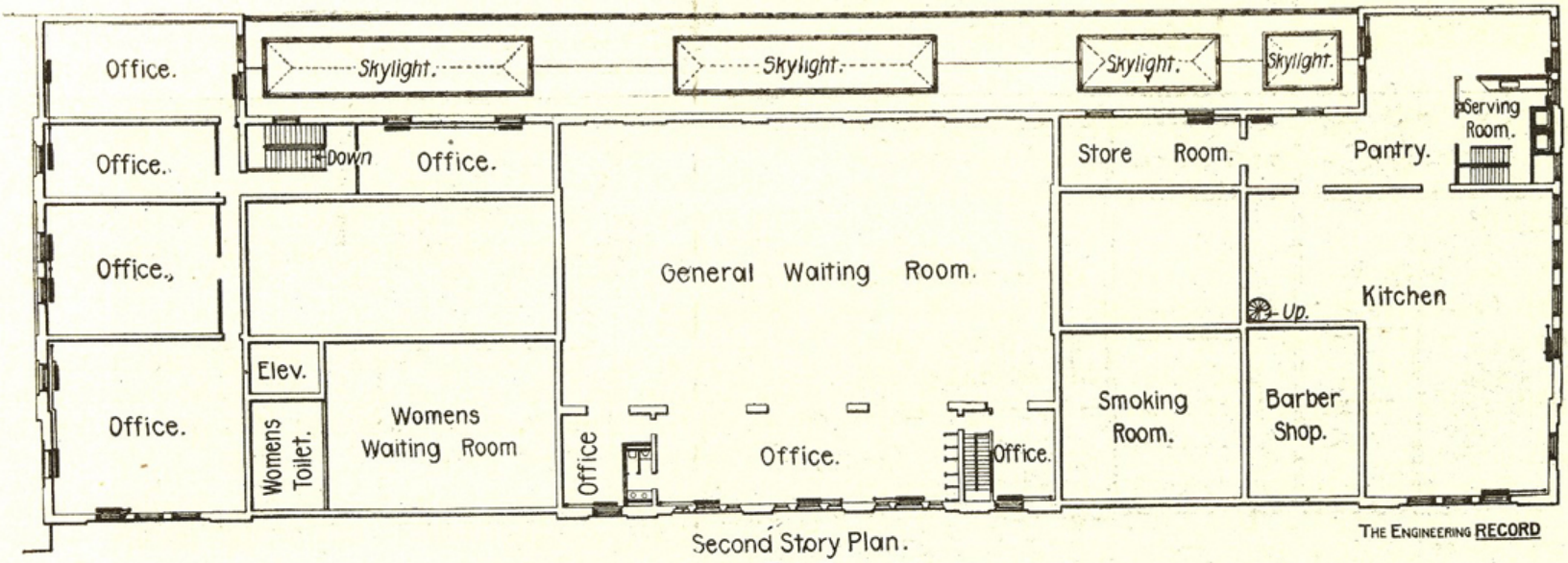
MESRS. D. H. BURNHAM & CO., CHICAGO, ILL., ARCHITECTS.



First Story Plan

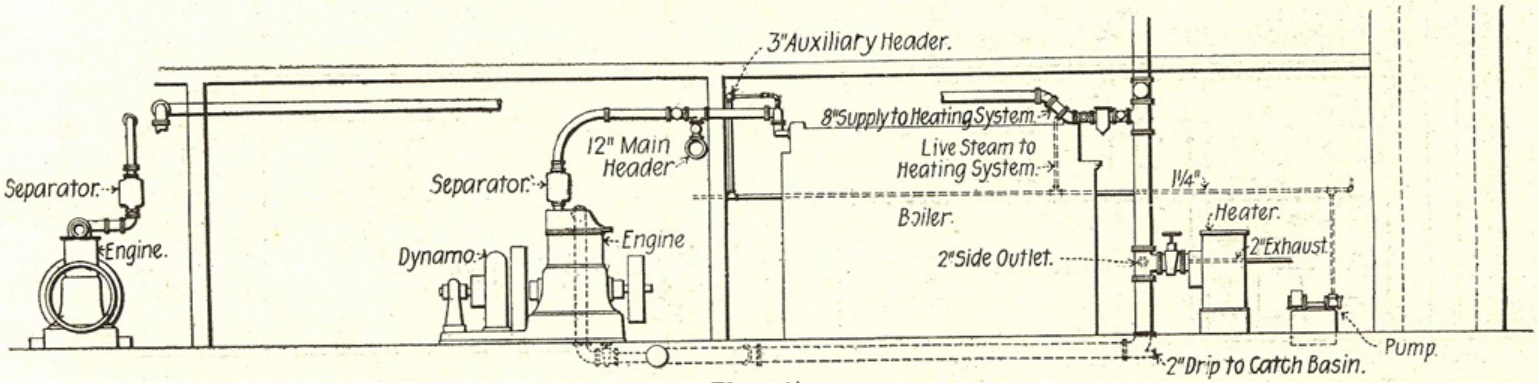
FIG. 2

THE ENGINEERING RECORD



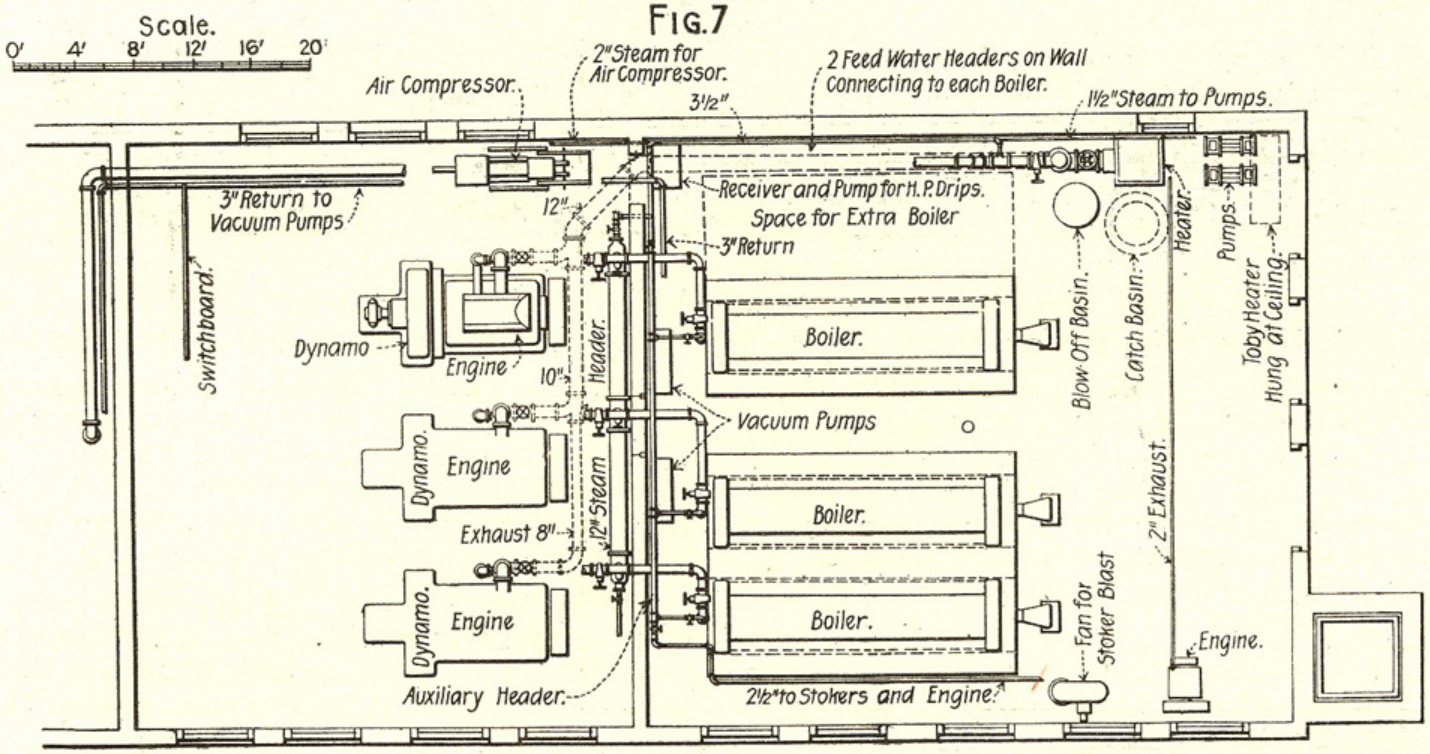
Second Story Plan.

FIG. 3



Elevation.

FIG. 7



Plan

FIG. 6