THE HOLLY GRAVITY RETURN SYSTEM.

Among the many recent installations of the Holly Gravity Return System is one worthy of especial notice. It has lately been erected in the Twenty-sixth Street power station of the Edison Electric Illuminating Company, of New York. It deserves mention for the reason that it accomplishes continuously and automatically a duty which ordinarily requires much care and expense. Although the conditions under which the system is working are somewhat unusual, it is operating with complete success. In this station there are engines and electric light machinery aggregating 7,000 horse power on a floor line below Twenty-sixth Street grade, while the boilers which furnish steam to drive the same are located on the fourth floor above, or at an elevation over the engines of about 60 feet.

The accompanying illustration shows a general arrangement of the station in section, and the "gravity" is employed for the purpose of receiving all the condensation and boiler entrainment from the steam mains, separators, headers, and all points of high pressure drainage pertaining to the west side, and returning it continuously to the boilers above without loss of pressure or temperature, taking the place of the traps and pumps formerly used for that purpose. Its simplicity is remarkable, as it consists practically of but two parts in which there are no floats, valves, or mechanical movements of any kind.

The receiver, *A*, Fig. 1, is cylindrical in form, and is located horizontally below all points to be drained. It is 12 inches diameter by 6 feet long, and at one end all the water of condensation, etc., is received through an ejector fitting (or suction tee), *L*. Many of the drip pipes that convey the water of condensation to the receiver are brought from remote points of the station, and there is as a result a slight loss in pressure. These drips are brought to and connected with the side outlet of the suction tee, while the pipes draining the adjacent separators, etc., are connected with the forcing end of the device. The velocity of steam and water through the suction tee, due to the difference in pressure, is sufficient to draw with it all the condensation, etc., from the drips connecting with the side outlet, and all is delivered into the receiver under the initial or boiler pressure. The opposite end of the receiver is provided with a blank head having a series of holes drilled in a vertical line through its center; the combined area of these holes equaling the area of a rising pipe, *C*, which connects with a discharge neck covering the openings, and forming a part of the head. This riser ascends to the top story of the building (the vertical distance being something more than 100 feet), and enters the separator, *B*. At a point near the top it extends into the separator to a central position, and terminates in an open tee arranged vertically. The separator is supported vertically, and its dimensions are 8 inches diameter by 10 feet long. It forms a kind of reservoir to contain or catch the water continually arriving from the receiver 100 feet below.

A small pipe, *P*, usually ½ inch diameter, connects with the top head of the separator, penetrating into the interior about 6 inches, which portion is perforated with small holes and the end sealed, forming a spray pipe. The continuation of this pipe outside of separator includes a small reducing valve, *R*, from which it terminates in the hot water tank. (May be connected with condenser, heater, radiation, or sewer.) Between the reducing valve and the separator there is interposed a three-way cock, *S*, with side branch, *T*, connecting directly with the boiler feed pump. An air vent, *N*, is also attached to top of separator for the free escape of all air that would otherwise accumulate there. The return pipe, *D*, Fig. 1, connects at the bottom the separator and drops down to the boiler room, and is there connected with an auxiliary header which has lateral branches provided with a gate and swing check valve to each boiler. A valved pipe, *G*, connects the lower end of the return pipe, *D*, with sewer, blow-off, or any other convenient discharge, and is called the "starting valve, or pipe."

The operation of the system is as follows: The drips are all opened to the receiver, the starting valve opened, and all air and dirt blown out until boiler pressure (or nearly so) is established throughout the system; then the reducing valve is set to establish a positive circulation from receiver to separator. The operation is then continuous, as the water of condensation and entrainment arriving to the receiver is then taken, or swept up through the riser in sections, or finely divided particles, into the separator, where it falls into the return pipe, *D*, to the boilers. The water is carried through its upward flight with the steam that is required to maintain circulation and will occupy some vertical elevation above the water line of boilers in the pipe, *D*, where the included column will weigh, plus the terminal or separator pressure, more than the pressure carried in the boilers.

The object of the reducing valve is to place the engineer in charge in absolute control of the circulation between receiver and separator. It permits an atmospheric escape of just steam enough to insure this result, and it may be adjusted for varying quantities. The amount is very small, and in nearly all cases it is utilized in the heater, condenser, hot water tank, or in heating radiation. To show how small this quantity is in a heating system including 5,000 square feet of radiation, the steam passing the reducing valve is all used in one radiator containing 100 square feet of surface.

When the three-way cock, *S*, is open to the reducing valve it is closed to the pump, and when open to the pump is closed to the reducing valve; so in cases where there is no convenient way of utilizing the steam passing the reducing valve, this cock is opened to pump, and a small quantity of the feed water is forced through the spray pipe into the upper end of separator, condensing sufficient steam to accomplish the same result. In this way there is no loss of steam whatever, and the circulation is under perfect control by either method.

The system is practically an open circuit from all points of drainage back to boilers, as there are no mechanical movements whatever in its construction; the only obstruction being a check valve at each boiler. It is employed in the most important power station in the United States as a truly reliable adjunct.

The gravity system has proved to be admirably adapted to marine work. Two of the large steamship lines have made the system a matter of very careful experiment, and so far it has proved itself reliable and of great benefit in keeping the water of entrainment and condensation out of the engine cylinder. Rough weather, moreover, has no effect whatever upon its continuous operation.

Cut No. 2 shows the heater and return system combined in one device as in operation in the Suburban Electric Light Companies' power station at Elizabeth, N. J. The object of this combination is to utilize as far as possible the condensation and entrainment about a power station in bringing the temperature of all the feed water supplied to boilers up to the same degree of temperature as the water in the boilers. This is accomplished by the application of the principles governing the operation of the gravity system.

In the cut, the heater, *A*, occupies practically the same relative position to boilers that the gravity separator does, and all the feed water for boilers is by the pump delivered through a spray head, *K*, into top of heater. This heater does not displace the other device employed to utilize exhaust steam or escaping gases, as the feed water is first pumped through either, or both, and from there to the Holly, which takes the water at the temperature obtained from exhaust steam or gases and raises it to the temperature due to the pressure carried in the boilers by the application of direct steam. Upon entering the heater the water falls through nearly its entire distance in a space that is occupied by steam that is continually under boiler pressure, and it is obstructed in its fall by several perforated plates, *O*, which are supported on a central pipe. This pipe is perforated with numerous small holes at its upper end, occupies nearly the entire length of the heater, and, passing outside at the bottom, drops down to a position below all points of high pressure drainage and there is connected to a suction tee, *L*. A direct supply of steam, draining the near-by separators or steam headers, connects with the forcing end of the tee, and all other drips about the plant are brought into the side (or suction) branch of the device.

The velocity (through the suction tee) of the steam necessary to heat the arriving water in heater is great enough to insure that the water of condensation, etc., from the drips connecting at side is drawn with the steam, and all is delivered through the perforations at the upper end of pipe, *H*, into heater. The time occupied by the feed water in falling through the steam-occupied space of heater is sufficient for the water to attain the same temperature due to the pressure carried in heater and boilers. The return pipe, *D*, drops down and connects with the main feed pipe to all boilers.

A regulator, *R*, is provided where necessary, which contains a balanced valve, *S*, through which the feed water passes on its way into heater. The valve is closed and opened by the rising and falling of the water line in the heater. This is not necessary, however, where good elevation can be obtained.

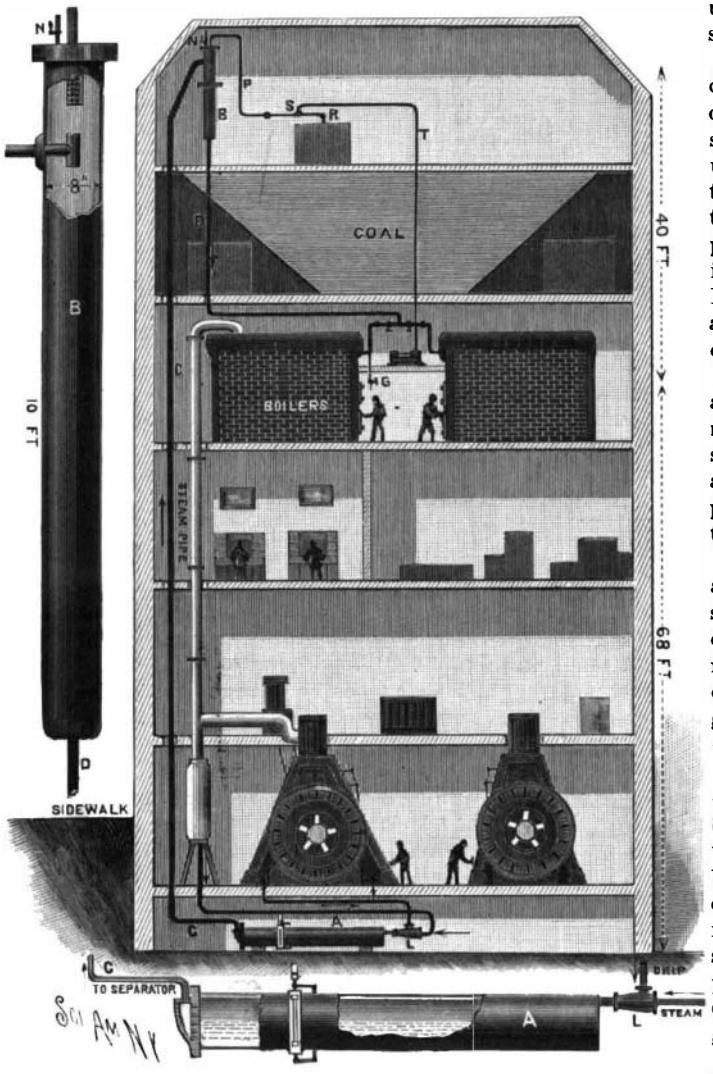

Fig. 1.—HOLLY GRAVITY RETURN SYSTEM.

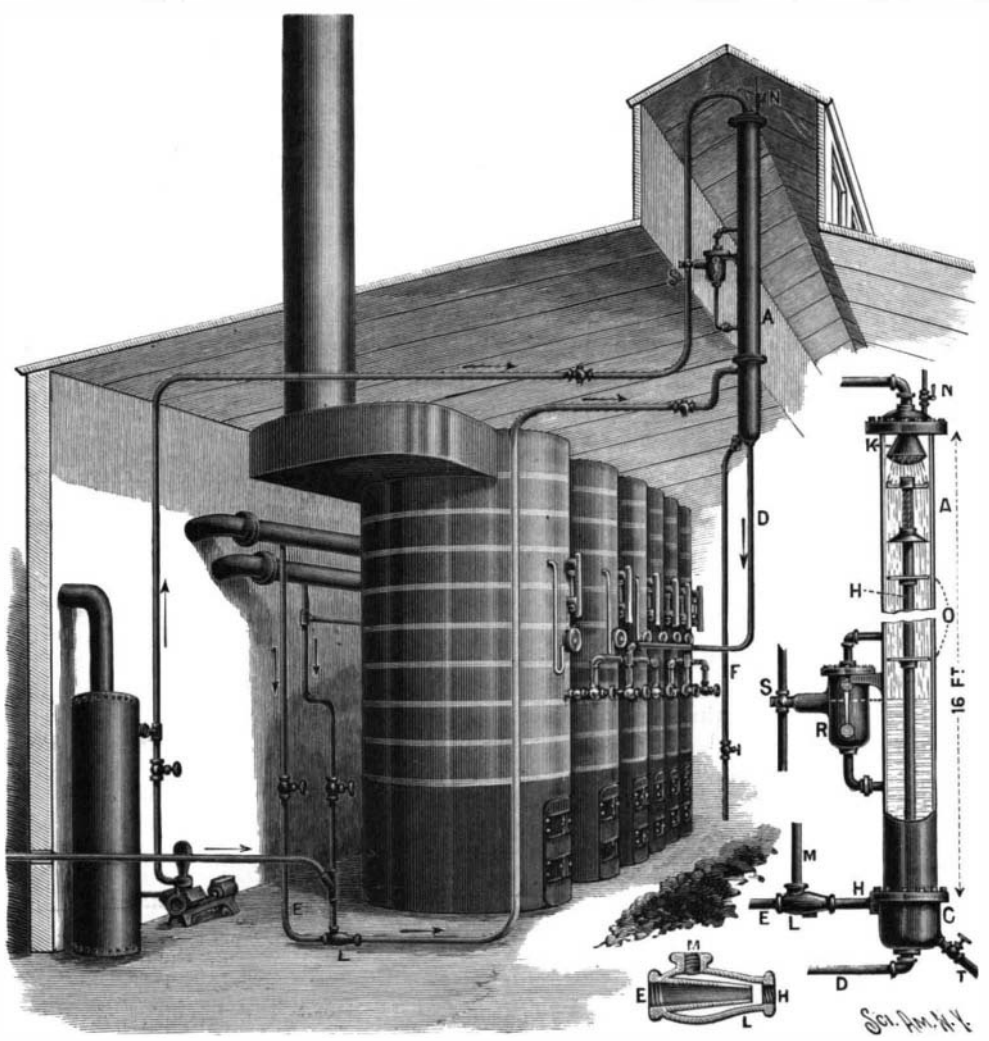

Fig. 2.—HOLLY COMBINED DIRECT HEATER AND RETURN SYSTEM.