The Non-Condensing vs. the Condensing Engine.

Experiments made with a Corliss condensing engine at a factory in Mulhouse, Germany, in 1878, and others made with a Corliss engine of the non-condensing type at the fifth Cincinnati Exhibition, in 1874, have been compared and ably discussed by Chief Engineer Isherwood, of the U. S. Navy, for the purpose of determining the boiler pressure at which the non condensing becomes equal in economy to the condensing engine. His paper is given in the *Franklin Journal*. The well known opposition of Mr. Isherwood to high measures of expansion in the marine engine need not affect the mind of the reader, as Mr. Isherwood considers it abundantly proved that no economic gain results from carrying expansion beyond the measures easily obtainable in non-condensing engines, when using steam at 70 pounds boiler pressure and upward. No motive, therefore, can fairly be imputed to him for departing from his usual accuracy and thoroughness in searching for the truth. It is assumed that, since the back pressure in good examples of both types of engines may be taken as constant at about 3½ pounds per square inch for the condensing and 16 pounds for the non-condensing engine, and the feed water at 100° F. for the former and 200° F. for the latter, there is an initial steam pressure at which the two types will be equal in economic effect.

To offset the less back pressure and the greater measure of expansion in the condensing engine we have the saving of the power required to work the air pump and the higher temperature of the feed water in the non-condensing engine; but the question of the boiler pressure at which the two types become equal must be determined by experiment for each new set of conditions, principally because of the variation of cylinder condensation, which has been shown to be, in former experiments with this size of condensing engine, cylinder, and measure of expansion, as much as 29 per centum of all the steam evaporated in the boiler. This amount is varied by the relative size of the cylinder, the grade of expansion, which affects the extremes of the temperature of the steam during a double stroke of the piston, the character of the metal of the cylinder as a conductor of heat, and the piston speed, with any given initial pressure.

The engines which are compared are not of the same size, nor were they worked at the same piston speed.

The non-condensing engine had a cylinder $16\frac{1}{16}$ inches diameter, and was worked at approximately 240 feet per minute piston speed. The condensing engine had a cylinder 24 inches diameter, and a piston speed of about 200 feet per minute. They were of the same length, 4 feet. The loss by cylinder condensation would have been something greater in the condensing cylinder if it had been as small as the other; and, on the other hand, the loss from this cause would have been greater in the non-condensing cylinder if its piston had moved at the slower rate, so that their differences in conditions may be considered as neutralizing each other as regards this loss. It is seldom, however, that conditions as nearly alike are subjects of careful tests for economic results. The horse power is measured by the number of Fahr. units of heat per horse power per hour. The cost of the heat, being a question of boiler efficiency, is ignored.

In his remarks after the discussion of the cost of the total horse power, the author says:

"The net horse power, representing the portion of the total horse power developed by the engine that was commercially useful, was obtained for the consumption of 31,707·0685 Fahrenheit units of heat per hour with the condensing engine, and of 32,091·6077 Fahrenheit units with the non-condensing engine; and if a very small allowance be made in favor of the latter for the greater economic vaporization in its boiler per pound of fuel, owing to the slower rate of combustion, the cost of the net horse power in both cases will be equal; showing that a non-condensing engine with an unjacketed cylinder of the experimental dimensions, using saturated steam of 70½ pounds boiler pressure per square inch above the atmosphere, with an expansion of nearly 4⅜ times, gave the same commercial result—that is to say, the same net power for the same quantity of fuel per hour—as a condensing engine with a 2¼ times more capacious unjacketed cylinder using saturated steam of 66½ pounds boiler pressure per square inch above the atmosphere with an expansion of nearly 8 times. Hence, under the experimental conditions, no economy would result from the employment of a condenser and air pump, when the boiler pressure was not less than 70½ pounds per square inch above the atmosphere. If the engine works with a variable load, this must be taken for the lower limit of pressure—not the average pressure—giving equality of economic effect.

"The foregoing results are true for only the precise experimental conditions, and they will be modified by any of the causes which diminish cylinder condensation, as, for example, steam-jacketing the cylinders, superheating the steam, employing larger cylinders, etc.

"It is probable," the author says, " that with boiler pressure of from 95 to 100 pounds per square inch above the atmosphere the non-condensing engine would give the net power with fully as much economy of fuel as the condensing engine using the same steam pressure with the measure of expansion found to produce the greatest economy, even with steam-jacketing, steam-superheating, and cylinders of the largest dimensions in both cases."

This is certainly a matter of great importance in marine economy. The omission of the air pump and its appendages, and the reduction of the size of the engine, thereby relieving the vessel of a permanent deadweight, are worthy of our best efforts. The greater weight of boiler, if any, of the old marine types, rendered necessary by the higher steam pressure, may perhaps balance the mere weight of the omitted air pump itself, while the surface condenser is still needed to supply distilled water for the boiler. In making up an estimate of the economies, the room occupied and the weight carried, not only of the engine, condenser, and pumps, but also of the boilers, the fuel, and the water, in boilers and condensers are to be considered. It is known, however, that in using steam of high pressure, even in heavy condensing engines using high measures of expansion and great cylinder condensation, substantial progress in economy has been realized, and it may be that a still further advance may be made by improving the boiler and reducing the amount of water and fuel carried, as well as by omitting the air pump of the marine engine.

Effects of Lightning on Trees Near a Telegraph Wire.

Some instructive facts in this connection have been brought to light by M. Montigny, in recent examination of poplars bordering part of a road in Belgium between Rochefort and Dinant. The part in question is some 4,600 meters in length, and runs westward; it is level for some distance, then rises gradually to a height of 61 meters, through a wood, traverses a wooded plateau 200 meters in extent, then descends, still through wood, to a plain. A telegraph wire runs near the row of Virginia poplars on the north side, and it appears that, out of nearly 500 poplars forming this row, 81, or a sixth, have been struck by lightning. Hardly any have been struck in the other row. The trunks have been mostly struck on their south side and nearly opposite the wire. Comparing different portions of the road, it is found that in the horizontal part none of the (129) trees show injury from lightning, or at most only one (a doubtful case), but as the road rises through the wood the cases quickly multiply, and on the wooded plateau as many as 9 out of 14 trees, or 64 per cent, have been struck. On the slopes the proportion is 25 per cent.

M. Montigny distinguishes three kinds of injuries: (1) the bark torn and detached on a limited part of the trunk; (2) a furrow, straight or (rarely) spiral, made on the tree, from near the wire, down to the ground; and (3) a peculiar oval wound, with longer axis vertical, and lips colored light brown. Now, the furrows, which are probably due to the most violent discharges, are relatively most frequent on the plateau and on the western slope, which the storms usually reach first. M. Montigny is of opinion that the lightning, while provoked by the wire, does not strike this first, then the tree, but strikes the tree directly. His conception of the process is to the following effect: Suppose a thunder cloud charged with positive electricity. A long telegraph wire under it, though insulated, may acquire as great negative tension in the nearest part as if in direct communication with the ground, and the tension is greater the nearer to the cloud. While the inductive influence affects the wire most, near objects, such as trees, share in the influence according to their conducting power. The lightning, attracted in the direction of the wire, yet does not strike this, the insulating cups presenting an obstacle to its prompt and rapid escape. It finds a better conductor to earth in a neighboring poplar, wet with rain. From the facts indicated it results, that of two similar houses, one built on a plain, the other in a wood, and having a telegraph wire fixed to them, the latter is the more liable to injury by lightning, and the danger is greater if the wood inclosing the house be upon an eminence.

Positive Pictures on Gelatino-Chloride.

Two methods of preparing the chloride emulsion are considered—the first method (without ammonia) yielding pictures which may be bright brown or reddish toned, according to the developer selected; while the same emulsion, if digested for twenty-four hours, can be made to yield pictures having a fine violet-black tone.

The non-ammoniacal emulsion is prepared much after the manner generally adopted for the production of a gelatino-bromide emulsion, the soluble chloride being contained in a warm gelatinous solution, to which the silver nitrate is gradually added, while the mixture is kept in continual agitation. Twenty-five parts of gelatine are dissolved in 200 parts of distilled water, together with·7 parts of sodium chloride, and 6·40 parts of ammonium chloride, it being convenient to allow the gelatine to swell for half an hour before applying heat. The gelatine being dissolved, and the solution at 50° C. (122° F.), a silver nitrate solution containing 15 parts of the salt in 200 parts of water is gradually added with agitation; and it should be noted that it is advisable to warm the silver solution to the same temperature as the gelatinous liquid.

The chloride is deposited, under these circumstances, in a very fine state of division, and the mixture is at once poured out to set, a beaker or drinking glass serving very well as a mould, and external cooling may be resorted to when it is desirable to work expeditiously. The gelatinized emulsion may now be cut into strips by means of a horn spatula or a strip of glass; but if a more perfect state of division is desired, it may be forced, nutmeg grating fashion, through a piece of wire netting. In either case the material is tied up in a piece of muslin, and is suspended in a vessel containing a considerable quantity of water, this being changed five or six times, unless a stream can be kept flowing through the vessel. The washing may occupy a period of six to twenty-four hours, according to the state of division to which the emulsion is reduced, the temperature, the frequency with which the water is changed, and other circumstances. This operation being satisfactorily finished, the emulsion is well drained, and is next melted at a temperature of about 50° C (= 122° F.)

As regards the filtration of the emulsion, fine linen, purified cotton wool, or a special paper which is sold for the purpose at the German photographic stock houses, may be used. The emulsion is now quite ready for use in coating either ordinary glass, opal glass, or paper; but if it is considered desirable to preserve the emulsion in the jelly form any great length of time, it is advisable to add 0·2 part of thymol or phenol to each 100 parts of emulsion, the preservative agent being previously dissolved in 5 to 10 parts of alcohol.

For the dark room, used for the preparation of the chloride emulsion, it is sufficient to provide the ordinary yellow or orange illumination required in working the wet collodion process.—*Photographic News.*

Influence of the Weight of the Air on the Flow of Springs.

In the geological section of the British Association, Mr. Baldwin Latham, M. Inst. C.E., read an interesting paper on the influence of barometric pressure on the discharge of water from springs. He stated that it was alleged by some of the long established millers on the chalk streams that they were able to foretell the appearance of rainfall from a sensible increase in the volume of water flowing down the stream before the period of rainfall. He had therefore undertaken a series of observations to investigate the phenomena, and he found, in setting up gauges on the Bourne flow in the Caterham Valley, near Croydon, in the spring of the present year, and selecting periods when there was no rain to vitiate the results, that whenever there was a rapid fall in the barometer there was a corresponding increase in the volume of water flowing, and with a rise of the barometer there was a diminution in the flow. The fluctuation in the flow of the Croydon Bourne due to barometric pressure had at one period exceeded half a million gallons per day.

The gaugings of deep wells also confirmed those observations; for where there was a large amount of water held by capillarity in the strata above the water line, at that period of the year when the wells became sensitive and the flow from the strata was sluggish, a fall in the barometer coincided with a rise in the water line, and under conditions of high barometric pressure the water line was lowered. Percolating gauges also gave similar evidence, for, after percolation had ceased and the filter was apparently dry, a rapid fall of the barometer occurring, a small quantity of water passed from the percolating gauges. The conclusion he arrived at was that the atmospheric pressure exercises a marked influence upon the escape of water from springs. The increase in the flow of the water was attributed to the expansion and escape of the gases held by the water under low barometric pressure, which caused the water to escape more freely, while with high barometric pressure there was a condensation of the gases, which led to a retardation in the flow.

MISCELLANEOUS INVENTIONS.

Mr. Bat Smith, of Spanish Camp, Texas, has patented an improved composition for preserving wood, consisting of eight parts of coal tar, one part of crude carbolic acid, and three-fourths part of crude pyroligneous acid, mixed and heated, but not permitted to boil. The wood to be treated is placed in a vessel filled with the compound, where it remains until saturated.

Mr. Frank B. Miller, of Enon, Clark County, O., has patented a novel design for a sleigh. A life-size, graceful deer is represented on each side of the sleigh, complete in every respect, from the hoofs to the horns. It is made of of one and one-half inch material, and is beautifully rounded and carved on the outer surface, the legs first being tapered to size of runner. The runners are single bent and are fastened together in front (in addition to a light rod) by two darts or arrows, neatly trimmed with gold and silver paint. The dash, back, and seat are so adjusted as not to mar the general features of the design.

Mr. Edward E. Bishop, of Littleton, N. H., has patented an improved incubator which is simple, economical, and efficient.

An improved chimney flue brush has been patented by Mr. David C. Greenway, of Abingdon, Va. The object of this invention is the production of a brush by which chimney and other flues may be conveniently and thoroughly swept, and one which is adapted to flues of different sizes.

An improved cultivator has been patented by Mr. Moses S. E. Pittman, of Harlem, Mo. The object of this invention is to facilitate the cultivation of plants and the adjustment of the cultivators to the distance apart of the rows of plants.

Mr. William S. Plummer, of San Jose, Cal., has patented an apparatus for pressing potatoes and other vegetables, and at the same time laying the pressed material upon trays in a convenient form for drying.

Messrs. John Greek and Francis M. Sellman, of Evansville, Ind., have patented an improved expanding rock drill for cutting a recess or cavity at the bottom of a drilled hole in a rock, or a coal or other mine, for the purpose of receiving the charge of powder or other explosive substance used in blasting. The invention consists in a novel combination with a drill rod or holder, of a pair of bits or drills, and the combination therewith of a cone of peculiar construction for expanding the bits or drills.