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Improvement in Hot-air Engines.

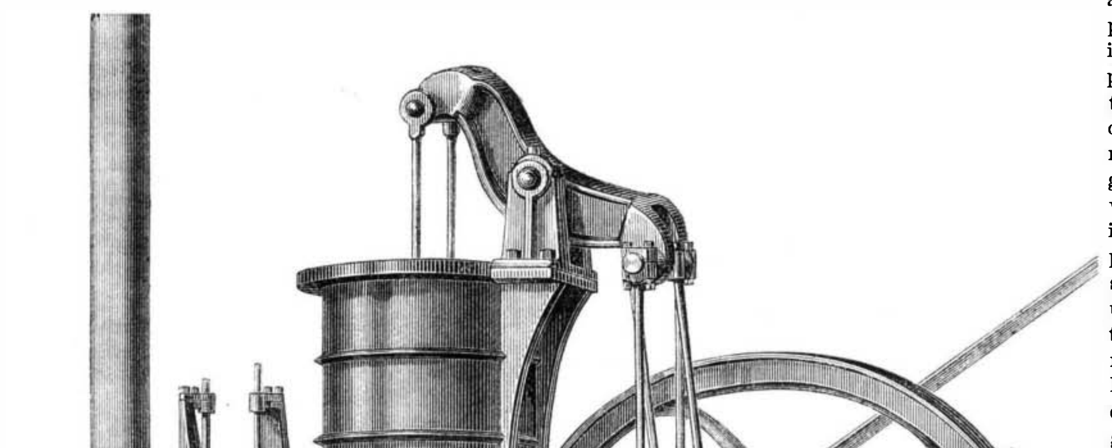
The attempt to substitute air for steam, as a motive power, is not so recent as is generally supposed, patents having been granted in this country as far back as 1824, for atmospheric engines. It appears to have been first used, in a really efficient form, by Rev. Dr. Stirling, of Scotland. He patented an air engine in 1816, and made one which was used for pumping, in 1818, that worked well for a short time. In 1827 Messrs. Parkson & Crosley, of City Road, London, England, constructed an air engine. In 1833 Lieut. John Ericsson, then residing in London, reduced to practice his long-cherished project of a caloric engine, and submitted the result to the scientific world. The invention excited very general attention, and lectures in explanation and illustration of its principles were delivered by Dr. Lardner, Prof. Faraday, Dr. Andrew Ure, and others. In 1837 Sir George Cayley constructed an air engine. In 1851 Ericsson patented his invention in this country, and in 1852 he built the ship *Ericsson*, of 2,000 tuns, driven by his machine, the working cylinder of which was 14 feet diameter, with six feet stroke.

Since then the engine has been considerably improved by himself and others, and it is now recognized as a cheap, safe, and efficient generator of power, within certain limits, and is extensively used in this country. The most perfect form of the engine, with which we are acquainted, is that shown in the accompanying engraving, known as the Roper Caloric Engine, which was first illustrated in No. 7, Vol. VIII., SCIENTIFIC AMERICAN, since which time it has been greatly improved, as the accompanying engraving and description indicates. This engine should not be confounded with other air engines that depend upon heated air alone. Mr. Roper claims to have accomplished, in his engine, what others have attempted and failed, and what experienced engineers claim necessary to a successful caloric engine, viz.: forcing the air directly into the fire, and thereby combining the power of expansion with the power and products of combustion. This result is accomplished, in this engine, by the use of an air pump, close, air-tight doors to the furnace, and poppet valves, arranged as follows:

The air, to supply oxygen for the combustion, is pumped in by pump, A, the carbon is burned rapidly and completely, under pressure, and the resulting carbonic acid gas and uncombined hydrogen gas from the air pass from the generator, or fire box, to the piston by use of poppet valves, B, which act the same as steam marine engine valves.

With this arrangement a quiet, steady pressure is continued in the fire-chamber, or air boiler, and the great difficulty experienced in others, of a blast carrying ashes and too great a heat into the cylinder and burning out packings, is fully obviated. The inside of the fire-box, C, is lined with heavy fire-brick throughout, and a wall of non-conducting material, three inches thick, between the brick and outer jacket, prevents injury to the iron and radiation of heat into the room The late important improvements do not, however, touch the principles of construction so much as the mode of application. At first, Mr. Roper placed his air-pump upon the top of the engine, taking the air, by the use of a pipe, through the casing to the fire-box. In this way the air became partially expanded before reaching the fire. In the improved engine he enlarged the air-pump and placed it on the base near the floor, using the coldest air more direct and with much less friction in clearances, by this means obtaining at once nearly double the power by the same size engine. Next he employed two dampers, one admitting all of the air into the fire-chamber, under the fire-grate, and the other over the fire. The first to be used in time of building the fire, and when it was low, and the other after the fire was complete. Thus the engine can be started as soon as the kindling wood begins to burn. The pump and check valves are made of leather—very simple contrivances. The bearings and all parts of the engine are made stronger and more durable than at first.

One of the greatest improvements obtained is a perfect governor or regulator. The old governor, which was connected with the air-pump, could not be changed so as to vary the speed materially, and did not hold the engine steady when work was thrown on or off suddenly. The present regulator is not much more or less than a safety valve, placed back of the check, taking air from the pressure, in the generator; and by use of a simple thumb screw, the engine can be made to run with the same power from 40 to 120 revolutions per minute, as required, and that with a steady, smooth, unvarying motion, and nearly as noiseless as steam.



THE ROPER IMPROVED CALORIC ENGINE.

We have examined several of these engines, driving different machinery very successfully, of one, two, and four-horse power; and, by inquiry, we find the amount of coal used is about 40 lbs. per day for a horse power, and that the engines fully show the amount of power claimed.

A one-horse power machine weighs about 2,000 lbs., a two-horse power 3,000, and a four-horse power about 5,000 lbs., so that they are readily moved. No water is required in these engines, there is no boiler to explode, and no extra rates demanded for insurance. A boy can manage one as well as an experienced engineer. The engine is the subject of a number of patents.

All orders or applications for information should be addressed to the Roper Caloric Engine Co., 49 Cortland st., New York city, where the machines may be seen.

WHAT is one man's salvation is another one's bane; this old saying is an axiom. Those who urge their remedies or medicaments on others do not understand that in unanimity or oneness there may be diversity.

CONTRAST AND ADMIXTURE OF COLORS.

From a paper on the science of color, by W. Benson, an abstract of which appears in the *Building News*, we collate the following statements relative to the effect produced by the juxtaposition of colors, which are of great value to all engaged in decorative arts. These statements are based upon deductions from the study of prismatic colors, and are confirmed by all sorts of experiments made with the colors of pigments. We may test the colors of pigments with the prism in a beautifully simple way. We have merely to cover a small part of a strip of white paper with the pigment, and view it over a dark cavity, through the prism, and we see the spectrum of the pigment color adjoining to that of the white, and detect at once the rays which are absorbed or extinguished by the pigment, and those which it sends to the eye, to which its color is due. Thus, with respect to yellow, which many will still maintain to be a primary color, unconvinced by the experiments on the combination of the prismatic rays (which show that the best yellow is produced by throwing together all from the first red to the last green ray); if we analyze the color of aureolin, of chrome yellow, or of king's yellow, or the petal of any bright yellow flower, we uniformly find that, the better and clearer the yellow, the more perfectly the object reflects all the red and all the green rays, absorbing only the blue.

Hence, if blue is a primary color, it is difficult to see how it can be supposed that a color produced by all the other rays of the spectrum, is not made up of both the other primaries combined, whatever those primaries are.

Colors intermediate between two pigments cannot be obtained by their admixture. Gamboge and Prussian blue, for instance, make, by admixture or superposition, a green, darker than either the yellow or the blue of those pigments; the scientific method gives, as their intermediate color, a gray of mean brightness, in agreement with the results obtained by experiments on the combination of the prismatic rays. So, also, it does the colors of king's yellow and cobalt, or lemon yellow and French blue or ultramarine.

Mr. Benson claims that facts determined by his experiments on the combination of prismatic rays, as well as those upon pigments, confirm the opinion that red, green, and blue are the primary, and sea-green, pink, and yellow the secondary colors.

In perfect agreement with these facts, are all those apparent changes of color which are perceived when the retina, having been strongly excited by some one or other color, becomes less sensible to it than usual, and every object to which we direct the eye appears, therefore, more or less tinged with the complementary color, as if a wash had been laid over it. For it is always found that in an eye excited by red, by green, or by blue, objects appear tinged with sea-green, with pink, or with yellow, and the reverse; and that by intermediate colors intermediate effects are produced.

Some of these effects have been otherwise described by several writers; it is usual, for instance, to hear it said that red tinges the adjoining colors with green; but this is not correct, unless the one be a pink-red, or crimson, and the other a sea-green green. So again, it is usual to say, that blue and orange mutually deepen each other; but, for this to be true, the blue must be of a sea-green blue or azure hue, and the orange must be yellowish.

The most careful experiments, made by looking steadfastly at spots colored with those pigments which best represent the principal compounds of the prismatic colors, and brilliantly illuminated upon a black ground, and then suddenly directing the eye to a perfectly neutral gray ground, will always clearly show the gray surface darkened and modified in hue in ac-