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For the Week ending February 5, 1881.

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STREET ILLUMINATION.

Almost the first thing that strikes the scientific economist, when gazing upward in admiration at one or the other of the numerous electric lights now being introduced in our streets, is the extremely small percentage of the light really utilized for achieving the purpose intended, viz., the effective lighting of the streets and thoroughfares. Somewhat more than one-half of the light emitted is totally lost, a fact scarcely requisite to be pointed out to any one acquainted with the rudiments of optical science, seeing that all light that passes upward into space rather than in the direction into which it is required must, for that requirement, be assumed to have no existence. The fifty per cent passing upward and outward is not more metaphorically than literally *in nubibus*.

The value of reflectors for projecting light in any required path is well recognized by all, but the proper application of the principles of reflection and diffusion appears in a large measure to be lost sight of. Divested of the reflectors or refractors to which they owe their efficiency, of what value would be the lamp in the lighthouse, at the pier-head, or affixed to that of the railway locomotive?

A parabolic reflector is that which utilizes to the greatest extent the light emanating from any lamp; but owing to the very perfection of this form it is quite unserviceable in aiding street illumination, the conditions of which demand something entirely different from those subserved by that perfect reflector. What is wanted is *radiation* rather than reflection in the optical sense of the term. A reflector is a polished surface, any one part of which reflects light from a radiant according to the law of the angle of incidence being equal to that of reflection; a radiator, on the contrary, possesses a surface from which is emitted in every direction the light that falls upon it. A silvered glass or polished metallic surface represents the former; a type of the latter being a sheet of white cardboard, a surface of porcelain, or of silver deposited upon *ground* glass. Unsilvered ground glass, translucent porcelain, or even a sheet of tissue paper, placed in front of a light, also act as radiators.

What is required to render perfect our system of street illumination by electric lamps is that all the light which is now lost by passing upward shall, by means of a bright radiating surface of a tolerably large area, be arrested and projected downward in the direction where it is really required. Dimension in the radiator is of importance, inasmuch as this forms a condition of softness and diffusiveness of the light. From several experiments which have been tried on a small scale, it is believed that a valuable means for utilizing in the most efficient manner the light from the electric lamp is to have erected over and at no great distance from it a nearly flat circular plateof coarsely ground glass coated with silver, according to the manner recently described in the SCIENTIFIC AMERICAN. The ground surface should be farthest from the light, and the deposit of silver protected first by a coating of varnish and afterward by a casing of thin metal. This insures the reflecting surface against becoming impaired by atmospheric or other deleterious influences. But it is also an essential part of this radiating "reflector" that it be surrounded by a deep edge, also of silvered glass, beveled outward in such a degree as to prevent any rays from passing out in a horizontal direction (that is, if the electric lamp be erected high overhead), but so as to arrest and diffuse them downward, which, by a proper selection of the angle at which the bevel is given to the edge, can be done so as to cause the greatest benefit to be received by those parts at a distance away from the lamp.

In such cases where it is desirable to hide the light itself from the eye this may be done in the best manner by the interposition of a plate of ground glass, which, of all other diffusers or radiators, is found to absorb less of the light than any other diaphanous body. Some kinds of porcelain shades are known to absorb sixty per cent of the light; to ground glass such an objection cannot apply.

UNRECOGNIZED QUALITIES IN CHARCOAL.

Among the numerous and varied properties possessed by charcoal there is one—one, too, of the most wonderful—which does not seem to be adequately recognized, probably from its being imperfectly known except to physicists. It is that of being able to condense and store away in its pores many times its own bulk of certain gaseous bodies, which it retains, thus compressed in an otherwise unaltered condition, and from which they can be withdrawn, as required, as from a reservoir.

That eminent scientist, M. Saussure, undertook the task of a systematic examination of this subject, with a result which will prove surprising to the general reader. Operating with blocks of fine boxwood charcoal, freshly burnt, he found that by simply placing such blocks in contact with certain gases they absorbed them in the following proportions:

Ammonia	90	volumes.
Hydrochloric acid gas	85	"
Sulphurous acid	65	"
Sulphureted hydrogen	55	"
Nitrous oxide (laughing gas)	40	"
Carbonic acid	35	"
Carbonic oxide	9·42	"
Oxygen	9·25	"
Nitrogen	6·50	"
Carbureted hydrogen	5	"
Hydrogen	1·75	"

It is this enormous absorptive power that renders of so much value a comparatively slight sprinkling of charcoal over dead animal matter as a preventive of the escape of the odors arising from decomposition. A dead dog having been placed in a box in the warm laboratory of an eminent chemist, and covered with charcoal to the depth of between two and three inches, could not be discovered to have emitted any smell during several months, after which time an examination showed that nothing of the animal remained but the bones and a small portion of the skin. To the large excess of oxygen over the nitrogen in the atmosphere, which, according to the above table, was absorbed by the charcoal, and which thus rendered harmless the noxious vapors given off by the carcass as they were being absorbed, is doubtless owing the fact above stated and the further fact of the charcoal never becoming saturated.

A reader of the SCIENTIFIC AMERICAN who has been trying certain experiments on the value of charcoal as a convenient means of storing oxygen, reports favorably as to the results. In a box or case containing one cubic foot of charcoal, may be stored, without mechanical compression, a little over nine cubic feet of oxygen, representing a mechanical pressure of a hundred and twenty-six pounds on the square inch. From the store thus preserved the oxygen can be drawn by a small hand pump.

From the fact of the charcoal absorbing oxygen in so much greater proportion than nitrogen, we have here a means of utilizing its discriminative powers of selection in obtaining unlimited supplies of oxygen from the atmosphere, which contains nitrogen five times in excess of its oxygen, or twenty per cent; whereas by the separating or selective powers of the charcoal the mixed gases capable of being extracted from it contain over sixty per cent of oxygen. It only suffices to withdraw this now highly oxygenized air into another vessel of charcoal, by the further exposure to which the proportion of oxygen will be increased to a still greater extent. This indicates a most feasible means by which atmospheric air can be decomposed in such a way as to provide a cheap supply of oxygen.

One cannot readily recognize the fact, which is nevertheless true, that the condensing power of charcoal as applied to ammonia is equal to what would be obtained by subjecting this gas to a pressure of nearly one thousand two hundred and sixty pounds on the square inch.

ELECTRIC SIGNALS FOR THE NEW YORK ELEVATED RAILWAYS.

A series of utterly inexcusable accidents have occurred on the elevated railways of this city, for which reasonable men will, we think, hold the companies responsible. It is easy to make a show of shifting this responsibility upon employes; but, so long as the companies persist in running these roads without providing electric signals, and all the other safety appliances used on our railroads, the recurrence of collisions, derailment at misplaced switches, etc., may certainly be expected.

The neglect to provide electric signals is all the more culpable when the comparatively small outlay required to supply them is considered.

The theory that accidents can be avoided on a double-track road when trains on the same track run all in one direction, has been over and again disproved by facts, and though the list of accidents has, as yet, resulted in little loss of life and small personal injury, this has been due rather to a fortunate concurrence of circumstances than to anything else.

Steps should be taken to compel the companies to provide every known means for securing the safety of the many thousands of people who daily trust their lives upon the elevated railways. The holders of these monopolies should be made to feel the full weight of public opinion till they yield to all reasonable demands for the public safety.

Suitable legislation, which we do not believe they could successfully obstruct or defeat, should be at once begun to compel what they do not seem disposed to voluntarily perform.

GAS IN STEEL AND GLASS MAKING.

A few years ago every maker of crucible steel in the city of Pittsburg surrounded his frail pots of clay and plumbago with coke, the direct heat from this fuel melting the metal. To-day finds every one of these furnaces discarded, and the regenerative Siemens gas furnace has supplanted the coke burning ones. As a consequence, instead of two heats, five or even six heats are obtained from each crucible, while the saving in fuel is a notable item. The gas producing furnace is fed with a grade of bituminous coal which in many cases can be had for the hauling. Such in brief is an outline of the results attained in the use of gas in steel making.

Very recently a glass manufacturer of Pittsburg has, with remarkable success, adopted gas as a fuel in the converting of a "batch" of ingredients into molten glass, and his little furnace is an object of the deepest interest to the glass makers of Pittsburg and elsewhere. The glass melting furnace of the present is in principle that of the furnace of a century ago, a towering mass of refractory brick, holding at its base a collection of costly and fragile "pots," containing usually 2,000 pounds of molten glass each, these pots being exposed to the direct heat of burning coal beneath. The extreme tenderness of these pots, their liability to deposit their costly contents into the ash pit, their first cost, about $50, and the care necessary in preserving them from sudden lowering of temperature are a few only of the objections that have always existed in the orthodox form of furnace. In the best of these a pound of melted glass produced for a pound of coal burned is considered extremely good results and the first cost of such a furnace is $6,000. On the other hand, the new gas burning furnace costs $500, and in it every day there is melted a 6,000 pound batch with 1,000 pounds of "nut"