Will "Cold Light" Soon Be a Scientific Fact?

M. Dussaud, French Engineer, Has Just Reported Definite Progress in Solving Problem That Will Be Revolutionary

In producing the most efficient artificial light known, less than 10 per cent. of the energy of the coal pile reaches us. Nature is much more efficient. Many years ago the late Professor Samuel P. Langley tested the efficiency of the firefly. His experiments were repeated not so long ago by Drs. Ives and Coblentz. As a result of these studies, we know that the firefly's efficiency is about 96½ per cent.; in other words, that its light is well-nigh cold. Less than 4 per cent. is wasted in the form of heat.

A few days ago the cable brought word that C. F. Dussaud of Paris had made some highly interesting experiments with "cold light," as described some time ago to the Academy of Science by Professor Branley, with whom M. Dussaud studied. It is authoritatively asserted that M. Dussaud has achieved a noteworthy result in enabling the physicist to give us a light which will be both cheap and agreeable. He has earned a good reputation by his achievements in engineering, and for several years has worked at the problem of separating heat rays from luminous rays.

In the illumination produced by apparatus invented by M. Dussaud, a rapid succession of illuminated incandescent lamps takes the place of a single source of light. It consists essentially of a wheel on the circumference of which a number of tungsten lamps are placed, connected, each one in turn, to a source of electricity. By the rotation of the wheel each lamp at a particular point on the wheel is in turn illuminated and cut off from the supply, the speed of rotation of the wheel making it possible to light any lamp for an exceedingly short interval, the succeeding lamps furnishing, in turn, a source of illumination. There was produced on the retina of the eye of one observer, who has described it, the impression of a continuous luminous source.

"This being so," this writer continues, "M. Dussaud operated his machine at such a rate that the period of darkness for any lamp was more than twice the duration of its brightness, and it was possible, therefore, he found, to apply a much higher voltage than that at which the lamp was rated. Furthermore, the short period of time during which the lamp is luminous allowed the development of a very small amount of heat, measurable, of course, yet so small as to be unobjectionable.

"Tests have shown that with from 50 to 160 watts applied to sixteen lamps ranging from 25 to 80 candle power, there was obtained a brightness equal to from 250 to 800 candle power for several hours continuously. It will be at once understood that such an arrangement, in connection with a moving picture machine, allows the latter to be run at any desired speed and even to be stopped without danger of igniting the film; and as regards the intrinsic brightness of the source of light, it has been shown, illuminating engineers assert, that pictures projected on a screen 15 feet square in a perfectly satisfactory manner involve the consumption of only 150 watts of energy."

Paradoxically enough, the cold light of Dussaud is produced at an unusually high filament temperature. Heat is necessary to produce it. Because he has devised a very simple and ingenious method of preventing the dissipation of that heat into space, Dussaud's light may be popularly regarded as cold. But, strictly speaking, his light is not, of course, absolutely cold. The term is justified in so far as Dussaud's lamps radiate a negligible quantity of heat.

His light is said to be particularly adaptable for use in situations where great luminosity must be obtained with a feeble current. These conditions, for example, are those which manufacturers of moving picture projectors have long tried to realize.

In an address delivered by Professor Wilder D. Bancroft, Professor of Physical Chemistry at Cornell University, before the Association of Illuminating Engineers at Pittsburgh, the question whether light may not be produced in other ways than by temperature radiation, and, if so, whether it is possible to produce cold light, was treated as follows:

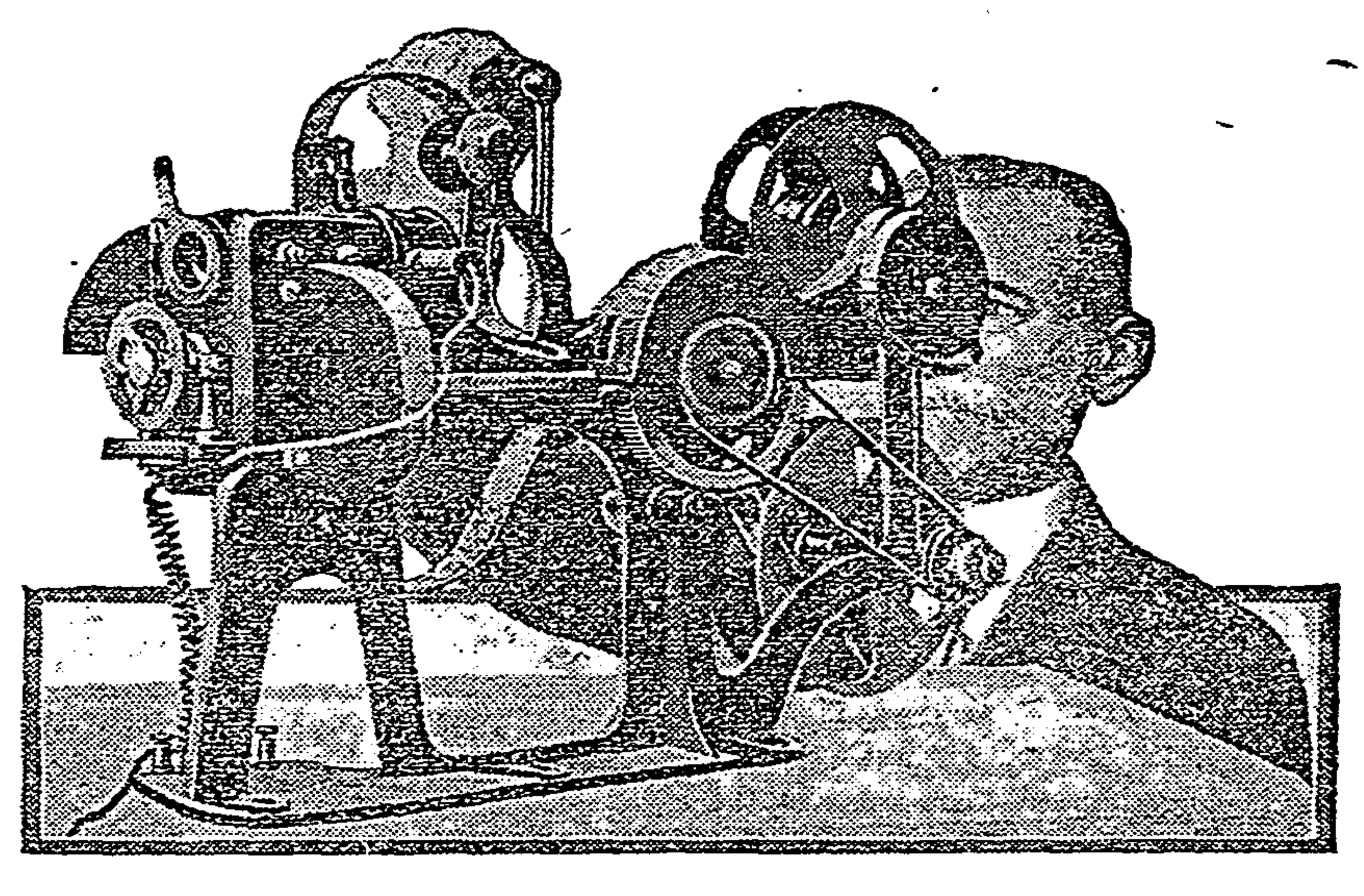
The firefly produces cold light. Langley's study of the firefly having shown that it gives about 95 per cent. efficiency; meaning that about 95 per cent. of the radiations are in the portion of the spectrum visible to the human eye, while only about 5 per cent. are in the ultra-red portion of the spectrum or what are popularly called heat rays. The light of the firefly cannot be due to a temperature radiation, because the firefly does not burn up. It does not involve life because its abdominal parts can be dried and kept for two years, and at the end of that time the powder will glow if moistened and exposed to oxygen

It is, Professor Bancroft asserts, simply an oxidation process. The firefly has the power of secreting a substance which burns with a luminous, cold flame. If one could make in the laboratory the substance that the firefly makes, it would behave in exactly the same way as the natural product. He continues:

Under certain circumstances cold light can be produced in the laboratory. Phosphorescing substances, such as zinc sulphide, emit light at low temperatures and do not involve temperature radiations. As yet such substances as Balmain's paint, &c., have to be exposed to light before they will emit light. Until some other way of stimulating them is found, they are of more theoretical than practical importance. At present very little is known about the chemical reactions involved, because these subjects have been studied chiefly by physicists. * * * The theoretical feasibility of cold light and the general conditions under which it is to be obtained have been demonstrated.

Some time ago M. Dussaud demonstrated that it was possible to project moving pictures on a sheet five yards square with an electro-generating apparatus of 150 watts; in other words, an apparatus so small that it can be carried very easily in the hand. The absence, or rather the quick dissipation, of heat enabled the operator to run the film off as slowly as he pleased, and even to stop it entirely in order to study one particular picture of the screen. Because of this rapid dissipation of the heat, it was possible to employ celluloid instead of glass plates for ordinary lantern slides.

The recent cable dispatches indicate that the substitution of paper rolls for celluloid films in moving-picture machines has been satisfactorily obtained. Celluloid is more combustible than paper, therefore it is asserted that paper films need a cold light less than celluloid. As a matter of fact, motion-picture film is nitrocellulose, "a first cousin of guncotton."

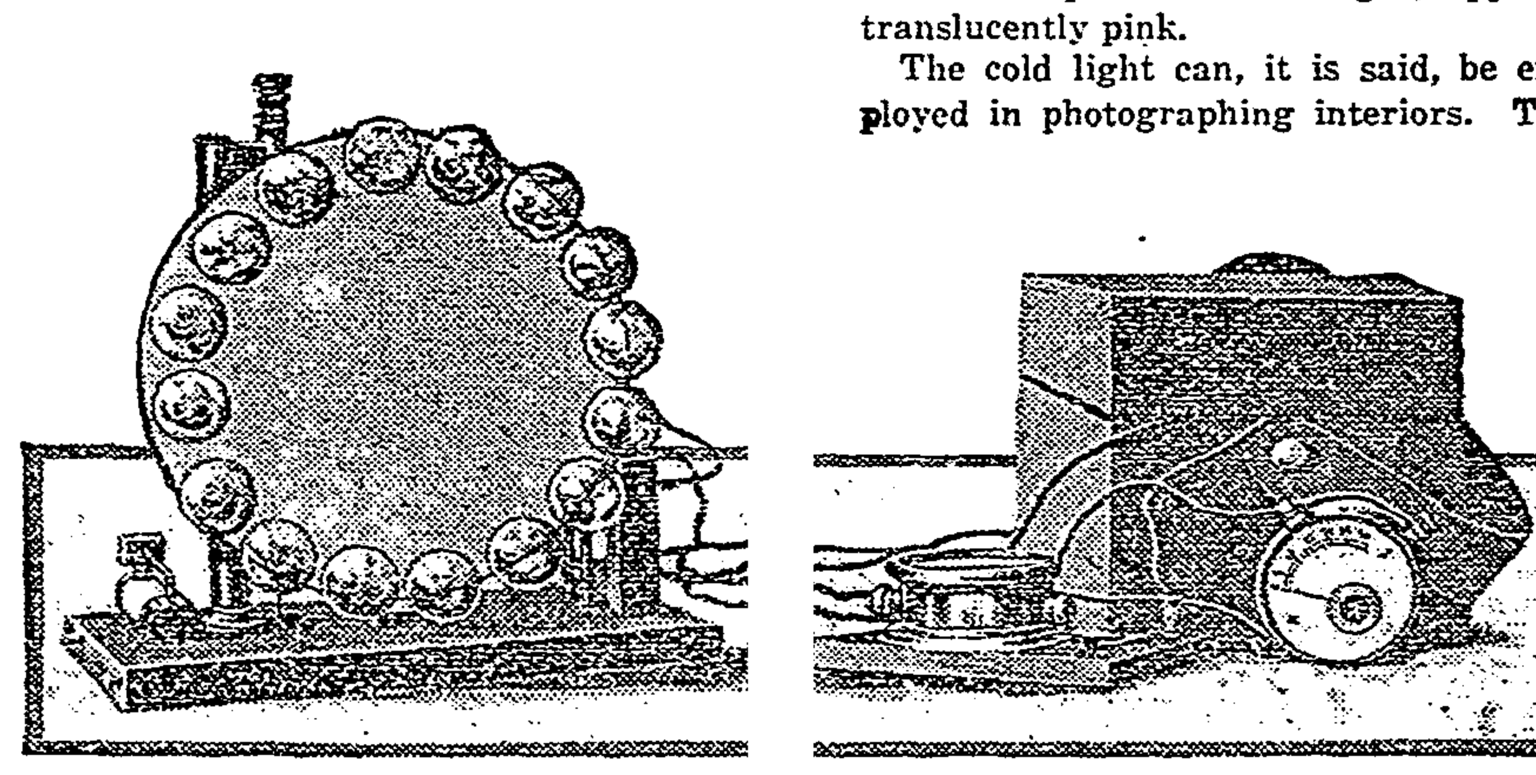


A Cold Light Moving Picture Projector on Which the Film May Be Stopped Without Danger of Ignition.
(Courtesy Scientific American.)

There is no danger, according to M. Dussaud, of setting the celluloid on fire or of causing it to shrivel up. The celluloid can, he says, be cut into long strips, perforated along the edges so that it can be printed mechanically, as in making moving-picture positives. Indeed, M. Dussaud asserts, a single operative can make 25,000 celluloid prints a day. These tiny photographs can be made by any amateur at a cost of not more than a cent, and can be projected on a screen by means of small, cheap projectors.

By means of cold light, auto-chrome plates can be projected, which otherwise suffer when exposed to the electric arc. Powerful lights can be concentrated upon parts of the human body without danger of scorching them, with the result that foreign bodies can be located very rapidly in the muscles. The hand, when held close to a powerful cold light, appears translucently pink.

The cold light can, it is said, be employed in photographing interiors. The inconveniences attending the use of ordinary magnesium flash powder are well known. Powerful cold lights render it possible to make very brief exposures without polluting the atmosphere of the room with smoke.



Dussaud's 16-Inch Cold Light Apparatus.
(Courtesy Scientific American.)

Illuminating engineers, when asked what will be achieved in the science of illumination in the next ten years, point to the latest and most efficient incandescent lamp—the inert gas or nitrogen-filled incandescent lamp. It has a tiny filament but the bulb is filled with nitrogen—an inert gas. At present, the lamp is used commercially only in the larger sizes of several hundred watts.

Lighting has passed through a combustion stage where illumination was obtained by burning tallow, oil, and finally gas. We are now in the incandescent era, light being obtained by the incandescence of the mantle of the gas lamp and the filament of the incandescent electric lamp. The limit of illuminating efficiency by incandescence is believed to be at hand. The next era is believed by some experts to be one of luminescence in which light will be obtained by causing a gas in a bulb to glow by passing an electric current through it. The efficiency of the luminescent lamp is expected to be very high.

The progress which up to the present time has been made in lighting is summed up in a general way by an illuminating engineer, as follows:

"Whatever way you get light, whether by a gas flame, a burning stick, or any one of a dozen kinds of electric light, the basis of illumination is always the same—the light is produced by particles of carbon being heated to incandescence. In all cases you must remember that the higher the temperature the whiter the flame that is given off, and you have a good example of this if you compare the dull red of the sparks which fly from a blacksmith's forge with the intense white light of a Welsbach gas burner.

"The conveniences attending the use of a gas flame are well known, but people are not so familiar with the great disadvantages of this form of light. It is a dangerous light, because, if it is not carefully extinguished, the result may be an explosion or the poisoning of some one through breathing escaping gas. Then the gas flame consumes the air and renders it unfit for the lungs, and the heat and smoke are also disadvantages. The whole problem now facing the illuminating engineer is not so much one of producing an improved light, but of discovering better methods of utilizing the light after it has been produced and of directing the light where it is needed without the great present loss, and also of softening the light, when viewed directly, without the great loss incident to the use of shades."

Perhaps the time is almost here when the untutored lightning bug, without scientific or technical training, will no longer so far surpass man in the field of applied science. "A lady of the Phengodini," writes one observer, "flashes a red light at each end of her body, and a green light along her sides. Her Paraguayan admirers call her the railroad beetle. The cucuyo, one of the Elateridae, reaches a length of two inches, and is the beetle used as a hair ornament in the countries fortunate enough to harbor it. The light of these interesting fellow-citizens is produced practically without heat, as is the luminosity of the familiar lantern carriers who may be seen on the lawn at night. But the method by which they generate their illuminant is a mystery."

Nikola Tesla, inventor and physicist, is hopeful that, within the next few years, wireless plants will be installed for the purpose of illuminating the oceans. The project is perfectly feasible, he says, and if carried out will contribute more than any other provision to the safety of property and human lives at sea.

"The same plant," says Mr. Tesla, "could also produce stationary electrical waves and enable vessels to get accurate bearings and other practical data without resorting to the present means. It could also be used for time signaling and many other purposes of similar nature."

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