AN AUTOMOBILE HOE.

BY JACQUES BOYER.

An automobile hoe, or cultivator, represents a recent application of automobilism to light agricultural machinery. The new implement, which is designed especially for the cultivation of beets and other crops planted in rows, has six blades and is driven by an explosion motor, by means of gearing. The chassis, constructed of steel angle bars, is pointed in front and rests on four wheels, of which the front pair serves for steering and the hind pair for driving. In the front of the machine is a two-cylinder, four-cycle motor of 10 or 12 horse-power, which may be adapted to burn either carbureted alcohol or gasoline by an easily effected change in the carbureter. The feed and escape valves may be controlled by hand, and the ignition is furnished by accumulators, an induction coil and electric bougies. The bearings are continuously lubricated by a mechanical device. The cylinders are cooled by water, which is continuously pumped through a radiator of the wing type, which is shown very clearly in one of the photographs (Fig. 2). On the axis of the flywheel and almost surrounded by its rim is a conical friction clutch, so constructed as to exert no lateral pressure on the collars. This clutch is connected by an elastic sleeve with the speed changing box, which contains two trains of gearing, one for forward, the other for backward motion, the latter effecting a reduction of speed in the ratio of 1 to 3. The differential is controlled by an endless screw. The maximum speed of the machine is about 2 feet per second or a mile and a quarter per hour. Because of the reduction mentioned above the speed backward cannot exceed 8 inches per second. The driver sits in the center of the machine and steers by means of a Galle chain connected with the front pair of wheels. But the apparatus is so arranged that the position of the operator may be varied to suit the requirements of the work. In some cases he walks behind the machine, where he can watch the hoes and regulate the speed accordingly. On reaching the end of the row the machine turns on one of its driving wheels as on a pivot, and that wheel returns along the track made by it in coming. This maneuver, which is illustrated in one of the photographs (Fig. 2) is easily effected by means of the differential.

The automobile hoe complete weighs 2,750 pounds, and cultivates a strip more than 8 feet in width. Over horse hoes it possesses the advantage of suppressing the trampling of the young plants, in addition to greater uniformity of action. Hence it will, doubtless, be generally employed wherever drilled crops are cultivated on a large scale. By the substitution of blades of special form the machine can be adapted to accomplish, rapidly and neatly, the preparation of the ground before sowing, which is so important, especially in the cultivation of beets.

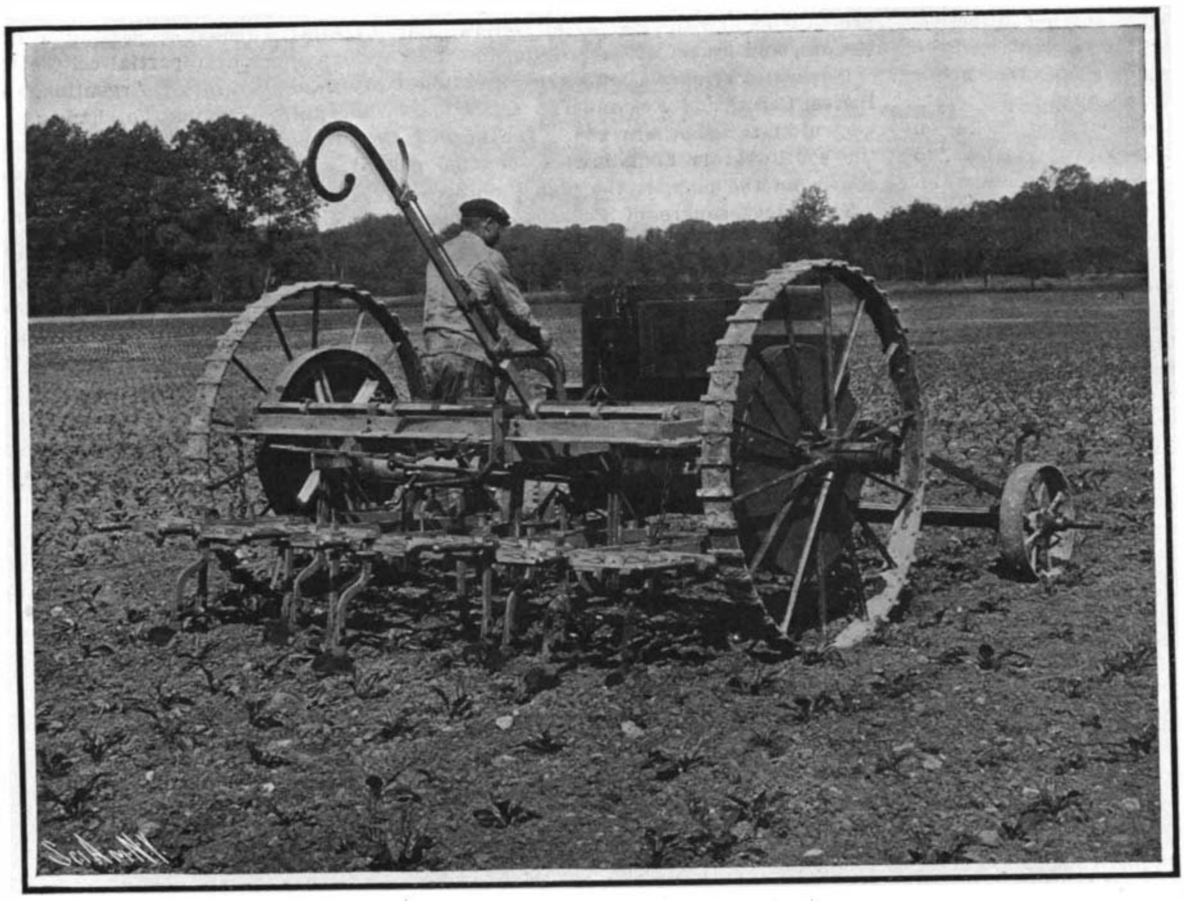


Fig. 1.—The automobile hoe in operation.

Fig. 2.—The automobile hoe turning.

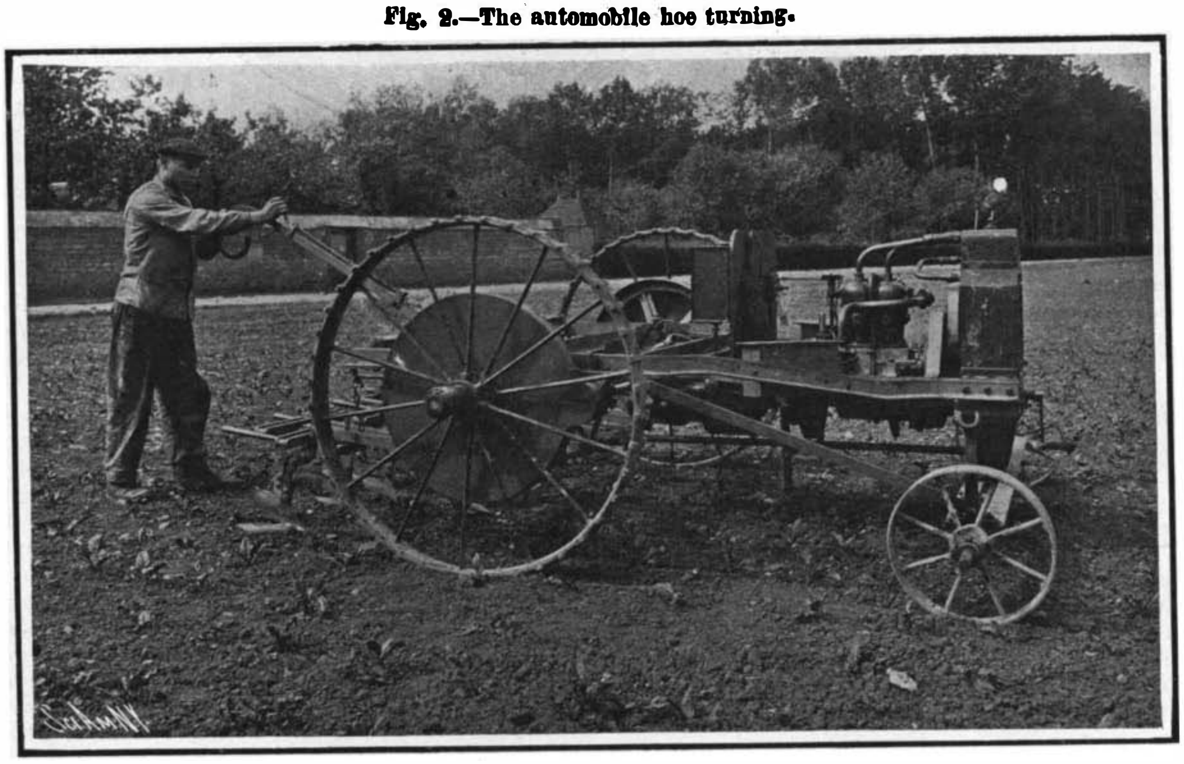


Fig. 3.—The automobile hoe with bonnet removed to show mechanism.

AN AUTOMOBILE HOE.

Electric Cleansing Compound.—Spot removing preparation. To 500 parts of water add 30 parts of glycerine, 7 parts of the strongest caustic ammonia, and 30 parts of ether, mix all thoroughly, then add 500 parts of water and 30 parts of white olive oil soap, shaking thoroughly until everything is dissolved.

Optical Properties of Colloidal Solutions of Gold.

The study of the remarkable phenomena exhibited by the colors of colloidal solutions of gold was commenced, and pursued with some success, by Faraday, but no further progress was made until the recent invention of the ultramicroscope made it possible to prove the absolute uniformity of the particles of gold in a given solution.

W. Steubing has indicated a new method of investigation, by which the quantity of light diffracted laterally by the colloidal solution can be measured. He begins by preparing a number of gold solutions of each of the characteristic colors (blue, red and violet) in such a manner that the solutions are very permanent, pure in tint and as much alike (for any one color) as possible. These solutions are first examined with the ultramicroscope for the purpose of determining the color, luminosity and size of their particles. Two series of observations with the spectrum photometer follow. In the first series the absorption of various rays of the solutions (suitably diluted) is measured; in the second series the color and intensity of the light diffracted by the solutions are determined. The polarization of the light is next studied with the ultramicroscope in combination with a Babinet compensator. A second very careful examination with the ultramicroscope alone is then made, for the purpose of making sure that no change has taken place in the solutions. Finally, the quantity of gold is measured by two electrolytic methods.

In general, it was found that most the incident light was absorbed by the particles of gold and only a small fraction was diffracted. It was shown also that the color phenomena could not be explained by resonance. The lateral radiation from red solutions (containing green particles) was maximum for wave lengths between 560 and 570$\mu\mu$. In blue solutions (containing reddish yellow particles) a weak maximum was found at 570$\mu\mu$ and a stronger maximum in the red. The violet solution (containing both green and reddish yellow particles) is equivalent to a mixture of the red and blue solutions. The dull green solution (containing yellowish particles) exhibited a feeble luminosity with no well-marked maximum.

The curve of absorption of colloidal gold does not coincide with that of massive gold. The red solutions showed a well-marked maximum of absorption at 525 to 530$\mu\mu$. The blue solutions showed a minimum absorption at 490$\mu\mu$ and an ill-defined maximum in the yellow, orange, or red. The absorption of the grayish green solution was almost uniform throughout the spectrum. The diffracted light was found to be partially polarized, the maximum polarization occurring with a deviation of 90 deg. The ultramicroscopic examination of the red and blue solutions by polarized light revealed considerable differences in the form of the particles. With the red solution the diffraction disks were always circular, but with the blue solution they were often curiously deformed. In general, the phenomena exhibited by the blue solutions were far less uniform than those of the red solutions.

THE GUIDING LIGHTS OF OUR COASTS.

BY C. H. CLAUDY.

The goal toward which the Lighthouse Board of this country is striving, is a continuous chain of lights, completely encircling the United States and possessions, and, in the case of rivers and inland seas, bounding the waters on all sides, so that a ship may never leave the area of light thrown by one lighthouse, before entering the circle of light of another. As fast as Congress will appropriate the money, the gaps are being filled.

But what makes the light? When the curious inquirer is told "kerosene," he naturally wonders why his own student lamp does not give a better one, if the same oil in the lighthouse sends its beam from five to twenty-five miles.

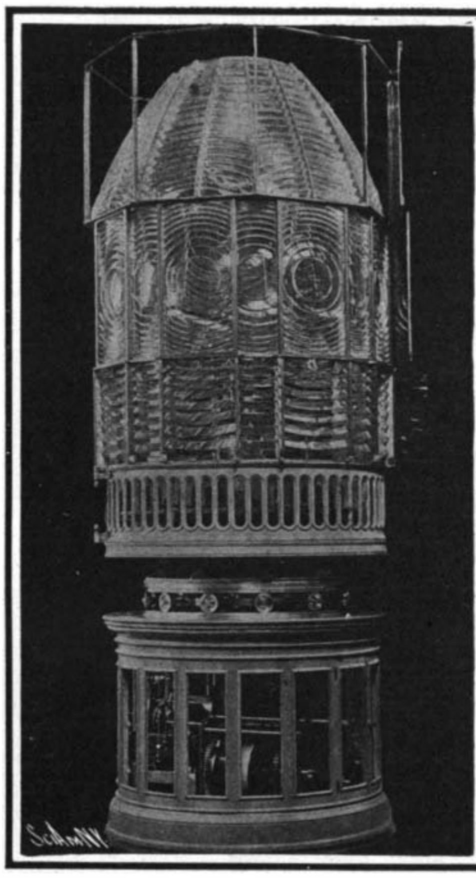
Various methods of lighting were in use until 1840, when a new system was introduced of employing nearly true paraboloid reflectors and better glass lenses. In some cases these reflectors gave a light which is not surpassed even to-day, except when handled with intelligent care. In 1852, when the present Lighthouse Board was instituted, the Fresnel system of lenticular glasses was introduced from France, and still remains. The first cost is great, but by the saving in oil over the reflector system this is soon reduced. With any reasonable care, a fine light always results; and it is impossible for a keeper to maintain a poor light with this apparatus without flagrant disobedience of instructions.

The accompanying illustration shows a first-order lenticular apparatus. It gives a flash every four seconds, alternate flashes being of slightly different duration. It will be seen that there are more or less complete lenses in the center of the apparatus, surrounded by more or less complete rings of prisms. Above and below are other sets of prisms, which catch the spreading rays of the central light and send it out straight toward the horizon.

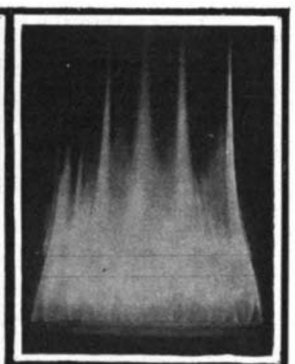
Even with such an apparatus, no common lamp can supply the light. First-order lamps have five wicks, one inside the other, and are fed with oil by a pump and pipe system. The oil is fed to the wicks so that it reaches the ends, where the flame is, in the right time and in the right quantity. It is difficult to look at it, so intense is the light. In the lenses rather than in the lamp is the secret, for they pick up and utilize nearly all the rays of light which ordinarily go astray. The Fresnel apparatus collects almost all of this waste light, and reflects and refracts it out in one great broad beam of light, parallel to the surface of the sea, where it is needed.

A diagram is reproduced with this article, showing the relative range of lights of the different orders and the relative intensities of a flash and a steady beam. All the light available is concentrated into the flash. In the steady beam, which has no intervals in it, the light covers a broader space, and so cannot cover it so far. That is one reason for making most first-order lights, which are to be seen at a great distance, very high, when they are fixed, and flashing whenever possible, so as not to interfere with near and similar lights.

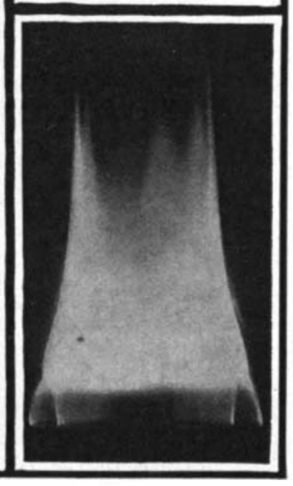
The flames which come from the lamps are largely transparent. So, of course, are all other similar flames. If flames were not transparent, there could be no advantage in having one flame inside another, and a third inside the first two, etc. The lights from the inner ones could not get out, and would do no good. Pictured with this article are flames of a first-order and a third-order lantern, to illustrate the transparency of the flames. These photographs were taken in a fraction of a second, and developed with great care, so as not to block up the delicate tracery of detail. As it is, the reproduction necessarily loses much of the fineness of the original.



First-order revolving Fresnel lamp.



First order flame.



Third-order flame.

The irregularity of the flames is of less importance than the maintaining of a solid band of flame across the focal plane of the system, which is shown in the larger flame photograph, by black lines. It is from this point that the lenses take the light which they project out to the horizon, this part of the flame being the brightest and the steadiest. The relation of lamp and lens system is carefully adjusted, until all the light from the flame in the focal plane of the system is being sent to the place where it is most needed.

In some lighthouses, usually for range light purposes, the light is all to be concentrated in one beam. This is done by concentric rings of prisms and a central bull's eye and a reflector. Vessels getting such a light in range, either by itself or with another light, and running down the beam, are safe from obstructions which may be nearby the range lights, or beams of light, marking out the channel to be followed.

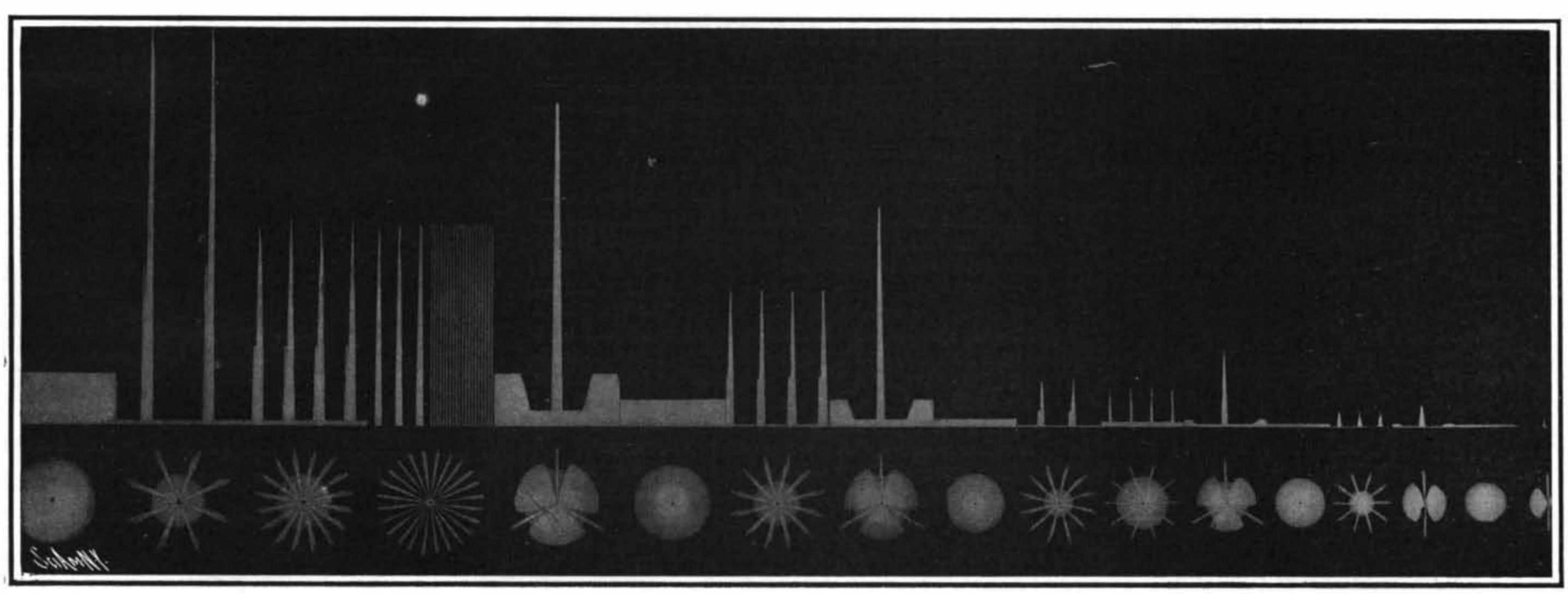
It is frequently asked of light keepers, why electricity is not used in place of mineral oil. An electric light is expensive to install, and difficult and expensive to maintain. There is always difficulty in keeping the arc exactly in the focal point of the lenses, the carbons never burning twice alike, and constant watching being necessary. Failure to have the light source exactly in the focal point of the lens results in sending the light rays up or down instead of straight out where they are wanted. Electricity, while superior in penetrative power in a fog, has no advantage over a powerful oil lantern in clear weather. Mineral oil, colza oil, or lard oil lights of the first order could be seen a hundred miles were it not for the curvature of the earth; and as long as the light is visible long before the coast is, all purposes are served.

It is only within recent years that mineral oil has been in use. Lard oil succeeded colza oil, and was used exclusively up to 1880, and with mineral oil up to 1889. Since the latter year, mineral oil has been used entirely, except where electricity has been experimented with, or coal or acetylene gas. So far, coal oil, for power, efficiency, cleanliness, ease of operation, and cheapness, holds its own against all other means of light making.

Electricity, if it can be successfully installed, is the best light; but through expense of maintenance, and in the inability to get skilled attendants for such a light for the price the law sets on keepers' services, it makes slow headway. The Lighthouse Board, however, keeps fully informed as to all improvements in such apparatus, and is anxious to experiment further whenever Congress will provide the funds.

The traveler who cruises up the coasts, and who sinks one light before picking up another, may know that somewhere in the dark circle is a spot picked for the foundation of a light which will be erected as soon as funds and time allow.

It is reported that from 2,500 to 3,000 tons of electrolytic copper will be required for the electrification of 1,310 miles of railroad in Sweden, the conversion of which from steam to electricity has been decided upon. The lines concerned are all to the north of Stockholm except the Charlottenburg and Laxa and the Gothenburg and Stramstad lines. The system will be fed from five power stations, and work will be commenced early next year.



Fixed light. — Eclipse every minute. — Eclipse every 30 seconds. — Eclipse every 20 and every 3 seconds. — Fixed light flash every 4 minutes. (1st order)

Fixed light. — Eclipse every 30 seconds. — Fixed light, flash every 3 minutes. (2nd order)

Fixed light. — Eclipse every 30 seconds. — Fixed light flashes without eclipses. — Fixed light flashes every 3 minutes. (3rd order)

Fixed light. — Eclipse every 20 seconds. — Flash every 3 minutes. (3rd order (small))

Fixed light. (4th order)

Diagram showing relative intensities of lights of different orders and different characters.

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