OPTICAL PROJECTION OF OPAQUE OBJECTS.

BY GEO. M. HOPKINS.

The projection of opaque or solid objects by means of the optical lantern affords a way of showing upon the screen a large variety of objects in their natural colors, and greatly magnified. The form of lantern best adapted to this purpose is the simplest imaginable.

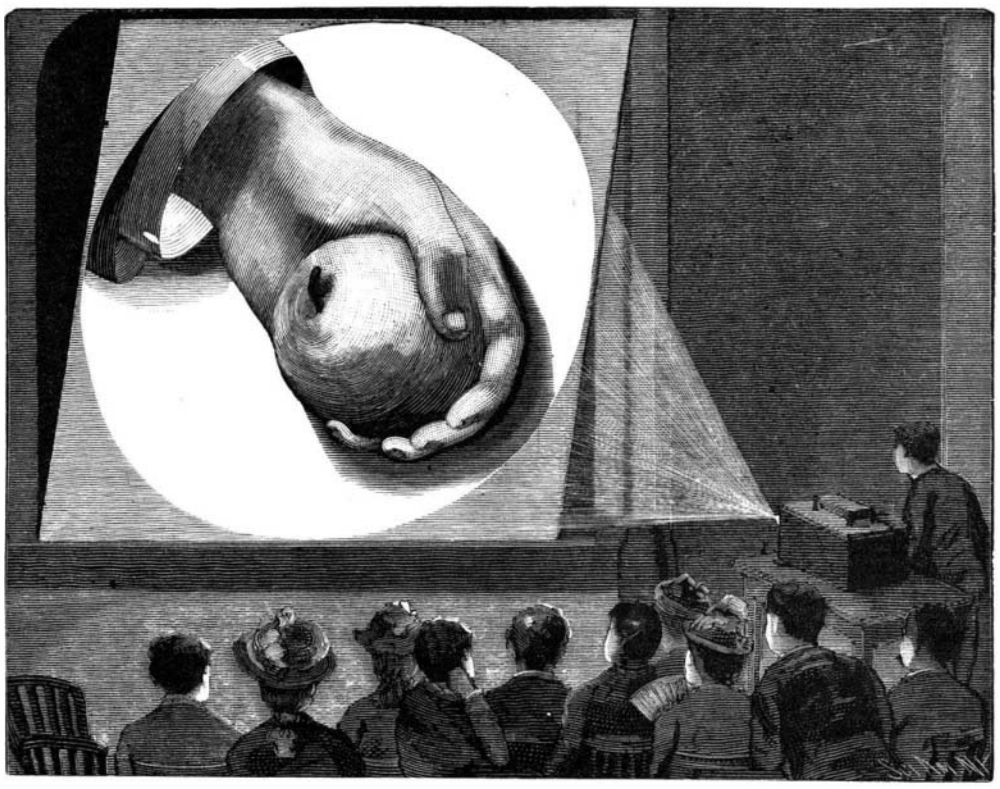

Fig. 1.—THE MEGASCOPE.

The works on optical projection briefly describe different forms of apparatus for this purpose. Prof. A. E. Dolbear in his book describes a megascope, consisting of a plain box, with a large lens in front and an oxyhydrogen light within. Mr. Lewis Wright, in his new work on "Optical Projection," shows two or three forms of megascope; but notwithstanding all this the idea is current that opaque projection is difficult, and several persons known to the writer are so thoroughly convinced of the magnitude of the undertaking that they do not make the attempt to project in this way.

In describing a few ways of opaque projection two or three points are noticed in the beginning. First, all the light attainable is required; second, all kinds of work cannot be done with one and the same instrument; and third, to secure the best effects, suitable shadows are as necessary as strong lights. It is useless to attempt projection on a large scale with a source of illumination inferior to the calcium light. For large objects and a large screen, two large burners are essential, and the use of three insures a much better effect.

The length of the box inclosing the object and the burners is determined by the focal length of the object glass. In the instrument illustrated, the lens has a focal length of 24 inches. The box is made 4 inches longer, *i. e.*, 28 inches, to allow of moving the object, for the purpose of focusing the image on the screen.

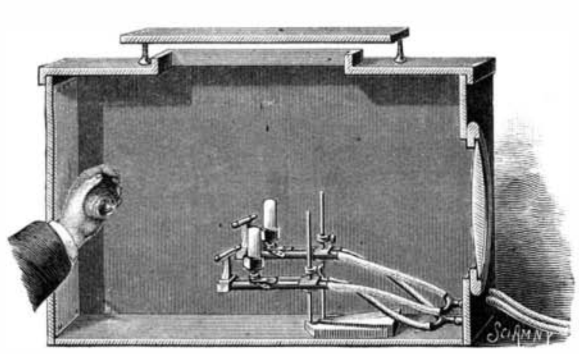

Fig. 2.—MEGASCOPE BOX, SHOWING POSITION OF BURNERS.

When two oxyhydrogen burners are used, they are arranged at one side of the megascope box, at slightly different elevations, and a short distance apart to secure soft shadows. When three burners are used, the third is placed at the opposite side of the box. It increases the volume of light and modifies the shadows. If the apertures of the burners are the same, they may all be supplied with gas from a single pair of cylinders, by using branch pipes. The burners should be pushed as near the object as possible, without bringing them into the field of the objective.

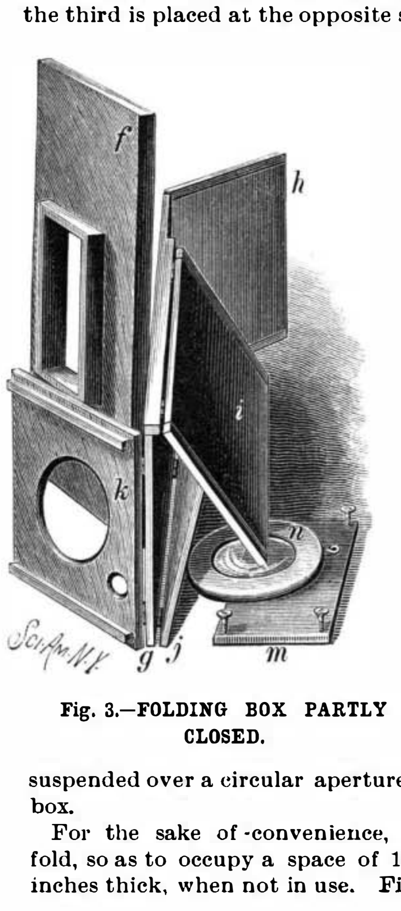

Fig. 3.—FOLDING BOX PARTLY CLOSED.

In the present case the objective consists of a 6 inch double convex lens, but a 7 or 8 inch would be better. The lens is mounted in a soft wood ring, and suspended over a circular aperture in the front of the box.

For the sake of convenience, the box is made to fold, so as to occupy a space of 18 by 28 inches, by 3 inches thick, when not in use. Fig. 3 shows the construction clearly. The top, *f*, is like an ordinary box cover, with the exception of the central draught hole surrounded by a collar.

To the bottom, *g*, are hinged the end, *h*, sides, *i j*, and the front, *k*. The cap, *m*, is supported over the opening in the center of the cover, *f*, by the wood screws inserted in the corners. The lens, *n*, is arranged to hang over the large opening in the end piece, *k*. In this end piece there is a smaller opening for the insertion of the gas tubes. The side piece, *i*, is discontinued near the back end of the box, to provide an opening for the insertion and removal of objects. This opening is covered with a black curtain, which falls over the arm, and prevents the escape of light. Upon the inner surface of the back end of the box is secured a piece of white cardboard for a background.

The sectional view, Fig. 2, best shows the internal arrangement.

The object must be inserted in position and moved forward or backward until it is focused. If difficulty is experienced in holding the objects properly for exhibition, they may be placed on a movable support.

Fruit of all kinds projects well, either whole or divided. A bunch of California grapes forms a fine object. A bouquet of flowers is beautiful. Shells, especially polished ones, are very pleasing objects. Peacock and other feathers show well. Pottery and bronzes, plaster casts, toys of various kinds, particularly of the Japanese variety, carvings, embroidery, paintings, engravings, photos, the pages of a book, are all of interest. Whole machines of a suitable size, and parts of machinery, or apparatus of almost any kind may be shown to advantage in this way.

Another way of accomplishing the same result without the use of a box is illustrated in Fig. 4. In this case one room serves as a megascope box and another as the room in which to place the screen. The same general arrangement as that already described is observed. In this case the lens is secured over the space between two sliding doors, and all escape of light is prevented, excepting of course that which passes through the lens. The screen is made of translucent tracing paper. The lens may be such as is used for the examination of paintings or photographs, but the kind known as cosmorama lenses, sold by the principal opticians, are preferable, on account of being about the right focus. They are not expensive, and may be obtained of a diameter of six or seven inches. Two or three calcium lights are used. The objects may be held in front of a white or tinted background, or the background may be omitted. It is absolutely necessary that no stray light should escape into the room in which the image is thrown. Of course an opaque white screen may be used in this arrangement if desirable.

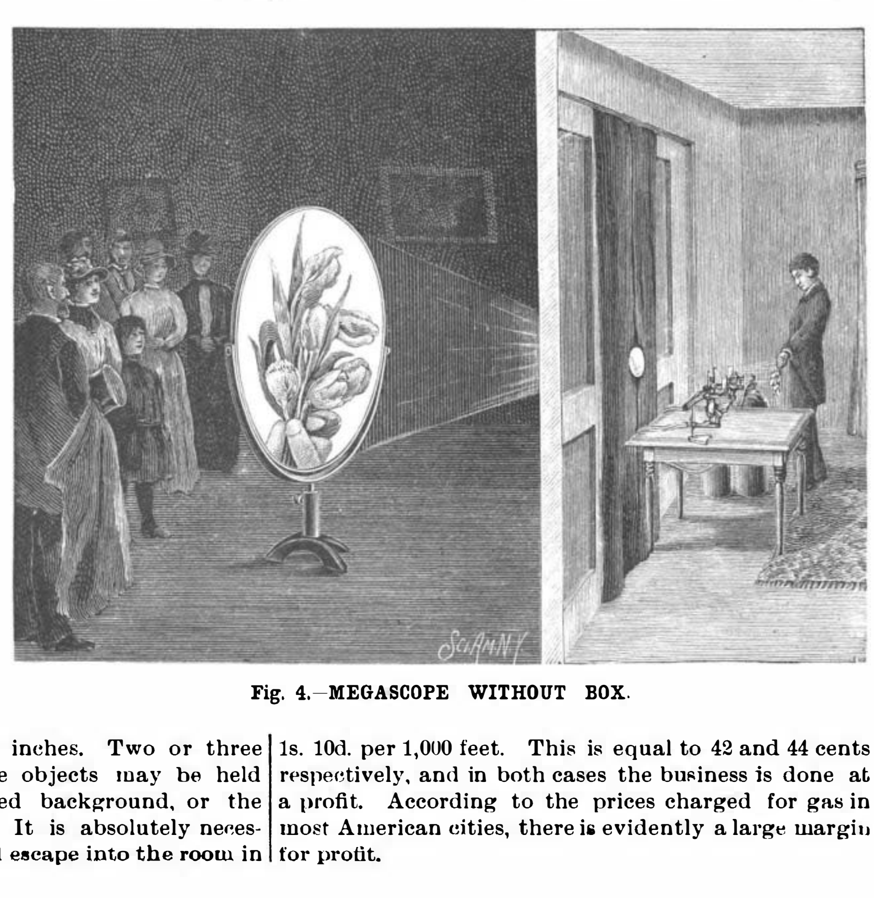

Fig. 4.—MEGASCOPE WITHOUT BOX.

For the projection of fine objects, such as gems and their settings, a watch movement, or a fine piece of machinery or apparatus, the arrangement shown in Fig. 5 is effective. A plan view of the apparatus is here shown. The objective of the lantern is removed and supported at an angle with the optical axis as indicated. The lime is pushed forward so as to cause the divergent cone of light to cover the object, *d*, as shown. The light reflected from the object, *d*, passes through the objective to the screen.

The wire frame, *e*, secured to the front of the lantern and held by the standard, *f*, is designed to support a thick black cloth for shutting in all light excepting that passing through the objective. Apparatus similar to this in principle is sold by some of the dealers in lanterns.

The wonder camera shown in Fig. 6, on opposite page, is an instrument having a marvelous amount of power considering the source of light, which is simply a single Argand kerosene burner. This toy is furnished by Ives, Blakeslee & Williams Company, of this city.

The lamp flame is in one focus of the ellipsoidal reflector and the picture or object to be shown is placed at the other focus, on the swinging adjustable holder. Opposite the holder in a perforation in the reflector is placed the objective by which the image is projected on a screen three or four feet distant. The small plan view shows the shape of the mirror and the course of the light. The linings of the box around the lamp and focus of the reflector are removed in the picture to show the interior. These linings are made of asbestos, to withstand the heat. This instrument will project coins, shells, flowers, pictures, etc., very satisfactorily.

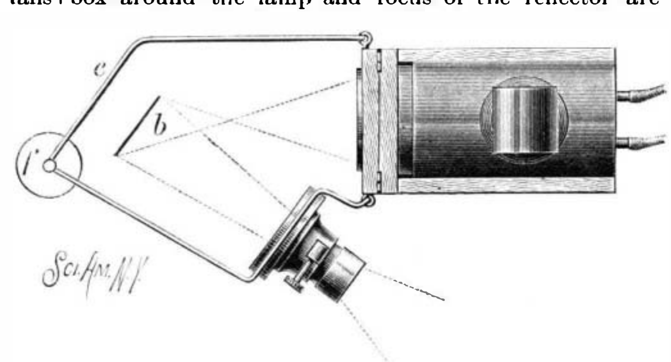

Fig. 5.—MEGASCOPE ATTACHMENT TO LANTERN.

GAS for illuminating purposes is sold by a private company at Plymouth, England, for 1s. 9d. per 1,000 feet, and at Leeds it is sold by the local authorities for 1s. 10d. per 1,000 feet. This is equal to 42 and 44 cents respectively, and in both cases the business is done at a profit. According to the prices charged for gas in most American cities, there is evidently a large margin for profit.

Manufacture of Aluminum.

A suit has been brought against the Cowles Electric Smelting and Aluminum Company, by the Pittsburg Reduction Company, of Pittsburg, in the United States Circuit Court, and the Pittsburg Reduction Company moved for a preliminary injunction to stop the Cowles Company from manufacturing pure aluminum at its works in Lockport, N. Y., under what the Pittsburg Company alleges is the Hall process, covered by letters patent owned and controlled by itself.

A large number of affidavits is filed by the Pittsburg Company in support of its motion. Alfred E. Hunt makes affidavit that he is the president of the Pittsburg Reduction Company, and has been since 1876 a civil and metallurgical engineer and chemist. For some years he has made pure aluminum a special study, realizing that in due time, if its manufacture could be made more inexpensive, it would be an important article of commerce in the mechanical arts. It was not until 1888 that he heard of the Hall process of reducing aluminum electrolytically from a fused bath of fluorides containing alumina in solution. The patented process was secured and the Pittsburg Reduction Company organized. It was successful and in due time was enabled to establish works in Pittsburg and in Great Britain and to manufacture and sell pure aluminum at $1.50 and $2 a pound, where previously it had been sold as high as $12 a pound. Until January, 1891, the Pittsburg Reduction Company was the only manufacturer of aluminum in this country, though many concerns applied to it and were refused on the ground that the Pittsburg Reduction Company could supply all the demand and desired to retain the exclusive use of the Hall patent. In the spring of 1890, Eugene Cowles, of the Cowles Smelting and Aluminum Company, notified Mr. Hunt that a concern in Boonton, N. J., was manufacturing pure aluminum by the Hall process, and on this hint the New Jersey concern was investigated, owned up, and desisted. The Cowles people have made overtures to the Pittsburg Reduction Company to unite patents, but have been refused, and last month began manufacturing pure aluminum in Lockport. Mr. Hunt declares that this was done to harass his company into a combination and thus secure to the Cowles Company the value and use of the Hall process. The Cowles Company has been offering pure aluminum at $1.25 and has even quoted it at $1. Prior to January the Cowles Company has not pretended to make pure aluminum and has referred purchasers to the Pittsburg Reduction Company for it. Mr. Hunt says that the Cowles process is an alloy process and not adapted to produce unalloyed metallic aluminum.

Among the other affidavits is that of Henry P. Moore, of Pittsburg, who says that he worked as a laborer over night in the Cowles works at Lockport, and who describes the manufacture that went on there. Moore describes the plant as being situated on an island in a swift and turbulent stream, guarded by watchmen night and day, with doors barred and windows painted within and without.—*Cleveland Plain Dealer.*

Heart Sounds at a Great Distance.

Dr. Guido Bell, who had previously reported in the *Memorabilien* a case in which, after contusion of the thorax, the hearts sounds were plainly audible the whole length of the room, and even further, now publishes a second case of a similar kind. A large and heavy but healthy man had, in the presence of the author, fallen backward from an open vehicle to the street, and in a state of unconsciousness was carried the short distance to his house. He had fallen on his right shoulder and had fractured several ribs, but without injuring the pleura. His breath was short and superficial, the pulse frequent and very small, the pupils of moderate size, but insensible to light, the eyes open and expressionless, the skin cool and pale.

When the patient was placed in bed the heart sounds were very loud at the distance of a foot. This abnormal loudness lasted half an hour. The patient recovered after a serious attack of pleurisy, and both he and the patient previously referred to are now strong and well. Both patients had been under the influence of shock while these peculiar symptoms lasted, and these are in Dr. Bell's opinion merely symptoms of shock. Assuming that in low vitality of the vagus and sympathetic the ganglia of the heart may have increased activity, he considers that we may look upon the increased action of the heart as simply a symptom of shock. The author considers his theory proved by the fact that each nerve system, besides being under the control of the brain, also has an independence of its own, with ganglia for centers. The spinal cord, and still more the sympathetic, certainly have this independence, and probably also every other ganglion in a corresponding manner. When the influence of the brain as nerve center has ceased to be felt in any organ—the heart for instance—this may still exercise its independent activity, and especially so when its antagonist has become inactive. Even the apparent contradiction of a small pulse with increased action of the heart could be explained by assuming a certain independence of the ganglia. This independent action is further increased by the narrowing of all blood vessels through paralysis and consequent increased resistance. —*Lancet.*

A Gigantic Railway Property.

The Pennsylvania Railway system is called an "empire" by an Eastern contemporary, and well it may be, measuring it by the magnitude of its receipts and disbursements. The gross earnings of the entire system for the calendar year 1890 were $133,531,623, and its expenditures were $92,603,325. Never before 1864 did the United States collect so large a revenue, and never before, except in time of war, did it expend so much in a single year. But it is the net earnings rather than the aggregate business that those who look forward to government ownership of the railroads will regard with the greatest interest. The net earnings were $41,518,258. These earnings were realized on 7,915 miles of road operated—2,435 east of Pittsburg and Erie, and 5,480 west of those points. The net earnings, therefore, were about $5,255 per mile of road operated. The capital stock, including nearly $9,600,000 issued last year, is $123,082,050, or about $15,580 per mile of road operated. The net earnings were not far from one-third of the capital stock in a single year. It is to be borne in mind that the capital stock represents very much less than the actual value of the property, estimating the value at cost, and not on the basis of earning capacity. The roadbed, rails, and bridges could not be duplicated in their present state of solidity and general excellence for less than double the amount of capital stock, to say nothing of locomotives, cars, depots, shops and machinery, right of way, etc. Still, the earnings were unquestionably a large percentage of the amount which it would cost to duplicate the entire property at present prices of materials and labor, assuming that the right of way could be obtained at something like the original cost. Arguing from this system alone, therefore, it might be contended with some plausibility that railway earnings are excessive. But it must be remembered that this system is exceptional. Its mileage is less than one-twentieth of the aggregate mileage of the country, but its gross earnings were not far from one-ninth of the gross earnings of all other roads. Its earning capacity, therefore, is considerably more than double that of other roads on the average, although its tariffs are low, and lower than those of most roads, especially those that stretch through comparatively unsettled regions and are more remote from the great centers of traffic.—*Chicago Herald.*

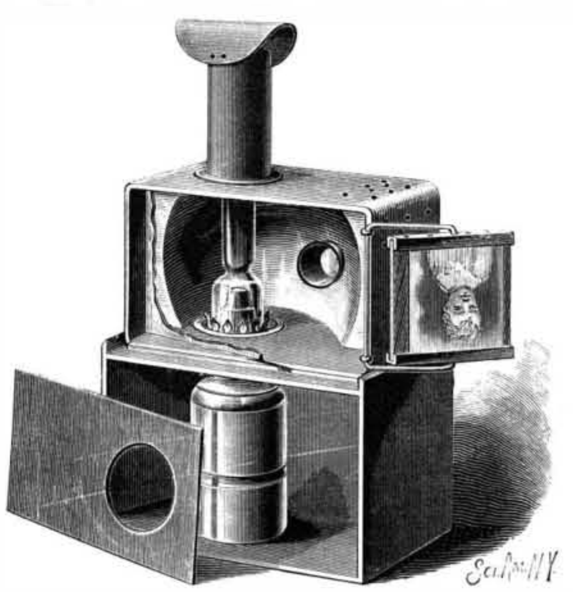

Fig. 6.—WONDER CAMERA.

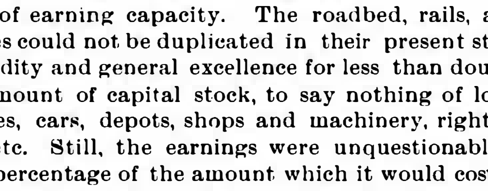

Fig. 7.—PLAN OF WONDER CAMERA.

Eucalyptus Extract as a Scale Remover.

Many of the railways in India traverse calcareous regions that produce water as badly impregnated with lime salts as anything to be found in our Western States. The result is that how to keep boilers free from incrustation is as pressing a problem as it is on many of our railroads. Of course all sorts of remedies have been tried, and the quack with his lotions was driving a roaring trade, as he always does where a malady is raging that defies the skill of the regular practitioner. There are few chemicals with the least affinity for lime that have not been tried as a preventive of scale, and numerous mechanical appliances, guaranteed to prevent incrustation and to remove with certainty and dispatch what has been formed, all had their day and were declared to be wanting in utility. The case appeared to be growing hopeless, and the men in charge of the motive power were concluding that the constant calking, patching and renewing of sheets was inevitable, when some one tried the extract of eucalyptus leaves. This is reported to have proved an effectual anti-incrustation agent.

The eucalyptus is an Australian gum tree which thrives in all warm climates. It has a thick glossy leaf which stands upright and receives the rays of the sun on both sides. The leaves are rich in a volatile oil, which is the substance that acts on the lime salts with the effect that formation of scale is prevented. There are many regions in the Southern States where the eucalyptus tree would thrive and do good, for its presence is reported to be a specific against malaria. The tree was planted extensively in the swampy regions near Rome and is said to have greatly decreased the malarial fevers of the districts.

The extract of the leaves for use in boilers of the Indian railways is obtained in a very simple fashion. The leaves are collected and slowly boiled, about one thousand gallons of strong fluid being produced from fifty pounds of the leaves. Three gallons of this extract is used for a trip of 100 miles, and keeps the boiler in the condition that all impurities deposited by the feed water can be readily washed out. When a boiler is foul with scale, about twelve gallons of the eucalyptus extract is put in after washing out, and the incrustation immediately begins to soften, and soon falls off in large pieces. By keeping up the treatment and washing out thoroughly, the worst boiler will be cleaned in about two months.—*Nat. Car Builder.*

Advice to a Young Man.

So you were a little too pert, and spoke without thinking, did you, my son? And you got picked up quite suddenly on your statement, eh? Oh, well, that's all right; that happens to older men than you every day. I have noticed that you have a very positive way of filing a decision where other men state an opinion, and you frequently make a positive assertion where older men merely express a belief. But never mind; you are young. You will know less as you grow older. "Don't I mean you will know more?" Heaven forbid, my boy. No, indeed; I mean that you will know less. You will never know more than you do; never. If you live to be 10,000 years old, you will never again know as much as you do now. No hoary-headed sage, whose long and studious years were spent in reading men and books, ever knew as much as a boy of your age. A girl of fifteen knows about as much, but then she gets over it sooner and more easily. "Does it cause a pang, then, to get rid of early knowledge?" Ah, my boy, it does. Pulling eye teeth and molars will seem like pleasant recreation alongside of shredding off great solid slabs and layers of wisdom and knowledge that now press upon you like geological strata. "But how are you to get rid of all this superincumbent wisdom?" Oh, easily enough, my boy; just keep on airing it; that's the best way. It won't stand constant use, and it disintegrates rapidly on exposure to air.—*Burdette, in the Brooklyn Eagle.*

Ten Wheeled Locomotives.

The demand of the time is to move weight over distance at the least possible cost to it on slow freight or fast passenger trains. There are hundreds of locomotives in service of about 40 tons weight capable of hauling a train of 100 tons at the average running rate of 60 miles an hour. But that is not the kind of fast train that our railroad managers want. They are required to make money for the companies employing them, and they realize that it pays much better to use locomotives weighing sixty tons that are capable of hauling a fast train of 300 tons. It is a curious study, and one that is interesting to some minds, to investigate the rapid speed that might be made with safety with locomotives having abnormally large drivers, but as far as the bearing on American railroad operating is concerned, it is just as practicable as speculations or calculations respecting the time it would take a balloon of certain proportions to reach the moon. Locomotives with a single pair of driving wheels had their day on our railroads, and when business increased, the four wheel connected engine took possession of the field. This type of locomotive held its own so long that it became known as the "American locomotive." That kind of engine did admirable service, but the indications are that its days as the motive power for fast passenger trains are nearly over. Running two trains where one will suffice is not good railroading, and trains are becoming so heavy that two pairs of drivers and a four wheel truck will not carry the weight of the boilers and cylinders necessary to provide the required power. The mogul and the ten wheel locomotive are slowly taking the place they will eventually monopolize. To talk of employing single driver locomotives at this day is trifling with a serious subject.—*Nat. Car Builder.*