in cost. The price of glass is altogether saved and the labor reduced to a minimum, a band of several yards being coated in the most perfect manner in a few minutes. I hope to return to the subject again as the experiments of my friend proceed, and trust that, meanwhile, other workers will turn their attention in this direction, as the greater the number who put their hands and heads to the work the sooner will the desirable end be accomplished.—*John Nicol, Ph. D., in the British Journal of Photography.*

MECHANICAL INVENTIONS.

An improvement in the class of cotton presses whose followers are operated by a screw or screws, and are provided with an automatic mechanism for shifting the driving belt, and thus arresting the follower either in its ascent or descent, has been patented by Mr. George Cooper, of Augusta, Ga. Its construction cannot be readily described without an engraving.

An improved form of axle box and journal for vehicles has been patented by Mr. James A. Manning, of Danville, Ind. It prevents rattling, and it may be adjusted to compensate for wear; the journal will retain the oil or grease, and the box is prevented from wedging upon the journal.

An improvement in side-bar wagons has been patented by Messrs. William and Cyrus R. Fenstermacher, of Shippensburg, Pa. The invention consists in combining with the king bolt and fifth wheel a stay or brace having rear branches secured to side bars passing up on the inside of fifth wheel, and having the front branches fastened to the bolster.

A machine for manufacturing barbed fence wire of that kind in which the barbs are formed by wrapping a strip of sheet metal having inclined slits formed in its edge or edges around a wire spirally, has been patented by Alanson Cary, of New York city.

An improvement in the class of sash locks, in which an eccentric and sliding bolt are so connected that the action of the eccentric operates the bolt, has been patented by Mr. Hermann T. Raeke, of Baltimore, Md.

An improved monkey wrench has been patented by Mr. Baziel W. Lloyd, of Jackson, La. It consists in the combination of a box having arm and screw cutter sections held in the box, and a wrench having parallel jaws, the movable one being provided with a socket for holding the dies.

Mr. Moses R. McGregor, of Pine Bluff, Ark., has invented a lap ring or link of novel construction, adapted for use with plows and chains, and wherever available. It consists of the two flat links of similar size and shape, each having an opening at one side, and connected together. Upon one link is fixed a flat-sided pin or lug, which passes through a slot that is formed in the other link. This pin is headed or upset upon the link so as to retain the links together.

Mr. Daniel Kunkel, Sr., of Oregon, Mo., has patented an improved washing machine, which may be applied to an ordinary wash tub. It is simple, convenient, and effective. It is an improvement upon the washing machine for which letters patent No. 155,873 were granted to the same inventor, October 13, 1874.

An improved clay press has been patented by Mr. Simeon G. Phillips, of Perth Amboy, N. J. The object of this invention is to construct a press or adapt the ordinary presses for pressing clay in thin sheets one half the usual thickness, more or less, and sufficiently dry for the potter's use, without increasing the bulk of the press or using more cocks to produce the usual amount obtained at one pressing.

An improved attachment for clocks, to be connected with a self-lighting and self-extinguishing attachment for gas burners, which shall be so constructed that the gas will be lighted and extinguished automatically at fixed times, so long as the clock continues to run, so that the only attention required will be to wind up the clock at the proper time, has been patented by Mr. Simon Goldsmith, of Boston, Mass.

Mr. John F. Curtice, of Fort Wayne, Ind., has invented an improvement upon the car brake shoe, patented March 21, 1876, by I. H. Congdon, in which detached pieces of wrought iron are embedded in a body portion of cast iron, by casting the said body portion around the wrought pieces, whereby the wearing face of the shoe is composed in part of wrought iron, and is enabled to better resist wear, and gives an increased friction for stopping the motion of the car. The object of this invention is to provide such a construction of this composite brake shoe as will, while retaining and even increasing the wearing qualities, also secure the requisite strength to resist the breakage to which its use renders it liable, and at the same time allow the use of a much lighter and less expensive shoe.

Mr. James Tripp, of Coldwater, Mich., has patented improvements in that class of sewing machines in which a revolving shuttle takes the upper thread from the needle and loops it around the lower thread, which is carried by a bobbin contained within said revolving shuttle. The invention consists in the peculiar arrangement of the revolving shuttle with respect to its driving mechanism, its holding plates, and other co-operating parts, and in the means for facilitating the removal of the shuttle and its bobbin.

Relative Economy in Steam and Gas Engines.

According to Mr. J. T. Sprague some of the improved gas engines now in use, of small capacity, realize 1 horse power on the gas derived from 1 3-5 lb. coal; and the best steam engines, of large capacity realize 1 horse power on 2½ lb. coal. Gas engines are thus shown to be much more economical as motors than steam engines.

A Couple of Clocks.

Dr. J. L. Blair, of Abingdon, Illinois, has recently completed a clock which is locally regarded as one of the most wonderful pieces of mechanism ever made. This clock is 8 feet 2 inches high, 3 feet 4 inches wide, and 10 inches deep —lower half. The upper half is 6 inches deep and has a circle top. The largest wheel is 13 inches in diameter. The longest shafting is 3 feet. Weight of clock, 118 pounds; of weights—two in number—8 and 22 pounds. The case and works are made mostly of walnut wood. In addition to its time-keeping capacity, this clock minutely illustrates (it is claimed) the composition and movements of the solar system. Time is indicated at the center of the sun, a ball 15 inches in diameter. Around the sun the planets circle in their respective orbits. The earth is 3 inches in diameter, turns on its axis once a day, and goes round the sun in an orbit 9 feet in circumference once a year. In its daily revolution the earth indicates the time of day everywhere, shows day and night, longitude, and so on.

The moon, 1¼ inch in diameter, accompanies the earth with its proper motion, illustrating its phases, eclipses, and the rest. The motion and phases of Venus are illustrated in like manner, and similarly the orbits and motions of other planets. Halley's comet, 7 inches long, traverses an orbit 14 feet in circumference, with a period of 76 years.

At the right of the clock a skeleton, 10 inches high, strikes the hours. At the left another skeleton plays a tune as often as required. A skeleton "Father Time" swings his scythe at the center of the lower half of the clock. Above are places for showing pictures of historical events. Other details are described, at great length and with much enthusiasm, in the local newspaper, the most remarkable feature being the circumstance that the entire contrivance was whittled out with a jack-knife in the space of one year.

This Abingdon clock, however, appears to be a very rude affair in comparison with one now on exhibition in Detroit, Mich. The latter is the work of Mr. Felix Meier, a mechanic, and is said to eclipse the famous clock at Strasbourg in complexity and interest. It stands 18 feet in height, and is inclosed in a black walnut frame elaborately carved and ornamented. The crowning figure is that of Liberty, upon a canopy over the head of Washington, who is seated upon a marble dome. The canopy is supported by columns on either side. On niches below, at the four corners of the clock, are four human figures representing infancy, youth, manhood, and age. Each of these figures has a bell in one hand and a hammer in the other. The niches are supported by angels with flaring torches, and over the center is the figure of Father Time. At the quarter hour the figure of the infant strikes its tiny bell; at the half hour the figure of the youth strikes his bell of louder tone; at the third quarter the man strikes his bell, and at the full hour the graybeard. Then the figure of Time steps out and tolls the hour, as two small figures throw open doors in the columns on either side of Washington, and a procession of the Presidents of the United States follows. As the procession moves, Washington rises and salutes each figure as it passes, and it in turn salutes him. They move through the door on the other side, and it is then closed behind them. This procession moves to the accompaniment of music played by the clock itself. The music machinery is capable of playing several airs.

The mechanism also gives the correct movement of the planets around the sun, comprising Mercury, which makes the revolution once in 88 days; Venus, once in 224 days; Mars, once in 686 days; Vesta, once in 1,327 days; Juno, once in 1,593 days; Ceres, once in 1,681 days; Jupiter, once in 4,332 days; Saturn, once in 29 years; Uranus, once in 84 years. As these movements are altogether too slow to be popularly enjoyed, the inventor has added a device by which he can hasten the machinery to show its workings to the public.

There are dials which show the hour, minute, and second in Detroit, Washington, New York, San Francisco, London, Paris, Berlin, Vienna, St. Petersburg, Constantinople, Cairo, Pekin, and Melbourne. The clock also shows the day of the week and month in Detroit, the month and season of the year, the changes of the moon, etc. It is said that Mr. Meier has worked upon this clock nearly 10 years, and for the last four years has devoted his whole time to it.

No doubt this ingenious contrivance may make a curious and possibly a remunerative show; still it would seem that the maker's time, skill, patience, and ingenuity might have been put to better use.

Fireproof Partitions.

A provincial builder, who is not acquainted with London practice, would be surprised to find that the inside partitions of most of the houses in the suburbs are constructed wholly of timber framing, and that the rooms of several stories are divided in this manner. The house, in fact, is nothing more than a shell of brickwork with partitions of wooden studs. How such a mode of construction can be tolerated, in utter contempt of all sanitary precautions, it is not easy to conjecture, but leasehold tenure encourages the system, and surveyors themselves wink at it. Of course this method expedites the erection of houses, and we would not complain if they were filled in with brick-work, or if the joists over the heads of one partition and its lower portion were filled up with incombustible material, so that a fire may have less chance of destroying the partitions above it. In Paris, as every one is probably aware, timber framing is largely resorted to, but the spaces between the uprights or quarters are built up with rubble laid loosely, and then plastered on both sides to fill up all interstices, so that, practically, a fire-resisting partition is the result. Our system of brick-nogging is a somewhat analogous operation, and answers tolerably well if properly done. In France the usual operation is as follows: The framed partition is inclosed on both sides by strong oak batten laths about three inches wide, nailed horizontally about six inches apart; within this the spaces are loosely packed with rough stone, and a strong mortar or plaster of Paris is laid on from both sides at the same time, and pressed through the interstices, so that the rubble becomes embedded in the mortar, consolidating both it and the timber. The surfaces are also covered so that the laths are hidden entirely. In this way a thoroughly concrete partition is formed, more effective and self-supporting than the brick wall; certainly superior and more durable than the English brick-nog partition, and throwing all ordinary plastered partitions into the shade. The brick-nog partition often fails; when the timber decays the bricks are not held together by a strong and independent thickness of plaster. The common hollow plastered partition becomes a nest for mice and a receptacle for vermin and dirt, and when a fire occurs it forms the means of communication, between the floors, and affords a channel for the supply of air. It is strange that although these facts are patent to every practical builder, architects and builders still adhere in an obstinate fashion to the plastered partition and the hollow wooden floor. We have constantly advocated floors, staircases, and landings, particularly, of concreted and incombustible materials, and though the idea is recognized and carried out in all large and important buildings, the ordinary dwelling-houses are allowed to be exempt from such salutary provisions. We called attention some time ago to the value of concrete in wall-building, and suggested the use of light timber lattice framing filled in or compacted with concrete. In a recent number of an American journal we find the same idea has been thrown out, and the writer gives a diagram of the system. The plan we suggest is to form a rough lattice of battens or strips 2½ × 3 in. or 3 × 2 in., with spaces of 4 inches or so apart, to fill up both sides with lime concrete, and to finish the two sides by a coat of plaster of the usual thickness. This construction would be cheaper than framing, and be admirably adapted for internal partitions, and for all temporary buildings.

It is occasionally necessary to divide an upper room into two by a partition, and to relieve the floor of unnecessary weight it becomes necessary to truss the former. Now the lattice partition or wall we have referred to becomes a self-sustaining structure, and may be supported easily by corbels at the ends. We are led, in speaking of weight, to say a word in favor of earthenware pottery as an excellent substitute for rubble or stone concrete. Common agricultural drain pipes of small diameter have been introduced by Mr. Pritchett for this purpose, but any kind of cellular construction may be adopted. It is to be regretted that architects do not adopt more largely the indestructible forms of partitions we have mentioned, and thus render a service to both sanitary construction and sound building. It is not less surprising that such ordinary precautions to insure buildings against fire, such as incasing and rendering solid the floors and partitions, should have escaped the vigilance of those who frame our building enactments.—*London Builder.*

The First Steam Ferry Boat Between New York and Jersey City.

In 1810 arrangements were made with Robert Fulton to construct steam ferry boats, and on the 2d of July, 1812, one named the Jersey was put in operation. The event was celebrated with a grand banquet given by the Jerseymen to the New York Common Council. A correspondent, writing to a newspaper of the time, says:

"I crossed the North River yesterday in the steamboat with my family in my carriage without alighting therefrom, in 14 minutes, with an immense crowd of passengers. On both shores were thousands of people viewing the pleasing object. I cannot express to you how much the public mind appeared to be gratified at finding so large and so safe a machine going so well."

This "large machine" was 80 feet long and 30 feet wide.

A year later the York was put on with the Jersey. They were supposed to run every half hour from sunrise to sunset, but frequently an hour was consumed in making a trip. The following is Fulton's description of the boat:

"She is built of two boats, each 10 feet beam, 80 feet long, and 5 feet deep in the hold, which boats are distant from each other 10 feet, confined by strong transverse beam knees and diagonal traces, forming a deck 30 feet wide and 80 feet long. The propelling water wheel is placed between the boats to prevent it from injury from ice and shocks on entering or approaching the dock. The whole of the machinery being placed between the two boats, leaves 10 feet on the deck of each boat for carriages, horses, cattle, etc.; the other having neat benches and covered with an awning, is for passengers, and there is also a passage and stairway to a neat cabin, which is 50 feet long and 5 feet clear from the floor to the beams, furnished with benches and provided with a stove in winter. Although the two boats and space between them gave 30 feet beam, yet they present sharp bows to the water, and have only the resistance in the water of one boat of 20 feet beam. Both ends being alike, and each having a rudder, she never puts about."

Is it Paying?

When the Fall River mule spinners struck work in the face of conditions which made the failure of the strike highly probable, to say the least, the question was raised, "Will it pay?"

The circumstance that the mill owners were able to fill the places of most of the strikers without much delay, leaving the strikers permanently out in the cold, strongly indicated that the answer to our question would have to be in the negative. Its probability is heightened by press reports to the effect that at a meeting of the directors of one of the mills, August 5, it was voted to discontinue the use of about ten thousand mule spindles—about one-fourth of the whole number used in the mill—and to substitute ring frame spindles therefor.

Correspondence.

The New Optical Delusion.

To the Editor of the Scientific American:

In your last issue you illustrate two optical puzzles. The explanation given below shows clearly, I think, that the phenomena depend on the property of the retina to retain images of objects for a certain interval after the latter are removed. Fig. 1, whilst being steadily gazed at, is to be moved in a small circle without being rotated; in other words, the

Fig.1

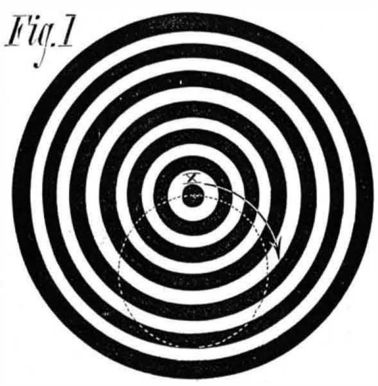
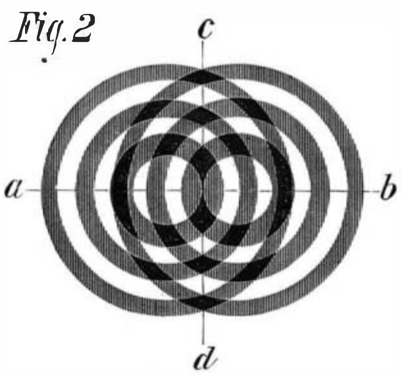


figure is to be moved in the same way that one moves a pail in rinsing it out. The rings will then appear to be rotating about their center in the same direction that one is moving the figure. The center of the circle in Fig. 1 is moved on the line of the dotted circle in the direction shown by the arrow. Suppose, for the sake of explanation, that impressions made on the retina are erased every $\frac{1}{8}$ of a second, and that you move the figure so that its center, *x*, completes the dotted circle once per second.

An impression of the rings is made on the eye; the rings are then moved so that their center completes an arc of, say, $\frac{1}{16}$ of the dotted circle; a second impression is made on the eye; the first impression is not yet erased, as only $\frac{1}{16}$ of a second of time has passed since it was formed, so that the retina has the two images superimposed, as shown in Fig. 2. In this figure the most white space is shown on the line, *a b*, and most black space along *c d*; the rings are moved another arc of $\frac{1}{16}$ of the dotted circle, and a third impression is made on the retina; $\frac{1}{8}$ of a second has now elapsed since the first impression was made, and, agreeably to our supposition, it is now obliterated; the figure on the retina is now as in Fig. 3.

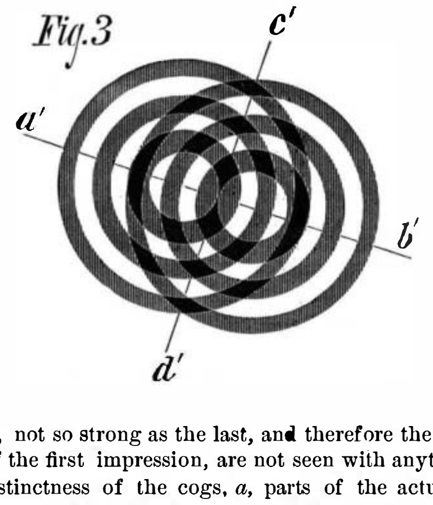
Fig.2



The line of white parts, let it be observed, has moved from its horizontal position, *a b*, Fig. 2, to the inclined position, *a′ b′*, Fig. 3; similarly the line of dark parts has moved from the vertical to the inclining position. The figure is moved another arc of $\frac{1}{16}$; now $\frac{1}{8}$ of a second has elapsed since the second impression was taken, so that it in turn disappears, leaving on the retina the impression like Fig. 4; here the white parts have moved still further from the horizontal, and the dark parts from the vertical position; the two, in fact, are traveling in a circle, and, as will be seen by imagining this series of figures completed to the number of sixteen, the light and shade will complete a circle every time the center of the rings completes one. It is the light and shade moving in a circle that gives the rings the appearance of revolving. Of course if the rings in the figures overlap each other more or less, or, in other words, if the rings are moved in a larger or smaller circle, the configurations sent to the eye are quite different, but in all of them the lights and shadows are following each other around the circle, and always giving the rings the appearance of revolving.

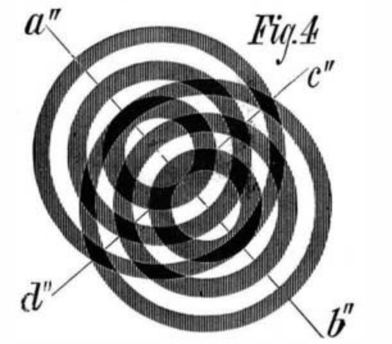
For the cogwheel puzzle, make the same suppositions as for the ring puzzle. An impression of the wheel, Fig. 5, is made on the retina; the wheel is moved an arc of $\frac{1}{16}$ of the dotted circle, when a second impression is made; the first impression still remains, and the eye sees an object like Fig. 6. The actual wheel is represented by the right hand one of the two superimposed figures, the left hand figure representing the first impression. The first impression is, of

Fig.3



course, not so strong as the last, and therefore the cogs at *b*, part of the first impression, are not seen with anything like the distinctness of the cogs, *a*, parts of the actual wheel. The cogs at the right hand side of the right hand wheel (the actual wheel) are not seen as distinctly as those on the left hand side, because they project into a black space; that is, the rays of light coming from these cogs to the eye fall on

Fig.4

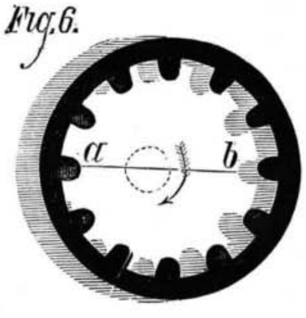


a part of the retina that is occupied by the, as yet unerased, first impression. These cogs, therefore, although on the actual wheel, are vaguely seen; the only cogs seen distinctly, therefore, are those at the left hand side of right hand wheel, at *a*. While the cogs, *a*, are clearly seen, the center of the wheel is moved $\frac{1}{16}$ of the way round the dotted circle in the direction of arrow.

The wheel is thus moved in a downward direction; the cogs, *a*, the only parts distinctly seen, are moved downward.

Fig.5.

Fig.6.



This is remarked by the retina, and then the third impression is taken. The first impression of the wheel (that is, the left hand wheel of Fig. 6) now disappears, and the second impression (that is, the right hand wheel of Fig. 6) becomes pale. By the same reasoning employed with Fig. 6, we find that the only cogs seen distinctly in Fig. 7 are those at *a′*, and that they move in the same direction that cogs, *a*, in Fig. 6, do. Fig. 8 shows a further stage in the reasoning process,

Fig.7

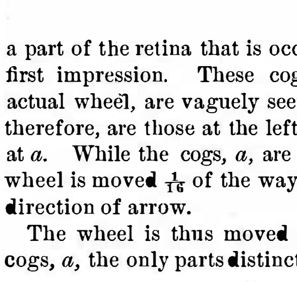
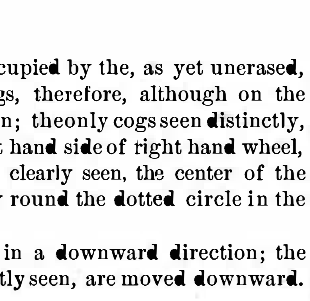


Fig.8.



the prominent cogs being at *a″*, moving also in the same direction as those at *a* in Fig. 6. Now, all the cogs when distinctly seen are moving in a direction contrary to the hands of a watch, thus giving the wheel the appearance of revolving in that direction.

The drawings can be better understood by tracing Figs. 1 and 5 on tissue paper, and then moving the tissue paper over the prints in the prescribed way. A. O.

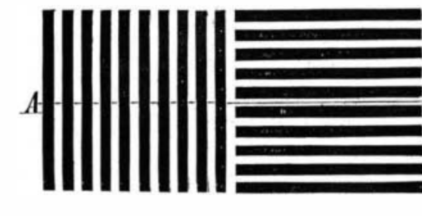
Cincinnati, O., August 3, 1879.

The Optical Delusion—An Explanation.

To the Editor of the Scientific American:

In the last SCIENTIFIC AMERICAN, for the week ending August 9, I saw an article respecting some remarkable optical delusions, and as no explanation has been offered, I should like to state a theory which seems very well to answer the conditions of the question involved.

In Fig. 1 we have two sets of parallel lines, one horizontal, the other perpendicular; if we move the paper backward and forward, along the line, A B, the horizontal lines will remain clear and distinct, while the others will be blurred and indistinct. This principle has been applied in the octagonal figure, in Fig. 2. If the paper is moved to the right and left, the sections, A and E, will be clear, while C and G are dim, because of the lines overlapping each other. If it were possible to move the paper first across G and C, then D and H, E and A, and so on around, A and E would shine out clearly, then B and F, while the sections at right angles to these would be dimmed. In this way two bright sections would be seen to advance from section to section, followed by two dim sections; and if it were not for the sharp angles, which arrest the attention, the whole polygon would seem to revolve. If we increase the number of the sides of the polygon, the angles will be less prominent; and if this process is continued, the polygon will become a circle. When we perform the experiment with the circle we are immediately struck by this shadow, which is seen to cross the circle in the direction of the motion, and when it is whirled around, according to the instructions



given, we can see it very distinctly moving around, and giving the impression that the circle itself is in motion. Another reason suggests the truth of this "shadow theory." If, while the circle is in full motion, the observer throws his eyes out of focus (some have that power), all the rings will become blurred, and the shadow will disappear, causing the circle to stand still. This delusion differs from the other in a very marked degree. In Fig. 6—[as H. W. F.'s Fig. 3 corresponds with A. O.'s Fig. 6, we refer to that figure]—suppose that the paper is moved in the direction of the arrow. As we move it in a curve toward the right, the tooth, *a*, comes into notice; but as the paper retires, in a curve to the left, the tooth is overlapped by the shadow of the ring, which the retina holds. This takes place at each tooth, and the interior of the ring seems to have a retrograde motion. This second delusion is not so easily seen as the first, and I have devised a surer way of seeing it, namely, by making the teeth longer and more numerous, and by filling in the center of the circle with black. In observing this class of phenomena I was much surprised by another curious fact. I was looking at a moving circle, while others on a separate piece of paper lay near me on the table, and, although my

Fig.2.

attention was concentrated on the moving paper, I could see the other circles going at the same rate of speed. As soon as I looked at a stationary object, the other circles stopped.

I afterward tried the same thing in a different form: I placed the point of my pen near one of the circles, and moved it around, watching it closely all the time. I could then see all the circles spin around, as before.

Stamford, Conn., Aug. 4, 1879. H. W. F.

The Aurora.

Professor Trouvelot states that a beautiful auroral display was observed at Cambridge, on the evening of June 17. It began at about 9:15 P. M., and lasted until 11:45 P. M. The illuminated portion of the sky was nearly 20° E. and 15° W. of the magnetic pole, it extended about 40° vertically to the horizon, being highest in the vicinity of the pole. Many whitish and cream colored streamers were seen, especially to the west of the magnetic meridian, the undulations being well marked and numerous, no rosy-hued streams being observed. Along the horizon and densely massed were dark cumuli clouds, through openings of which could be seen the auroral light, showing distinctly that the effect must have taken place in the atmosphere beyond the clouds in question.