

air is forced by the pumps into the outer pipe and compressed therein, so as to apply the compressed air to the surface of the liquid in the outer pipe, and thereby assist in forcing it into the suction pipe. With this apparatus, water can be easily raised to any desired height.

This invention has been patented by Mr. Patrick F. Guthrie, of Franklin, N. J.

POLARIZED LIGHT.

A FEW OBJECTS FOR THE POLARISCOPE.

BY GEO. M. HOPKINS.

II.

Scientific experimentation, though practiced merely as a pastime, can but elevate the thoughts and bring the mind into new channels, thus promoting knowledge to some degree, even though the student proceed no farther than the observation of effects. But once interested in effects, the inquisitive mind cannot rest satisfied without probing for causes.

So far as effects are concerned, the subject under consideration is everything that could be desired, and no great scientific knowledge or high manipulative skill is required to secure splendid results.

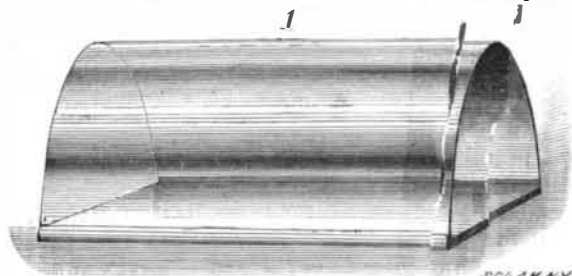
In a former article, the writer mentioned a few ways in which light could be polarized and analyzed, and gave hints as to some objects which might be viewed by polarized light.

A few simple objects easily prepared from mica are here shown. The material is of course procurable everywhere, and it requires little more than a glance at the engravings to enable any one to prepare the objects. Doubtless many other forms than those illustrated will suggest themselves to the student.

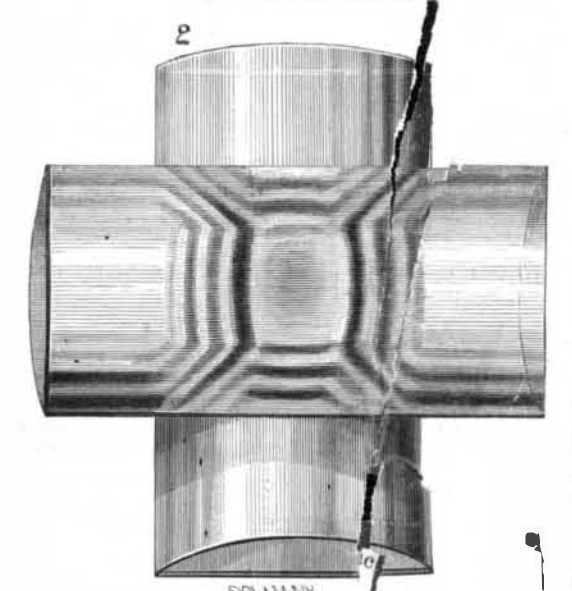
The simplest form is shown in Fig. 1. It consists of a thin plate of mica bowed into approximately cylindrical form, and secured by its edges to a glass plate by means of narrow strips of gummed paper. The size is immaterial; the glass plate may be 1 1/2 inches wide by 3 inches long. This object exhibits fine bands of prismatic color when viewed in the polariscope. Two such semi-cylinders, when crossed, exhibit the intricate figure shown in Fig. 2, with all the splendid colors of the spectrum.

The object shown in Fig. 3 is formed of a disk of mica having a sector cut out and the radial edges overlapped, forming a low cone. The overlapping edges are best fastened together by small tin clips inserted in holes in the mica and bent downward on opposite sides. The clips are not noticeable, and are efficient in holding the edges together. Cement will not answer the purpose, as it adheres to the surface only, and it must be remembered that mica splits almost indefinitely.

The cone thus made has the appearance in the polariscope of a huge circular crystal of salicite. The colors of the cone may be heightened by mounting it on a sheet of mica, as shown in the engraving. The cone is first placed in the polariscope, with the polarizer and analyzer crossed, and turned until it appears brightest, when the lower edge is marked. The mica sheet is then placed in a similar way in the polariscope,



MICA SEMI-CYLINDER.



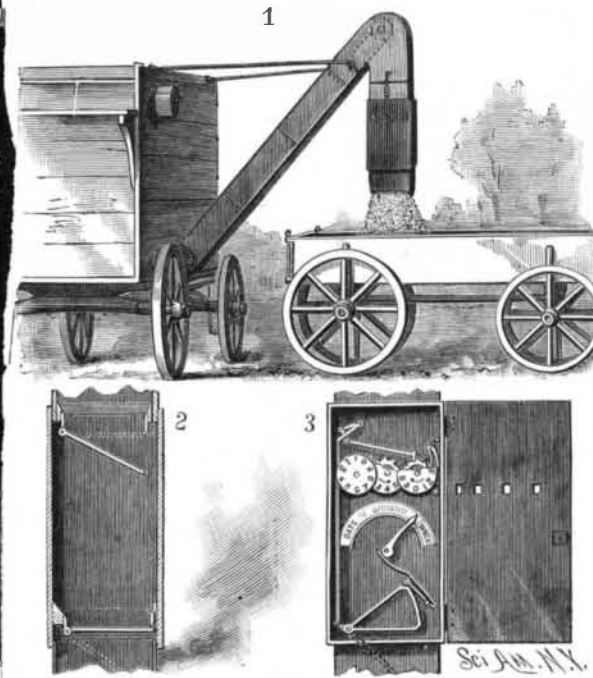
MICA SEMI-CYLINDER CROSSED.

and turned and marked. The object is then cemented by its edges to the sheet, the marked edges of both members being arranged in the same direction.

The Maltese cross shown in Fig. 4 is revoluble. The first step toward the preparation of this object is to

secure a pin head downward on a square of glass with sealing wax or other cement. A small paper tube which will fit the pin loosely is then made, and a little head of sealing wax is formed around the tube near one end. A piece of mica is selected which exhibits fine colors in the polariscope, and four equilateral triangles are cut from it, either with their corresponding sides cut upon the same base line, or with one side of each cut from one side of a square, or they may be cut and mounted haphazard.

To the apex of the angle designed for attachment to



GABBEY'S AUTOMATIC GRAIN WEIGHING AND REGISTERING MACHINE.

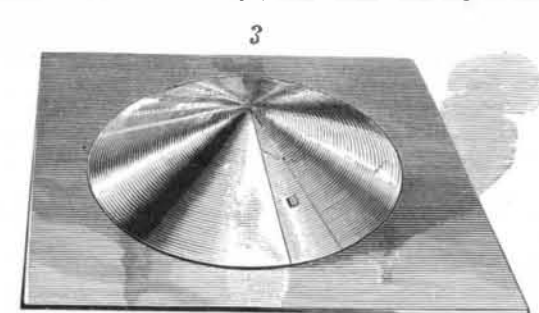
the paper tube a small drop of sealing wax is applied, and with the tube on the pin the first triangle is attached by holding it in the required position by means of a pair of tweezers, and then fusing the wax on the mica and that on the tube simultaneously by means of a small heated wire, such as a knitting needle.

The other members are placed and secured in a similar way, care being taken to arrange the triangles symmetrically, and at a slight angle with the plane of rotation of the object, as shown in the engraving.

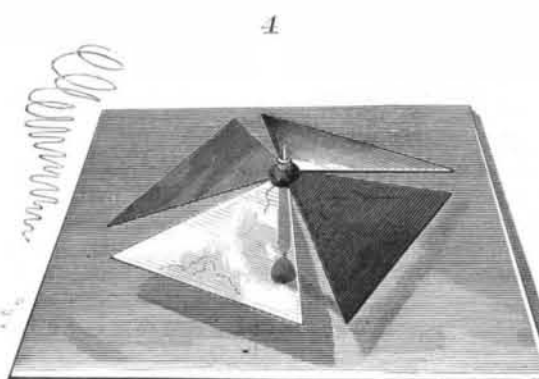
The wheel shown in Fig. 5 and the star shown in Fig. 6 are prepared in a similar way. The sections of the wheel are cut from a circular piece of mica, and cemented in place on the paper tube after the fashion of a propeller wheel or wind wheel.

Each ray of the star is made of two scalene triangles of mica oppositely arranged with respect to each other, and inclined in opposite directions, the longer and shorter sides of adjacent triangles being fastened at the periphery of the star by a minute drop of sealing wax.

In Fig. 6 beside the star are shown two somewhat similar objects, formed of strips of mica, pivoted together on a small rivet, one object having the pivot in the center of the strips, the other having it at the



MICA CONE.



MICA CROSS.

end, giving the object an appearance similar to that of a folding fan.

Any of these objects may be viewed by means of the black glass polarizer in connection with either of the forms of analyzer described in the former article, or in

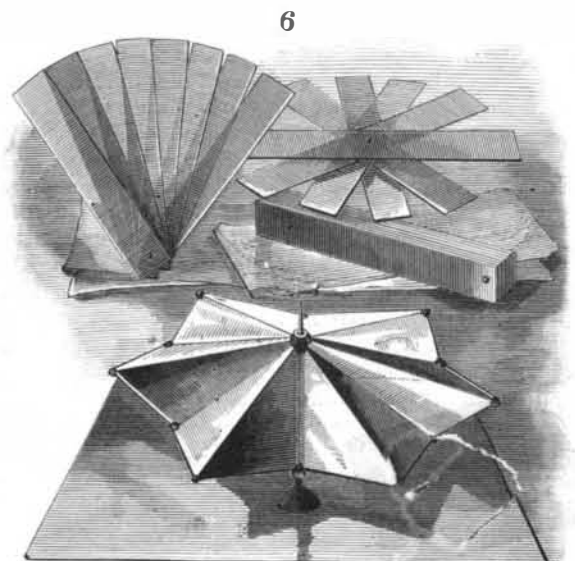
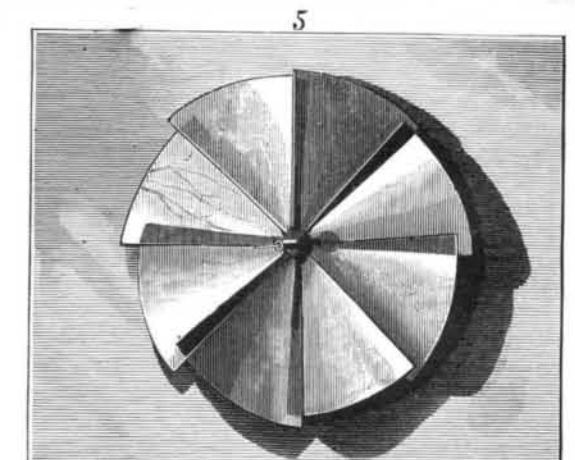
the simple form of Norremberg doubler. These objects are also very satisfactory when projected on the screen.

AUTOMATIC GRAIN WEIGHING AND REGISTERING MACHINE.

This machine is designed especially for attachment to the elevator spouts of grain separators and corn shellers. The case is made in three parts—a large central part and two smaller end ones. In the upper and lower ends of the central part are placed plate valves. The upper valve closes against the sharp beveled edge of a metal strap designed to cut off straws, weeds, and other substances that would prevent the valve from closing tightly. The lower valve closes against the lower edge of a metal strap, the upper parts of which are bent upward and outward and are attached to the inner surface of the end of the central part. The valves are so connected that one will always be closed when the other is open. Attached to the shaft carrying the upper valve is an arm pivoted to the rear end of a pawl operating numbered wheels (Fig. 3). With this construction, as the valve is lowered to admit grain to the central part of the case, which is designed to contain half a bushel, the pawl is drawn back, and when the valve is raised to stop the inflow of grain, the pawl is pushed forward to make the numbered disks register the amount. At the proper time the numeral 1/2 can be seen through one of the holes in the door covering the register. To the shaft of the lower valve is rigidly attached the acute angle of a triangular arm, whose outer angles are cut off to form seats for a friction roller pivoted to the end of the short arm of a spring attached to the frame.

The long arm of the spring rests against a pivoted eccentric provided with an index finger, which points to a scale marked with the names of the different grains to be cleaned and weighed, and the number of pounds of each to a bushel. The tension of the spring is regulated by adjusting the finger so that the spring will hold the arm with sufficient force to keep the valve closed until the weight of half a bushel of grain has been received upon it, when it will open to discharge the grain, and the upper valve will close to prevent any grain from entering the middle part of the case while the lower valve is open. The case is suspended from the spout of the elevator (Fig. 1) by spring hooks; the grain can be discharged in bulk into a wagon or into sacks. This invention has been patented by Mr. Robert S. Gabbey, of Rossville, Kansas.

SOME one suggests that trees after transplanting may be kept alive by burying a row of flower pots filled with water around the body and over the roots of the tree.



STAR FAN AND CROSSED BARS OF MICA.

The moisture which will percolate through the bottom and sides of the pots will be so gradual that two-gallon ones will hold enough so as not to require refilling for some time, and the roots will be kept moist till such time as they begin to sprout afresh.

A Promise of Better Things.

There are distinct indications of a reaction from the intensity of the labor disturbances. No doubt, this movement toward peace and quietness received its impulse from the murderous riots in Chicago. Reasonable workmen, who had yielded to excited feelings, saw in those events a plain indication of the direction in which they were drifting, and they shrank from the prospect. Evil not infrequently produces good, and it is probably not an unfortunate thing that the agitation of the laborers so soon culminated in such a manifestation of fiendish outlawry. If we must have sores upon the body politic, the quicker they come to a head and break the better.

It looks now as if the differences between employers and employed would have speedy adjustment, and that matters will settle down in quietness, with a promise of a strong stimulation of business. Commerce of all kinds has been dammed up for several months by the troubles, and the accumulation will sweep swiftly onward as the obstructions are removed. There has been a clear gain to all hands in two directions. First, the sensible men in the labor organizations have more control than they had three months ago. Second, manufacturers are better organized to deal with labor questions, to help each other to resist oppression, and, perhaps, to help wage earners as well as themselves by checking reckless competition.

That there will be any general reduction of the period of labor to eight hours a day appears unlikely. The obstacle to the success of this project is not so much the opposition of employers as the resolute antagonism of the great mass of workingmen. There can be no doubt that these are far too wise not to perceive that the proposed restriction simply involves a plan for depriving them of the privilege of selling to best advantage the only thing they have to sell, namely, their labor. This feeling is particularly strong among skilled workmen who are frugal as well as industrious. Many of them would much prefer to an eight hour scheme an arrangement which would secure to them frequent opportunity to earn extra pay for working overtime. It is not too harsh to assert that the bulk of the men who are eager to labor for eight hours only are just the kind of men to whom the two hours thus gained would be more hurtful than profitable. There is no greater nonsense than that contained in the theory that the two hours are wanted by men for the purpose of "improving their minds." Anybody who lives in a manufacturing town is aware that the number of workmen who care to improve their minds in any way is very small indeed. The men who have such ambition are almost invariably the very men who will vote against an eight hour law if the question should be carried to the polls. This is an assertion the proof of which is difficult, but we appeal fearlessly to our workingmen readers to declare if it is not true.

We may go a little further. The curse of the workman in this country is the rum traffic. It is this that robs him of most of his wages, and in many cases it is in the taverns that he spends much of his spare time. It may be feared that the two hours proposed to be gained, by reducing the hours of labor, would be spent in the same places, and with them much more of the money earned. It will be remembered that all the Chicago socialists were associated with the beer saloons, either as owners or frequenters, and their places were the haunts and the rallying points of the rioters. Rum sellers wax fat upon strikes and disturbances, and they form the only class that would make a clear money gain by cutting down the hours of labor. These are hard things to say, but they are true, and they ought to be said. The money squandered in this infernal business last year would have given us good trade and workingmen good wages right along. It is not the tyranny of employers that keeps men poor. It is the rapacity and devilish greed of the liquor dealer. The fact is demonstrable, not only that wages are far higher here than in other countries, but that they are far higher here now than they ever were before, and meantime living is cheaper. The constant tendency, moreover, is to still larger wages. Everything in this country tends to improve the condition and the chances of the laborer. If he falls behind in the race, when he has health and strength, the fault is almost certainly his. No organization can help him if he squanders his money and plays the fool. He will be beaten out of sight by the man who saves his earnings and obeys the requirements of reason and sense.—*Textile Record.*

Water Tests.

Test for Hard & Soft Water.—Dissolve a small quantity of good soap in alcohol. Let a few drops fall into a glass of water. If it turns milky, it is hard; if not, it is soft.

Test for Earthy Matters or Alkali.—Take litmus paper dipped in vinegar, and if, on immersion, the paper returns to its true shade, the water does not contain earthy matter or alkali. If a few drops of sirup be added to a water containing an earthy matter, it will turn green.

Test for Carbonic Acid.—Take equal parts of water

and clear lime water. If combined or free carbonic acid is present, a precipitate is seen, to which, if a few drops of muriatic acid be added, an effervescence commences.

Test for Magnesia.—Boil the water to a twentieth part of its weight, and then drop a few grains of neutral carbonate of ammonia into a glass of it, and a few drops of phosphate of soda. If magnesia be present, it will fall to the bottom.

Test for Iron.—Boil a little nut gall, and add to the water. If it turns gray or slate, black iron is present. 2. Dissolve a little prussiate of potash, and if iron be present, it will turn blue.

Test for Lime.—Into a glass of the water put two drops of oxalic acid, and blow upon it; if it gets milky, lime is present.

Test for Acid.—Take a piece of litmus paper. If it turns red, there must be acid. If it precipitates on adding lime water, it is carbonic acid. If a blue sugar paper is turned red, it is a mineral acid.

THE MINNEAPOLIS INDUSTRIAL EXPOSITION.

The people of the beautiful and enterprising city of Minneapolis, Minn., are actively engaged in arranging for their grand industrial exposition, which is to be opened on the 23d of August next. The financial department is strong and substantial, showing admirable management. The stockholders are about 2,500 in number.

The exposition has obtained, by donation of citizens, a site of 5½ acres of ground in the heart of the city, a

**THE GREAT EXHIBITION BUILDING MINNEAPOLIS.**

central and commanding position overlooking the Mississippi River and Falls of St. Anthony. The site alone is worth \$200,000. Including the value of the ground, the Exposition Association has a capital of \$500,000, and will open its fine building free from debt.

The exposition building is 336×356 ft. in ground dimensions and 80 ft. high. The height to the top of the dome is 144 ft.; to the top of the main pavilion, 128 ft.; of smaller pavilions, 112 ft.; and to top of mast of great tower, 260 ft. The tower is 34½ ft. square at the base, and has two balconies, one at a height of 160 ft. and one 200 ft. high. The main entrance is 32×64 ft., the size of tower windows 14×80 ft., and of other windows 18×30 ft.

The floor space amounts to 7½ acres, which exceeds that of the Chicago Exposition building by 100,000 ft. The walls are of brick and Mankato cream colored stone. The interior will be neatly finished in a fire-proof manner, and so arranged that when occasion requires it will form a single auditorium, with accommodations for 40,000 people. A spacious annex will contain the art exhibit. Isaac Hodgson & Son, of Minneapolis, are the architects of the building.

The exposition has been organized as a permanent institution. The officers and directors are all prominent citizens and business men of responsible character. Hon. W. D. Washburn is President; S. C. Gale, Vice-President; H. G. Harrison, Treasurer; W. G. Byron, Secretary; Col. L. B. Hibbard, General Manager. The exposition will be open for six weeks, from August 23 to October 3.

Leading among the industries of the city is the manufacture of flour. Minneapolis flour mills have a world-wide reputation. They are 22 in number, and furnish direct employment to 1,400 men. The value of buildings and machinery amounts to over \$4,000,000, and the operation of the business involves the investment of about \$8,000,000. The products for 1885 were worth \$34,000,000. The mills have an aggregate daily manufacturing capacity of 35,000 barrels of flour.

Second only in importance to the flour industry is the manufacture of lumber. The 21 sawmills last year cut 316,167,166 feet of lumber, 72,202,550 lath, and 101,896,250 shingles. The total cut for the past sixteen years amounts to over 3,000,000,000 feet, sufficient material for the construction of houses enough for a city of 1,000,000 inhabitants. In one day the mills can cut 2,600,000 feet of lumber.

Besides the State University, there are 31 public school buildings in the city. The University main building was erected about twenty years ago. Several others have since been added, and one structure is now building. Of the city school buildings, the High School is the finest. It was built eight years ago, at an expense of \$100,000. Three school buildings are to be erected this season. The schools have now 14,000 pupils enrolled, and the school population is rapidly increasing.

Lake Minnetonka, the leading lake resort of the Northwest, is practically a suburb of Minneapolis, being at a distance of only thirty minutes' ride by railroad. It is a lake of 15,000 acres, dotted with islands, and has 200 miles of shore. It is surrounded by heavy woods, and forms a charming retreat for summer tourists from all parts of the country. Palatial hotels and steamers have been provided.

Within the city limits are not less than ten lakes, three of which are each nearly a mile in diameter. In connection with these, a comprehensive system of public parks and boulevards is being arranged.

The world-famous Falls of Minnehaha are less than two miles from the city limits, and a few miles further below, at the junction of the Mississippi and Minnesota rivers, is Fort Snelling, a historic and picturesque place. The city territory of Minneapolis has an area of over 30 square miles, and touches, at one point, the limits of the city of St. Paul.

A detailed description of the city's many interesting features does not come within the scope of this article, but the following statement of the business and improvement record for 1885 will give some idea of the trading activity and progress: Assessed valuation, \$8,958; new buildings erected, 3,605, costing \$1,909; realty sales, 9,119 in number and \$22,034,230 amount; jobbing trade, \$77,060,700; manufacturing sales, \$63,625,000; bushels of wheat received, 32,000,000; street railway passengers carried, 9,388,017; banking capital, \$5,500,000, since increased to \$6,950,000; public improvements, \$500,000.

Despite a share of the prevalent industrial depression caused by labor troubles, building improvements in Minneapolis are being conducted upon a very extensive scale. During the past six months, fully 2,300 new buildings have been commenced. On a conservative preliminary estimate, these will cost \$6,000,000. Before the close of the year as many more building improvements will probably be inaugurated. Such rapid growth necessitates corresponding activity in the realty market. Recorded sales of real estate for the past six months have been about 6,000 in number, involving an aggregate consideration of \$14,500,000. This amount will doubtless be more than doubled before the close of the year. These are actual facts that indicate the great vigor of this young metropolis.

Old Roman Lead.

Recently, while the excavation for the new gas holder tank at the Chester, Eng., gas works were in progress, a pig of Roman lead, in excellent preservation, was discovered at a depth of 23 feet below the ground. It bears on its upper surface the following inscription: MP VESPAVG V T IMP III.; while on the side is inscribed DE. CEANGI. Its weight is 192 lb. The translation of the inscription is that it was a pig of lead, attribute to the Roman power from the tribe in North Wales commonly known as the Ceangi. The inscription tells us that it was cast during the fifth consulate of the Emperor Vespasian and the third consulate of Titus.

This synchronizes with our date A. D. 74; and consequently it may be assumed that the pig of lead has been lying where it was found some 1,800 years. The ground where it was discovered was gravel and marl, which evidently formed part of the old river bed. Close to it was found a human skull, and another was discovered about 15 feet away. The skulls and bones of horses and ullocks were also met with in or about the same place. The foreman of the works (Mr. J. Fish) at once called the attention of the company's engineer (Mr. W. Stevenson, Assoc. M. Inst. C. E.) to the discovery, and the treasure trove was placed in safe keeping. At the ground has to be excavated another three feet, further discoveries may be expected.

Progress of the United States.

In "Triumph of Democracy," a recent work by Mr. Andrew Carnegie, a Scotchman by birth, and now an American manufacturer, the author gives many interesting facts showing the progress and prosperity of his adopted country. He states that during last year 74,000 more tons of Bessemer steel were produced in the United States than in Great Britain; that more yards of carpet are made each year in Philadelphia and the vicinity than in all England, Wales, and Scotland; that the school libraries alone in this country contain 12,000,000 more books than all the public libraries of Europe combined; and that all the State and city debt of the Union added together, rating them according to valuation of property, do not amount to one-fifth the city debt of Manchester, Eng., or to one-tenth the debt of Birmingham.