HARVARD OBSERVATORY AND THE HENRY DRAPER MEMORIAL.*

II.

We have seen how the general photographic operations in photographing stellar spectra are carried on. One detail of work affecting the test of the plates remains yet to be described. Every plate before exposure in the photographic telescope receives the action of light over a small square area of a beam, which is impressed upon it, with definite exposure. The apparatus for thus standardizing the sensitiveness of plates is illustrated here. Back of a wall or partition a lamp is placed. Directly in front of the lamp, and a little above its wick, a small square hole is cut through the partition. On the other side of the partition, which forms a portion of its wall, is a dark room. Within this room a pendulum is hung with its point of sus pension above the square aperture. The pendulum has a period of oscillation of one second, from end to end of its arc. A catch is arranged to hold it well to one side. Thus held it completely covers the little square opening. If released it swings away, and just as it passes the central line exposes the opening. It then continues its course to the end and begins to return, the hole being open all this time. As it reaches the center of its arc on the return swing, it again shuts off the light. The bob carries a screen of such shape as to effect this operation. The opening is shielded during one-half of a double oscillation and exposed during the other half. Half of a double oscillation gives an exposure, therefore, of one second.

Every plate before use is tested in this apparatus. The lamp, which is treated as a standard source of light, is lighted and accurately adjusted as regards height and distance from the aperture. The pendulum is held back in its catch, covering the hole so that no light passes through.

A plate is set up in a support opposite the opening and about three feet distant. The pendulum is now released; it swings across and back as just described, and on its return is caught automatically. The plate is removed and another put in its place and the operation repeated for it. After this they are ready for exposure in the telescopes of the observatory. When they have been exposed they are developed, and then only simultaneously with the spectra the image of the spot of light appears.

Every plate thus bears upon it near a corner the signature of one second's exposure to a standard source of light. Those of our readers who are familiar with gas photometry will recognize a modification of the Methven screen in this lamp and opening. On the first page of this paper we illustrate

VISUAL AND PHOTOGRAPHIC COMBINATIONS OF LENSES.

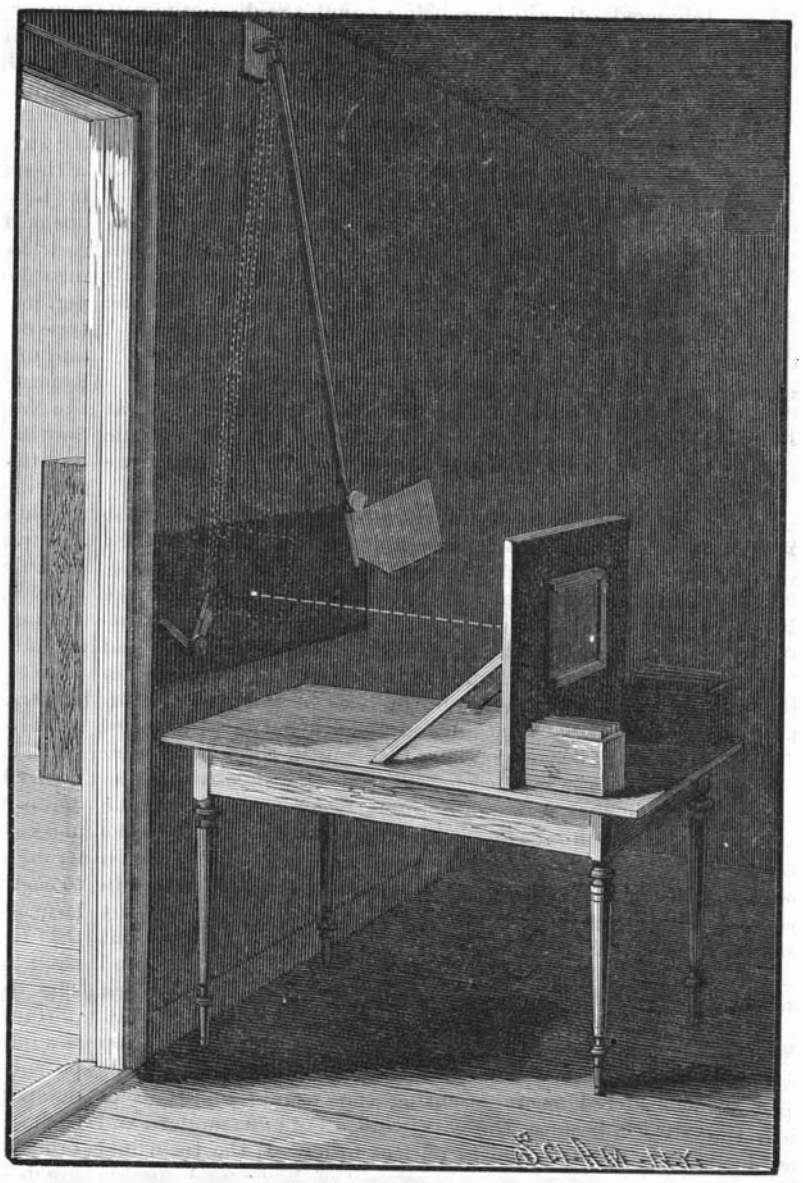
the 11 inch telescope. It is now used altogether with the 8 inch Voightlander shown in a recent issue, in carrying on the work of the Draper memorial. Its objective was made by Clark, and is a purely visual one. To make it available for stellar photography, a supplementary photographic lens was made, also by Clark. This is placed in front of the regular objectives, and corrects them for the actinic focus.

The arrangement is similar to the one adopted for the Lick telescope. The visual objective for this great telescope has been made and put in place in the observatory in California. The photographic lens is yet in the manufacturer's hands. An extra cost of over ten thousand dollars has to be incurred in supplying it.

The point is thus dwelt on because the Clark Brothers are at present working out a combination by which the regular members of a visual objective can be used for celestial photography. The crown glass lens is ground more convex on one side than on the other. The flatter side is in contact with the flint glass lens when the combination is arranged for visual use. For photography, the glasses are separated, and the crown glass lens is reversed. Thus two lenses of the regular achromatic combination are made to do the work of three. Had this combination been invented in time to have been applied to the Lick objective, the expense of the photographic lens would have been avoided. The new combination was devised by Prof. Pickering and the Clark Brothers.

The eleven inch telescope is provided with a battery of four prisms. Each member is mounted in a brass frame, which slides into place in the large box like a drawer. When all are combined, the box and battery of glasses weighs one hundred pounds. It is a foot cube in size. It is carried by the telescope in front of the objective.

At its other end the telescope is provided, as usual, with a finder. Owing to the refraction of the prisms, the field of the glass is far from its normal one, and the finder is set at an angle with the main axis equal to the angle of refraction of the prism. The tube is mounted in the ordinary eccentric way. It is so perfectly counterpoised that it can be pulled about by the hand ropes with ease. It is driven by clockwork controlled by electric impulses from a pendulum in the laboratory building. The pendulum, in its swing, sweeps, with a point of platinum below its bob, through a globule of mercury, completing at each swing an electric circuit. The closing of this circuit works an escapement on the base of the telescope. Without this escapement the clockwork would drive the telescope a little too fast, as it is controlled and, to a certain extent, governed by a vane wheel. The electric escapement has only to impart the last or residual correction to its movement. The building containing the telescope is a simple wooden structure, with dome, which rotates on cast iron rollers. One person can readily turn the dome by direct pushing against the handles, no tackle or gear being required. The two instruments described are soon to be supplemented by some of Dr. Henry Draper's reflectors, a twenty-eight and a fifteen inch one. The latter is one of the most perfect mirrors constructed by the great astronomer. With it he took his photograph of the moon. When these are mounted, it is intended to keep at least three telescopes at work all night.



APPARATUS FOR STANDARDIZING SENSITIVE PLATES.

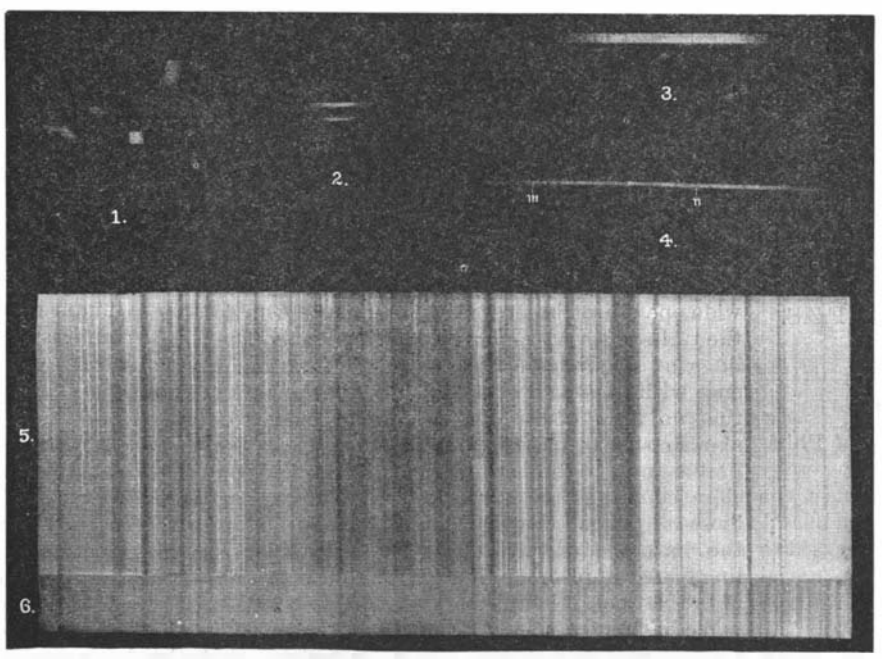
For the spectra of bright stars near the equator, an exposure of five minutes is given. For the spectra of faint stars, an hour is the period. Each plate contains a number of spectra. In one case over three hundred appeared. The telescope is made to trail the spectra to a width of one millimeter (1-25 inch) as near as may be.

If the work progresses as well as it promises, most important results may be looked for. Thus the motion of stars directly toward or away from the observer it is hoped may be determined with great exactness by the displacement of the lines of their spectra. To carry out such work, a standard is needed to refer the lines to. The ordinary spectrum is of course inapplicable. Quite good success has been attained in using an absorption spectrum. A tank with glass sides, and containing hyponitric and other absorbent fumes, has been tried. This is placed in front of the plate, so that the spectra have to pass through it. It absorbs certain known constituents, producing lines corresponding to known wave lengths, to which the natural lines of the star may be referred. It is questionable if a greater triumph in astronomy has ever been achieved than the determination of the motion of a star directly toward or away from us; and by photographic methods it is evident that a greater degree of accuracy may be introduced into the solution of this problem. The identification of the lines with those of terrestrial substances is also one of the lines of work mapped out for the future, and the grouping of stars of identical or similar spectra.

The first effort at celestial photography is stated to have been made at Harvard College observatory on July 17, 1850. Mr. T. A. Whipple, directed by Prof. W. C. Bond, exposed a daguerreotype plate in the focus of the fifteen inch equatorial, which was kept pointed upon α Lyræ. A very good image was thus obtained. The double star α Geminorum gave an elongated image, evidently due to its two components. It was found that such bright stars could be made to give faint images, but no success followed when fainter stars were the objects. Even of Polaris no image could be obtained with any exposure. The experiments were at last discontinued. Seven years later they were resumed. Collodion plates had now been introduced, which far exceeded in sensitiveness the old daguerreotype. A short exposure of eight seconds or less sufficed for a great many stars. The driving mechanism of the telescope had also been improved. Prof. Bond's account of these investigations is placed among the classics of astronomy. The work was continued by Rutherfurd and other astronomers, the work increasing in perfection as the photographic processes improved.

Dr. Henry Draper began to use dry plates. On March 11, 1881, he reached a critical point. He obtained photographically the image of a star so faint as to be barely discernible by the eye through the same telescope. This marked the point where the plate compared in sensitiveness with the retina. Even at the present day it is doubtful if the dry plate can capture more stars than can be seen by the eye. Owing to difference of color, it is possible that some stars invisible through a specified telescope can be photographed through it, while others visible through the same glass may not affect the plate. Mr. A. A. Common, in his photograph of the nebula in Orion, is believed to have obtained images of stars invisible through the telescope with which they were taken.

In 1863 Dr. Huggins obtained a photographic image of the spectrum of Sirius. It was merely of interest as



PROGRESS IN STAR SPECTROSCOPY.

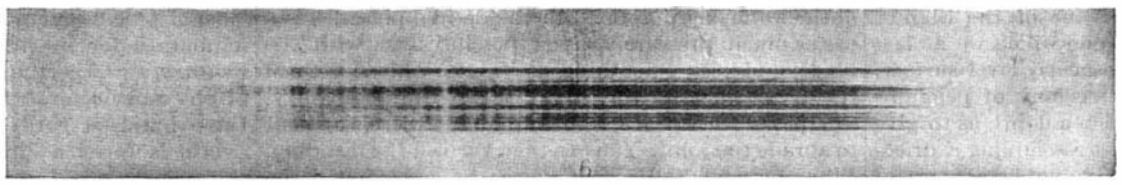
* Continued from SCIENTIFIC AMERICAN, October 15, 1887.

a curiosity, being valueless on account of its poor definition. No lines could be observed in it. In 1872 Dr. Draper made the first successful photograph of a spectrum of a star. It was of Vega, and showed four lines. He and Dr. Huggins continued the work. Their method was to concentrate the light by a telescope upon the slit of a spectroscope, the slit lying in the focus of the objective. This was a very troublesome operation, and lacked the simplicity of the present method. Progress was slow until the introduction of dry plates. The old collodion plates could only be exposed a short time because the film dried, and even then were less sensitive than the dry plate. In 1882, shortly after the era of dry plate photography, Dr. Draper died. Since that period the progress has been very great. By the use of the great battery of prisms, and the methods of trailing and enlarging that we described in a recent issue, the spectra have grown from little rectangles less than an inch in length, with barely discernible bars, to wide bands eight or nine inches long, and full of characteristic lines.

In the plate the recent progress of the science is shown. The scale is a diminished one. Fig. 1 represents the work of the year 1882. Five stars have their spectra in the little spot, the telescope having been directed upon them in s iccession with five minute exposures. Fig. 2 shows a modern spectrum of a bright star, with an adjacent one of a fifth magnitude star, as taken with the eight inch Voightlander objective. Fig. 3 is the spectrum of α Lyræ taken with the eleven inch objective and fifty-nine minutes' exposure through two prisms. Fig. 4, the spectrum of β Geminorum, was taken with fifty minutes' exposure through the same instrument, and with four prisms. Fig. 5 shows the enlargements of the same spectra between the points marked *m* and *n*. This is only a little over one-half the spectrum. Below it Fig. 6 shows an enlargement of the spectrum of the samestar from a less perfect photograph.

In the other plates the different phases of the work as described in the first article of this series are given. The horizontal streaks disposed of by the cylindrical lens, and the inclination of the lines of the spectra, can here be seen. Examples of the finished work are also given. By cutting out from the magnified spectra a band at a proper angle, the lines are brought into a perpendicular position.

These two articles can give but an imperfect idea of the work of the Henry Draper Memorial. By the liberality of Mrs. Draper, every clerical assistance is furnished that can forward the work. A large force of computers is at work reducing the observations, and the near future will witness the promulgation of a most important body of scientific data. We cannot close without expressing our thanks to Professor E. C. Pickering and Mr. W. P. Gerrish. To the monographs of the first named gentleman and to the personal attentions and explanations of the latter, and to the use of plates and prints furnished by the observatory, we are indebted for whatever of value we have succeeded in presenting our readers.

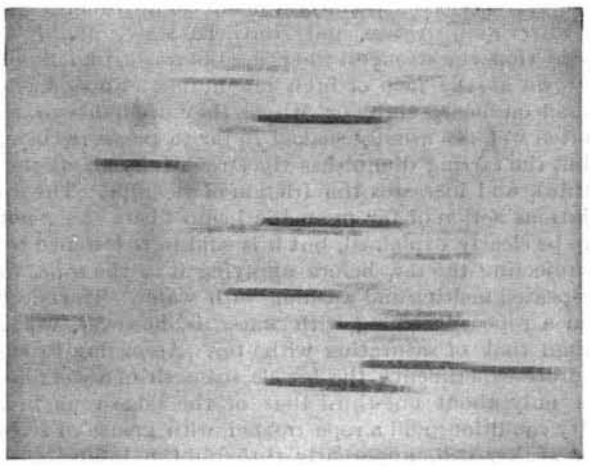


STAR SPECTRUM SHOWING HORIZONTAL STREAKS.

Fast Stenographic Writing.

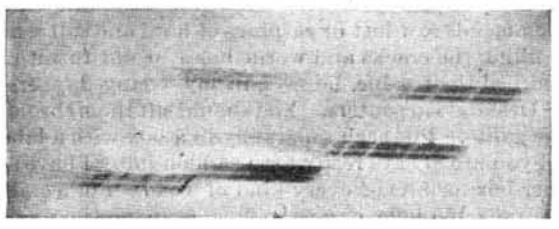
It is believed that stenographers in this section, as well as those having occasion to employ them, will be interested in the result of a test as to the possible speed of stenography, which took place at the convention of the New York State Stenographers' Association, at Alexandria Bay, N. Y., August 16 and 17, at which the writer was present. The test was in consequence of an offer of a $50 gold medal to any stenographer who should write 250 words a minute for five consecutive minutes, from reading of new matter, and should read it back correctly. The offer was made by Mr. A. P. Little, of Rochester, a member of the N. Y. S. S. A., and was made by reason of statements which have appeared from time to time regarding phenomenal rates of speed attained by Western stenographers.

Mr. Little's challenge was a very sweeping one, and the prize offered, together with the renown to be gained by the person who should carry it off, was calculated to attract to the contest each stenographer who believed that he could perform the feat. In fact, during the year that the offer has been before the stenographic public, Mr. Little has received letters, for the most part from Western stenographers, deriding him, in a measure, for his disbelief in the possibility of performing the feat, and, by implication at least, claiming superiority for the Western reporters over those of the East, generally closing by stating that unless sickness or death should intervene, the writer or one of his friends would be on hand and carry off the prize. The fact that but two stenographers presented themselves as candidates for gold and laurels—viz., Mr. Fred. Irland, of Detroit,



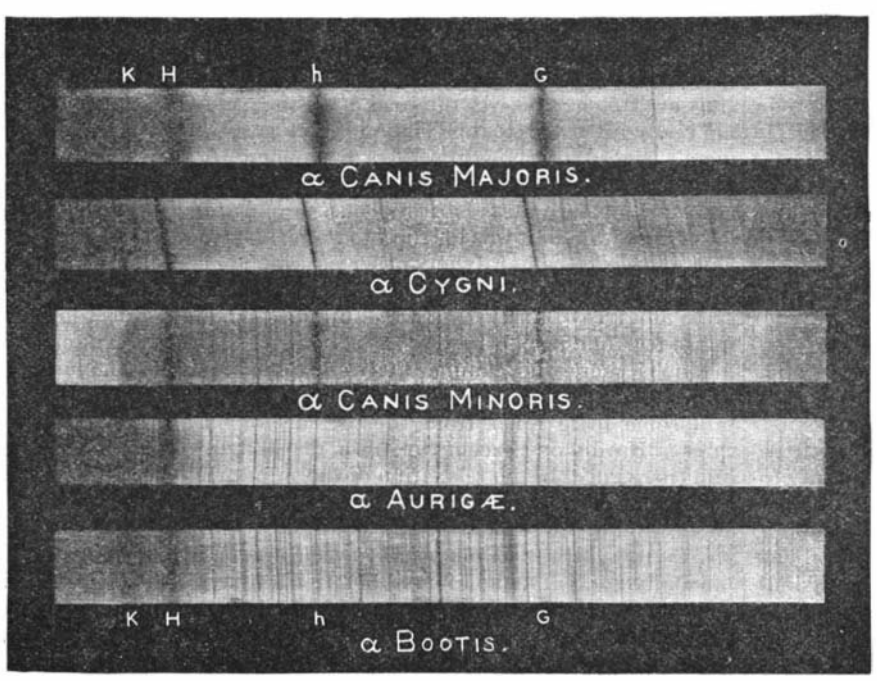
PHOTOGRAPHIC PLATE OF STAR SPECTRA AS DEVELOPED AFTER EXPOSURE IN TELESCOPE.

and Mr. Isaac L. Dement, of Chicago—would seem to indicate that the past year has been an unhealthy one among fast stenographers. Of Messrs. Irland and Dement only the latter made the trial, the result showing that Mr. Little knew what he was talking about. Mr.



STAR SPECTRA SHOWING INCLINATION OF BARS.

Irland read to Mr. Dement from a printed copy of notes of testimony supplied by Mr. Little; a committee, consisting of Mr. Bishop and Mr. Thornton, members of the association, and Mr. Easton, a stenographer practicing in Washington, making the selections of matter. Mr. Dement tried three times to accomplish his object, but failed, although the results indicated that he was a first-class stenographer, and that possibly he might have met with better success in a trial less calculated to upset his nerves, if, indeed, he has any, than before an assembly composed of 40 or 50 competent stenographers, three of whom held watches in their hands as a committee, the majority of the remainder keeping time and watching the lightning-like movements of his pencil for their own satisfaction. On one trial Mr.



STAR SPECTRA

Dement wrote after a reading 1,292 words in five minutes, an average of 258 2-5 words per minute, but failed to get all of it, though the committee reported, as the writer remembers it, that he made but three minor errors and one flagrant one. The other tests were failures, one by reason of Mr. Irland making a miscalculation, and reading but 1,200 words in the five minutes, it not being known how near Mr. Dement came to writing the 1,200 words, whether he did it or not.

One of the elements upon which Mr. Little relied was the extreme difficulty of reading or speaking 1,250 words correctly in five minutes. On the whole, Mr. Little was proved to have a fairer idea of what could be done in writing shorthand than he was given credit for, while Mr. Dement proved himself to be entitled to be rated among the first-class stenographers of the country, of whom the statement has been made, and not gainsaid, that there are not more than forty in the United States. *Boston Herald.*

Pine-Needle Baths.

Under the name of "Fichten-Nadel-Bäder," the balsamic and tonic properties of the fir-needles are largely taken advantage of in Germany, thanks to a new preparation which enables them to be easily used for baths. These baths are now being prescribed for children and adults, and are found to be truly efficacious in rheumatic complaints, gout, certain skin affections, etc. This new preparation is in the form of a powder, which is directly used for the baths by being put into lukewarm water and allowed to digest in the liquid for a few minutes, in order that the balsamic virtues of the needle-leaves may be drawn out. The same product is likewise used for fumigations in affections of the chest, etc., or as an antiseptic, for which purpose a little of the powder is placed upon a heated iron shovel and thus carried about the apartment.

The pine-needle power is put up in packets weighing about 1 lb. (or ½ kilo.)

A bath for an adult will require ¼ to ½ kilo. of the powder. For a child's bath, 1 to 4 tablespoonfuls will be found sufficient.

Not long since, we drew attention to the turpentine vapor baths used to some extent in Paris. But this German preparation of pine-needles is simpler, cheaper, and, we should imagine, quite as effective.

The pine-needle baths are prescribed for invigorating the system generally. They act upon the skin as a balsamic stimulant and antiseptic. Thus they may prove useful as a prophylactic remedy in epidemics of various kinds, and herein lies one of their greatest recommendations.

Dr. E. Meusel, of Gotha, has used these pine-needle baths with satisfactory results in the hospital to which he is attached. Dr. G. Grueb-ler, of Leipzig, says that he found water at 38° C., or thereabout, soon withdrew the aromatic principles of the fir-needles' powder, and that 1 per cent of the latter is amply sufficient to give the bath all the desirable properties. The water has then a powerful aromatic odor of the pine-needle essence. Dr. Von Schwartz, an able chemist, has examined the pine-needle powder as used for these baths, and finds that it yields about 25 per cent of active extractive matter—a result which corresponds very well with determinations by other chemists.

It results from what we have just said that in this pine-needle powder now manufactured in Germany we possess a material which enables any one to procure, at a moment's notice, the fashionable *Fichten-Nadel* bath, which appears likely to come more into vogue every day. The new product has placed this luxury at our disposal at a very moderate cost. —*Monthly Magazine.*

The Machine Screw Trust.

About a year ago, an association of the manufacturers of machine screws in this country was organized. The members of the association were as follows: The Chicago Screw Co., Chicago; the Detroit Screw Works, Detroit; Western Automatic Machine Screw Co.; Rochester Machine Screw Co., Rochester, N. Y.; Hartford Machine Screw Co., Hartford, Conn.; Worcester Machine Screw Co., Worcester, Mass.; McCloud, Crane & Minter, Worcester; Reynolds & Co., New Haven, Conn.; Hopedale Machine Co., Hopedale, Mass. The purpose of this organization was to secure uniformity of action relative to price lists and discounts. The *Industrial World* says the members have had ample time and opportunity to judge of the practicability of the association, and are so well satisfied with it that at their recent meeting held in Rochester, N. Y., they passed resolutions readopting their present price lists and discounts for another year, and re-electing the officers of the association. The officers are: Geo. A. Fairchild, Chicago, president; Chas. E. Roberts, Chicago, secretary and treasurer.

The South Pole.

Sir Graham Berry, the Agent-General for Victoria, has presented to her Majesty's ministers a request that they would be pleased to aid in an Antarctic expedition. This request proceeds from Victoria, Queensland, New South Wales, South and West Australia, Tasmania, and New Zealand, which have all agreed to support the enterprise, which will probably employ some sixty to seventy thousand pounds. The English government is asked to contribute the most moderate sum of five thousand pounds—not indeed that the money is wanted so much as the recognition of the parent country is to the undertaking of her loyal children. The Australians would not experience the least difficulty in financing an undertaking tenfold the magnitude of the present proposed one. Therefore their act in coming to the parent country should be looked upon as an act of filial duty gracefully rendered, and we hope, for the credit of the empire, that it will meet with a not less graceful recognition. The British Association had this matter down in its agenda, but was detained from bringing the object forward from want of time and other circumstances—a matter that is to be regretted, inasmuch as the subject would have been well and carefully handled, and would have gone forth to the cultured reader with the stamp of genuineness upon it, thereby enforcing its claims upon the country as well as upon the government. Sir Allen Young will be asked to undertake the command of the "British Australian Antarctic Expedition," should the reply of the government be a favorable one, which doubtless it will be.

A better man, perhaps, it would be difficult to get than Sir Allen, whose knowledge of thick-ribbed ice is well known. Deputy Inspector-General R. M'Cormick, R N., F.R.C.S., published some three years ago a very interesting work entitled "Voyages of Discovery in the Arctic and Antarctic Seas," being a personal narrative of attempts to reach the North and South Poles. Dr. M'Cormick was chief medical officer, naturalist, and geologist to the expedition the adventures of which he relates so graphically; and the narrative is by far the best reading we know upon that most interesting subject, the Antarctic regions. Wilkes, the American, took things too much for granted for his account to be relied upon of what he thought he discovered in the Antarctic circle. Apart from the enterprise, there is a prosaic side to the question, and one that may yield sterling results, for the narrator, who landed with Sir James Ross upon one of the islands, says: "The margin or ice foot upon which we at last effected a landing took us upon a nearly level surface, a guano bed in fact, formed by a colony of penguins for ages past. It had attained such a depth as to give an elastic sensation under the feet resembling a dried-up peat bog. It would afford valuable cargoes of guano for whole fleets of ships for years to come." And again he says, "As we coasted along the 'Barrier' (a wall of ice with a sheer descent of some 200 feet), we fell in with many whales, both finners (the right whale) and spermaceti . . . A very successful whale fishery might be carried on here. The whales are of the very largest size, especially the spermaceti, perhaps the most valuable of all." This was written before the days of steam whalers; and the difficulties that the Erebus and Terror had to encounter, under the command of Sir James Ross and Captain Crozier, would in a great measure have vanished. Then, with regard to the scientific side of the undertaking, our magnetic, meteorological, geological, and, though last but not least, our geographical knowledge must each and all become most valuable additions. A farther insight into the mysteries of that most mysterious active volcano, Mount Erebus, over 12,000 feet in height, is no mean factor in the matter. So is Mount Terror, in its mighty mantle of eternal snow. To achieve all this, and to add another page to our long list of daring and useful deeds with which the reign of Victoria abounds, should be incentive enough for the parent to go hand in hand with her lusty offspring in the "British Australian Antarctic Expedition."

Use of Ropes.

The *American Architect* translates from the *Bautechnische Zeitung* the following practical suggestions in regard to the use of ropes which may be worth remembering. With hemp ropes the character and probable strength may be judged in some degree from the appearance. A good hemp rope is hard, but pliant, yellowish or greenish gray in color, with a certain silvery or pearly luster. A dark or blackish color indicates that the hemp has suffered from fermentation in the process of curing, and brown spots show that the rope was spun while fibers were damp, and is consequently weak and soft in those places. Sometimes a rope is made with inferior hemp on the inside, covered with yarns of good material, but this fraud can be detected by dissecting a portion of the rope, or, in practiced hands, by its behavior in use. Other inferior ropes are made with short fibers, or with strands of unequal strength, or unevenly spun. In the first case the rope appears woolly, from the number of ends of fibers projecting, and in the latter the irregularity of manufacture can be seen by inspection. Occasionally, a hemp rope is spun with a core or central strand, such as is used in the interior of many wire ropes. This somewhat increases the strength, but the core, shut in by the outside strands, is liable to rot and infect the rest, and any rope with a musty, mouldy smell should be rejected. The best hemp comes from Russia, Switzerland, Alsace, and Northern Italy, and it is said that the strongest fibers are obtained from plants grown at the foot of high mountains. Ropes to be used on board ship, or where they are liable to be often wet, are usually soaked in tar to preserve them, but the tarring diminishes the strength by about one-third, and increases the friction of the rope. The injurious action of tar upon the hemp fibers seems not to be clearly explained, but it is said to be lessened by subjecting the tar, before applying it to the rope, to repeated melting and washing with water. The effect on a rope of soaking with water is, however, worse than that of saturating with tar. According to accurate experiments, the tensile strength of a wet rope is only about one-third that of the same rope in a dry condition, and a rope treated with grease or soap is weaker still, apparently through the influence of the lubricant in facilitating the slipping of the fibers. It should never be forgotten that hemp cords contract strongly on being wet, a dry rope twenty-five feet long shortening to twenty-four feet or less when dipped in water or exposed to heavy rain.

Restoring Old Furniture.

A correspondent in the *London Mechanic*, who has evidently had experience in a cabinet making shop, recommends sawdust or raspings of hard and soft wood for filling the cracks and worm holes in old furniture. I learned their value, he says, in my young days from the Oriental carpenters. You should sift them through wire gauze. Put each separately in a box with a label, and you are always ready for a sudden job. I have another box for bits of every kind of wood. For a crack, a worm-eaten hole, or a deep flaw, prepare the proper dust, by the admixture of brickdust in flour (also kept ready), or whiting, or ocher, or any required tint. Then take well-cooked glue, and on a house plate stir it in slowly while hot, with sufficient powder for your work. Dab the hole or crack with your glue brush, then with a putty knife stir about the mixture on the plate, taking care you have the right color. When sure on this point, take some of the cement on the end of the knife and insert it in the desired place. Then use as much pressure as you possibly can with the blade, and keep smoothing at it. Sprinkle a little of the dry powder on the spot. When thoroughly dry, sandpaper the surface with an old used piece, so as not to abrade the joint. You can then varnish the mending. Where weevil and wood worms have devoured the furniture, cautiously cut out the part till a sound place be reached. Poison the wood with a solution of sulphate of copper injected into the hollow. Let it dry, Cut an angular piece of same wood from your board, and with a sharp chisel make a suitable aperture for its reception. Fix it with glue. When thoroughly dry, work with carving tools or rasp and glass, scraping till the new bit of work exactly matches the old.

The Train Dispatcher.

How few there are who, when riding along in comfort and safety upon one of our railroad lines, ever think of the officer who is watching the progress of their train, directing its movements from station to station, and side-tracking the numerous other trains upon the road, in order to present a clear track to the one in which they are riding; and yet the lives of all the passengers are really intrusted to his vigilance and care. A moment's neglect or thoughtlessness, a moment's doze in his chair, a single glass of liquor to befuddle his brain, and sudden death in its most hideous form may be the lot of those whom it was his duty to watch and protect. There seems to be hardly any other position among all the numerous avocations of a civilized life calling for as great a degree of unrelaxing watchfulness and involving so fearful a responsibility.

Who is there who cannot safely allow his thoughts to wander for a few minutes during the day, and so obtain some little relief from the pressure of business cares? Hardly one except the train dispatcher. For him there must be no relaxation of the mind while he remains on duty. Not a minute of day dreaming; not an instant of forgetfulness. So constant a strain, so great a responsibility cannot fail to wear upon a man's life and vigor and make him old before his time.

When we consider the nature of his duties, it must be a matter of surprise that so few accidents occur which can justly be charged upon the train dispatcher. A thousand times a day does he give orders for the safety of the trains under his direction, and scarcely once in a generation does the wearied brain for an instant relax its watchfulness. These men, in whose hands our lives have been placed time and again, and who have safely carried us through all the dangers which environed us, are certainly entitled to at least the degree of thankfulness that is implied by an occasional remembrance of their existence.—*Railway Review.*

Power in the Future.

Let any one consider what the steam engine was forty years ago, and then examine the very latest improved compound engine of to-day, with all its appliances for economy and efficient service, and then let him try to estimate what the electric motor of thirty years hence will be. The compound engine, with its wonderful performance, has come as a result of long practice, large experience, profound study, and the application of a wide acquaintance with principles. Why should not the electric motor gain as much from the same sources? And, if it shall so gain, is it unreasonable to suppose that electricity may crowd out steam, in a good many cases, as a source of power? If large power can be stored in the form of electricity, so that it may be transported on a street car, why may it not be generated at one point, and then be shipped to another, like any ordinary commodity, to be used as it is wanted? Why, for example, should not the water power of Niagara be employed to generate power, which shall then be stored, transported, and sold to operate mills in Philadelphia? There is a regular market now for coal. Why should there not then be a regular market for stored power? Why should not a mill owner then go out and buy his power, for the season, just as he buys his cotton, his wool, or his dye stuffs? If power can be baled up like cotton or barreled up like sugar, then we shall have power dealers, power brokers, and, may be, a power exchange—in fact, all the details of a new and important industry. Is this a fantastic supposition? Not half so fantastic as the notion of traveling from Boston to Philadelphia in a single night was to our grandfathers. It is rather a clearly indicated possibility, the promise of which is contained in the street car which is now moving about under an impulse derived from a steam engine that stopped before the car started.—*Textile Record.*

Military Dogs.

The canine service which had been introduced by way of experiment in the maneuvers of the Ninth French Army Corps proves to have exceeded the most sanguine expectations entertained of its utility. During the separate operations of the 32d Line Regiment, the animals were placed under the control of Lieut. Jupin, with a party of four privates, and after three days' training they were fit for service. Upon vedette duty, and in company with single sentries, it was found that the keen scent and watchfulness of the "dachhunds" and poodles, which had been selected haphazard for the trial, enabled them to give notice by growl or importunity to their human companions of any movement or the approach of strangers within three hundred yards of their posts at night time. Sentinels were reassured by the society of the dog, and the pickets could repose in all confidence after the fatigues of the day. The communications between the main guard, or headquarters, and the posts were in the meanwhile efficiently maintained, and not a single dispatch or report intrusted to the animals for conveyance in the leathern wallet at their necks was either miscarried or delayed in transmission. The carriage of papers, especially, was performed with more celerity and greater dispatch than by horsemen, and one quality of the four-footed orderlies, not unimportant in its way, was the instinct that naturally guided them in the search and discovery of potable water when the troops, as it frequently occurred, were athirst, and needed the refreshment.

Diminution of Water Supply.

Reports from Indianapolis, Ind., are to the effect that fully ninety per cent of the "dug wells" in the city are becoming exhausted, and many which have been furnishing a supply for twenty years have had to be deepened. There are two strata of water-bearing soil under the city, separated by a layer of impervious clay, and within the past ten years the surface of the upper stratum, from which nearly all the wells are supplied, has gradually gone down, until now it is at least five feet lower than a decade ago. In time it will become exhausted and the supply will have to be drawn from the lower stratum, which is practically inexhaustible. According to a statement in *Fire and Water*, the benevolent institutions and the larger factories are already drawing from this supply, and the water is purer than that which is obtained from the upper level. This diminution of the water supply is attributed to the clearing away of the forests and the tilling of land, these two causes increasing the evaporation and carrying away the rainfall quickly to the streams, instead of allowing it to gather in underground reservoirs and watercourses.

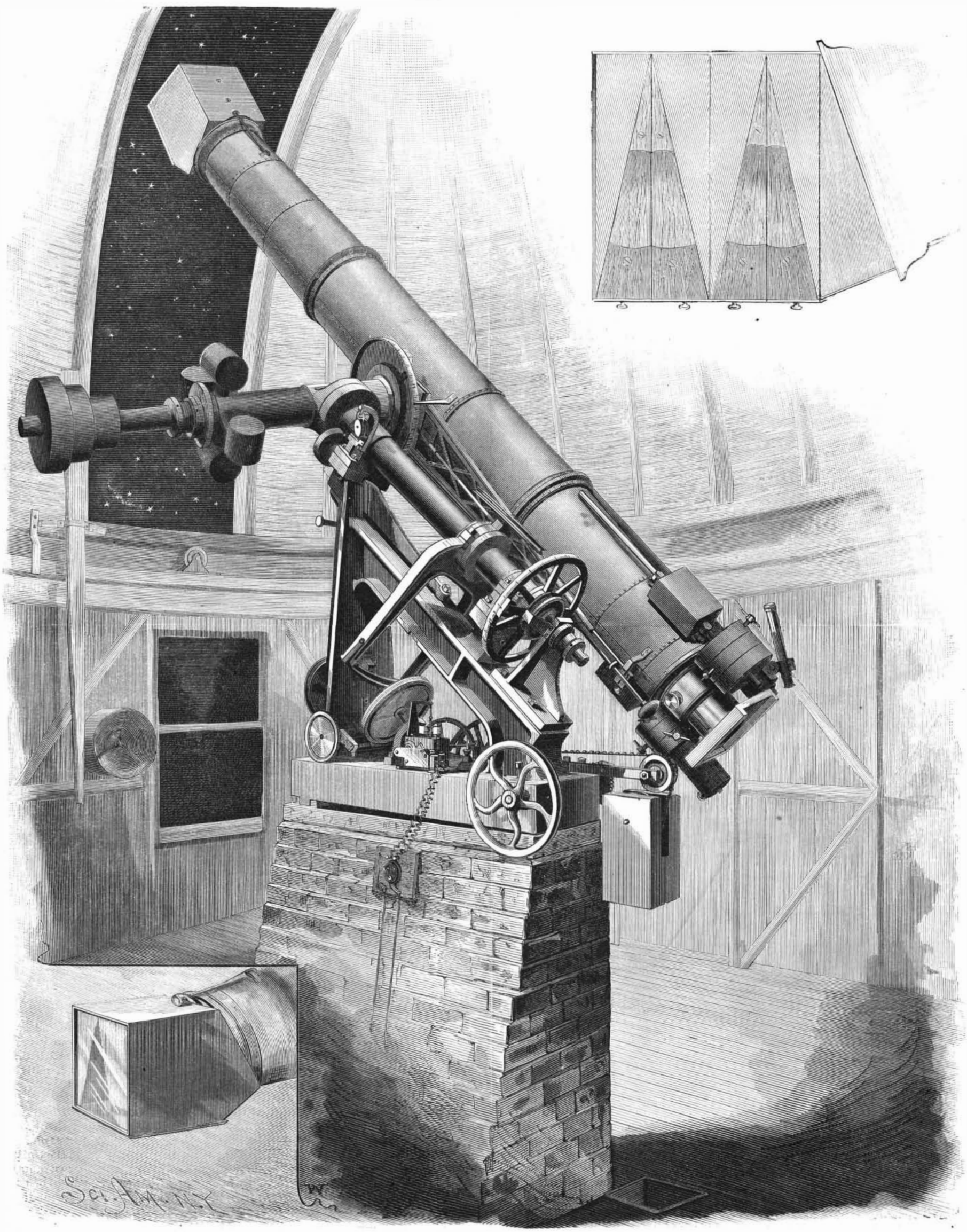
NEAR Nashua, N. H., recently a muskrat, in digging a hole in the bank of the canal, caused a leak and, eventually, a disastrous flood. The water swept through the woods, carrying trees and everything else movable with it into the Nashua River. The mills at once shut down, and 3,000 persons will be kept out of employment for an indefinite time. *Fire and Water* is our authority for saying that it will take three weeks to repair the damages caused by that one muskrat.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1887, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LVII.—No. 18. [NEW SERIES.] NEW YORK, OCTOBER 29, 1887. [$3.00 per Year.



THE HARVARD OBSERVATORY—11 INCH PHOTOGRAPHIC TELESCOPE. [See page 278.]