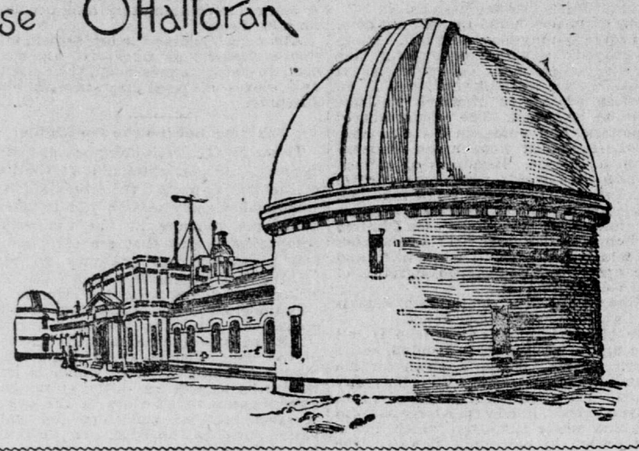
MARVELS OF MODERN ASTRONOMY

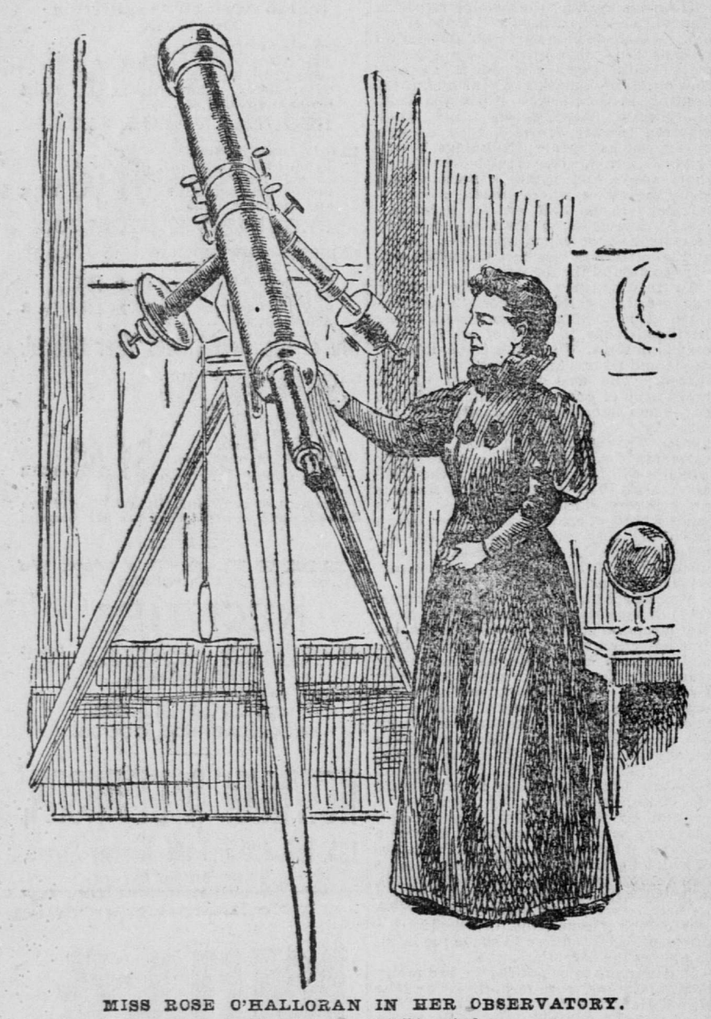
·BY· Rose O'Halloran



Forming a spherical triangle with the tapering extremities of Africa and South America, and nearly equidistant from them, the shores of Southeastern Australia rise above the watery wastes of the Southern hemisphere.

It seems, indeed, as if an adequate number of relay stations were thus designedly provided for successive vigils as the wonders of the night sweep by overhead.

If the astronomer of Chile discovers some great comet through the southwestern haze he knows that its career is in convenient view of the zealous watchers under Australian skies, and that a few hours later on it meets the investigating gaze of Cape Town before it rises to his view again in the southeast. If it were otherwise many intermediate phases would be lost to the scientific world. This effect of rotation is either a boon or a bane to the first observer, according as science or self predominates within him. The general members of the astronomical profession, though emulative, are singularly co-operative and fair minded, and the first discoverer of an object is very apt to retire from his post satisfied that the views lost to him will be greeted with attention far over the western seas.



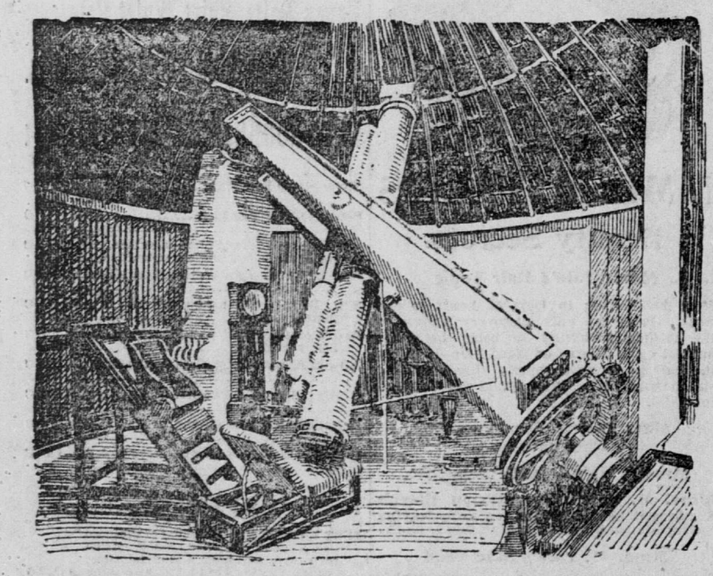
MISS ROSE O'HALLORAN IN HER OBSERVATORY.
[*Sketched by a "Call" artist.*]

When the gold mines of Australia were discovered and numbers of ships anchored in its bays it was necessary, in order to furnish the true time, to found an astronomical station. Williamstown, near Port Phillip, was the site selected in 1853, and to Mr. Ellery was deputed the duty of finding the true time by means of a sextant and of announcing it to the populated sections of the colony.

A time signal was established at Williamstown and Melbourne, and in the following year a clock and a very small transit instrument were forwarded to him from England, and some time afterward now that facilities for manufacture and transportation are greater than ever, no doubt many others of equal size will soon share the privilege of capturing the beams of the "southern cross." When the veteran director, Mr. Ellery, turned the ponderous tube toward the light of some distant sun, perhaps he recalled the days, now forty years gone by, when he fulfilled the duties of his post on the heights of Williamstown with the simple adjustments of a sextant.

Sir Thomas Brisbane was one of those gifted men whose talents take a markedly twofold character, and though an efficient soldier, his well-set mind rose above the coarsening influence of military camp life, and he became as expert with the use of the sextant as with the saber or rifle.

At Parramatta, fourteen miles from the city of Sydney, N. S. W., he built an observatory in 1821 at his own expense, and provided instruments of sufficient size for the needs of research in a field that had been little heeded since the return of Lacaille nearly seventy years before from the Cape of Good Hope. With the able assistance of Rumker and Dunlop this military star-gazer, at that time created Governor of the colony, commenced observations and compiled a valuable star catalogue, afterward published by order of the Lords of the Admiralty of England. In a few years the observatory became a Government institute under the direction successively of Rumker and Dunlop, and on the death of the latter was permitted to decline, its work being discontinued altogether in 1855.



STAR CAMERA.

Three years after the instruments were transferred to Sydney, where a new observatory had been founded to meet the urgent needs of the seafaring portion of the population.

A 7-inch equatorial and other instruments having been added to the original outfit, Mr. Scott, the director, resumed the search for double stars so ably commenced by Sir John Herschel and Dunlop in that latitude.

As some difficulty had been experienced in recruiting the staff from among the colonists, efforts were made to awaken an interest in this useful and ennobling study, and in a few years astronomical skill and talent were no longer among the required imports.

When the scope of the institution became more varied, and the important duty of geodetic surveys was assigned to it, something more than ordinary skill in star-gazing was needed in the management, and in 1870 H. C. Russell, the present efficient director, was appointed. Two 10-inch equatorials of colonial manufacture were added to the equipment and extensive preparations made to observe the transit of Venus in 1874.

In these new lands magnetic and meteorological observations are of special importance, and any unique atmospheric phenomena cannot be too soon discovered, as life and health often pay a heavy tribute to the possibilities of untried surroundings.

In these important branches Sydney became the oracle in the colony of New South Wales, and assumed the post filled by the physical observatory of Kew in England.

The utilitarian side, however, does not engross the entire attention of the staff, and cometary and planetary observations are carried on with much success.

The "great red spot" on the planet Jupiter was detected in its first beginnings and a drawing made of it by H. C. Russell two years before it attracted the attention of the astronomical world at large.

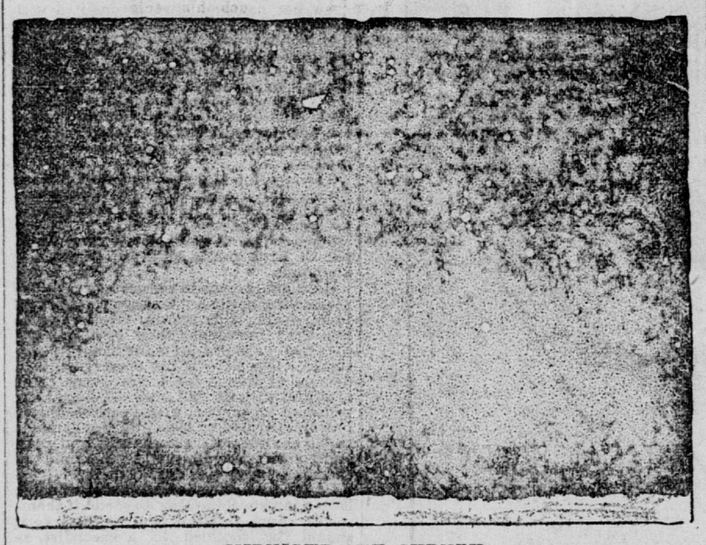
The charting of the heavens is now in progress, and these practical believers in home industry did not go beyond the limits of their own city for the entire construction of a star camera, with the exception of the lenses and one important wheel which baffled the skill of the colony. As shown in the photograph, the instrument consists of two telescopes of different size, but so mounted and weighted as to balance each other, the name twin-telescope being often given to such a combination.

The larger, 13½ inches in aperture, is for photographic work, and the other, about half that aperture, is used as a pointer. The long extension constructed crosswise is the polar axis which such an elaborate contrivance requires. In the interests of home industry in general, it is satisfactory to hear that excellent results have been obtained.

Though the observatory is situated rather centrally, it escapes many of the objectionable results of city surroundings, as it is built on an eminence in a small park, and moreover, has beneath it solid sandstone ledges of a thickness that defies the tremors caused by street traffic.

The scope of the work has continued to widen steadily, and the publications that appear from time to time are of great value to the sailor and to the scientist.

The present site of the populous city of Adelaide was a verdant but unculivated tract on the banks of the River Torrens far into the present century; but, like the other cities of the watery world that sprung up on some desolate shore, its stately buildings now number hundreds, and its halls and academies devoted to scientific pursuits show that the wildest surroundings cannot permanently numb the intellectual yearnings of the Caucasian races, though such yearnings may be wisely subordinated to physical needs for many years.



MIDNIGHT SKY, SYDNEY.

Though not one of the most imposing of these structures, perhaps that which best indicates its cultural advances is the observatory, first established when the city was twenty-four years in existence, in 1860, with Director Todd (now Sir Charles Todd) in charge as Government astronomer. As in many of these official institutes, the instruments at first were small and inferior, but some years later an appropriation was voted to the use of the observatory, and a medium-sized equatorial, a large transit instrument and a suitable outfit for meteorological observations were procured.

Observations of the positions of the southern telescopic stars, of the planets and of comets are regularly carried on with the aid of five assistant astronomers.

Much attention is given to atmospheric phenomena, and as the climate differs somewhat from that of Sydney it is an important ally in these investigations so essential to the welfare of new colonies. About a year since the three veteran directors of Melbourne, Sydney and Adelaide met in conference in the former city to consider the interests of Australian science, and especially of the meteorological department. No doubt the needs of the country will be efficiently dealt with, as long experience is an invaluable factor in practical science.

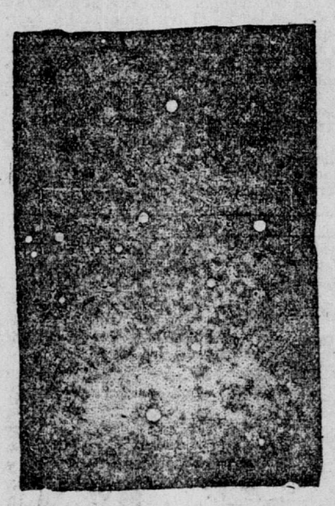
The private observatory of John Tebbutt, Windsor, N. S. W., owes its existence to the scientific predilections of the owner, fostered to some extent by the official encouragement given to the study of astronomy previous to 1861. It is now more than forty years since he commenced to observe and measure with 1¼-inch telescope the celestial orbs that at that period glimmered down unnoticed by the gold-hunting colonists, who sought only the gleams hidden in the murky earth.

The residence of this scientist occupies a hill on the eastern side of the town of Windsor, near the confluence of the South Creek with the Hawkesburg River.

He built a small observatory close by for a 3½-inch refractor, and later on, when he became owner of a 4½-inch, a substantial brick building was prepared for it.

This moderate-sized instrument, however, soon gave place to a fine 8-inch equatorial, with which his later work has been chiefly carried on. Early in his astronomical career it received the priceless impetus of an independent discovery. The great comet of 1861, which, according to the calculations of M. Liais of Rio de Janeiro, harmlessly swept the surface of the earth, was first seen, by Mr. Tebbutt, on May 13 of that year.

Cometary science, to which he has been specially devoted, is much indebted to his vigils, extended over half a century, and again in 1881 he was the first to announce the great comet of that year. Few of these celestial wanderers have roamed the austral skies unseen and unmeasured by the vigilant watcher on the hills of Windsor. In the meantime other branches of observation have been also assiduously pursued and many additions made to his outfit. He has long been a valued contributor to scientific journals, official and otherwise, in both hemispheres.



The Southern Cross.

By their equipments, achievements and publications these observatories, with those described in last SUNDAY'S CALL, are the most prominent in intermediate southern latitudes.

Being far from the equator the south circumpolar sky is seen at a favorable altitude, and though the stellar lights of the opposite pole are lost to view the heavenly hosts are under more complete surveillance than if the equator was the selected standpoint. Though oceans roll between some of them, jointly they gird the austral firmament in unbroken vigil. Undoubtedly a well-selected equatorial station has unique advantages, but science gains more by a southerly distribution of observers.

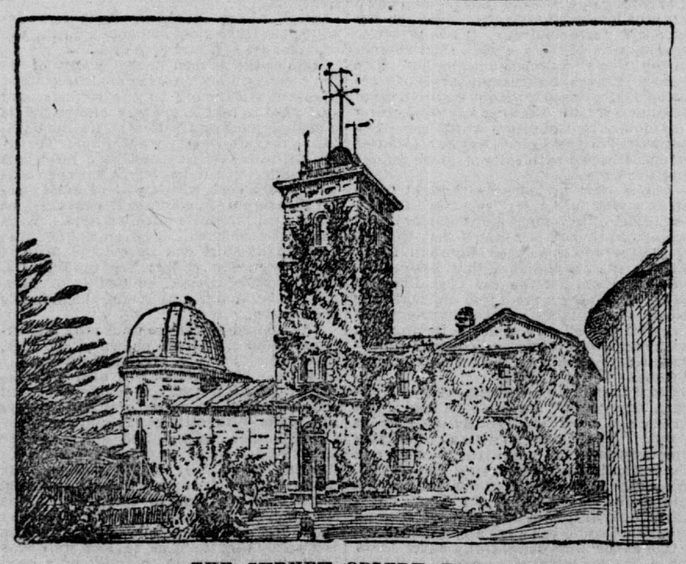
It is to be regretted that Helsingfors, Russia, in north latitude 60 deg. 9 min., cannot have a co-operative antipodal station for magnetic and astronomical observation.

New Zealand, at the central point of the watery hemisphere, may, in the near future, take a prominent place in scientific research.

The period of the famous prospective trip to London Bridge will be too late, as northern co-operation could not then be relied upon. Cape Horn is scarcely less inaccessible and uninhabitable than some East Indian stations, and an Antarctic oasis might be found as endurable as the summit of Mont Blanc.

There is still scope for new establishments in the southern seas.

Even those who are not star-gazers will readily notice how unfamiliar is the outline in the illustration of the Sydney midnight sky. In contrast to the intervening voids, the Milky Way spans the midnight sky, branching grotesquely and mingling its luster with the brilliant southern orbs. Among them is the famous cross, which is erect when on the meridian, inclines as it passes toward the west, is top downward near the south point of the horizon and inclines again as it passes eastward.



THE SYDNEY OBSERVATORY.

Below the cross is the prosphorescent Magellanic clouds, two strange groups composed of stars, nebulæ and clusters that convey the impression that they had rolled from the larger mass and left voids behind. And the mysterious pole, the immovable southern spot unmarked by star or nebula, that lies in the slightly sprinkled space above the "clouds."

Dwellers in these southern lands see the principal northern stars and, in addition, their own bright skies. They see the sun, moon and planets at about the same altitude as we do, but inverted, and a northerly aspect there is one of heat and sunshine.

Our circumpolar stars they can see, and perhaps, with the perversity of human nature, repine for the standpoint of the star-gazers of ancient times.

Rose O'Halloran

NEW THINGS IN ELECTRICITY

GETTING THE MOST OUT OF THE ARC LAMP.—It was shown recently that among the coming changes whereby better results would be attained in general lighting was the use of the inverted arc lamp. The inversion of the arc has been adopted under many conditions, and to the mass of testimony in its favor is now added the experience of a Rhode Island manufacturer. He tried the plan for twelve months and found it much more economical than either gas or incandescent lamps. His factory has already forty-two inverted arcs and before next winter the whole of the works will be equipped with them. The price of arc lamps is now so low that the cost of installation is about the same, for equivalent illumination, as incandescents, and the expense of maintenance, including interest, is about the same as renewals on an incandescent plant. One of the advantages of the arc is that it is always up to full candlepower, while incandescents begin to deteriorate the moment they are put into service. Another objection to incandescents, noticed particularly in worsted mills, is the oily scum which settles on the outside of the glass bulbs. This deposit readily collects lint and particles of dust floating in the air, and the result is a material decrease in the quantity of light until the lamps are removed from the sockets and washed. For a long time the arc light, with its intense glare and deep shadow, lost much of its illuminating value in posted rooms, or rooms having much shafting and belting. Now that the light is thrown upward by the inversion of the lamp and refracted downward by the white ceiling, the rays are equally diffused through the apartment and the ideal system for mill lighting has been reached. The important question for the manufacturer to consider is whether this method of lighting is sufficiently economical for his purpose. A mill-owner, who is satisfied on this point, has supplied some illustrative figures. In a braiding-room, 136 feet long, 66 feet wide, and 12 feet high, in which were two rows of posts, a main shaft and three short counter-shafts, and 420 braiding machines distributed in 14 rows of 30 machines each, he replaced 84 gasjets by eight inverted arc lamps. The lamps were placed in two rows, each row being 17 feet from the side walls. The 84 gasjets consumed in one evening 1890 feet at $1 50 per thousand feet at a cost of $2 73. In the same length of time the eight arcs consumed 9900 watts at 15 cents per thousand, at a cost of $1 48, leaving a difference of $1 35, or a saving of 47 per cent.

BASEBALL BY ELECTRICITY.—A very popular entertainment has been started in New York. The baseball ground is on the outskirts of the city, and many an enthusiast who would gladly make the journey to see the game in progress finds he cannot spare the time. Madison Square, however, is in the center of the city, and easily reached from the business districts. In a theater near the square a reproduction of the baseball game at the Polo ground is now being given by electricity, and the representation is so realistically put on the stage that nearly all the pleasures of the game, except mobbing the umpire, can be enjoyed by the spectator who sits comfortably in the orchestra, cooled by electric fans. The scenery is painted to show the Polo grounds, where the game is played, and the stage is set to represent the ballfield. The players, automatic figures, two feet high, are in their respective positions, ready for the umpire's call to "Play ball." The game begins: The ball flies from the hand of the pitcher, and is snapped by the catcher or hit by the batsman, who runs the slides to base; the fielders catch and throw, and the battery-work is reproduced in every detail. The ball is moved by electricity, and flies about from different parts of the mock arena as quickly and as accurately as in the game being played at the Polo grounds. But the representation is not confined to New York games. When the New York Club is away from home, the games going on in distant cities will be reproduced at the theater every afternoon, so that a baseball-crank who is mightily concerned about the New Yorks' chance for the pennant can save his fare to Baltimore, Boston or Chicago by taking a ticket for the afternoon's performance.

ELECTRIC SOLDERING AND CURLING IRONS. — Electric soldering irons are rapidly taking the place of the iron heated in the ordinary way. The iron can be brought to the required temperature in an instant by inserting the terminal on the flexible cord carrying the current in the handle of the iron, and all the trouble of making and maintaining a fire is saved. The iron is provided with interchangeable copper tips, so that when one becomes worn another can be substituted at slight cost. The ease and rapidity with which electric heating can be effected are bringing this class of apparatus forward, not only in the industries, but in the domestic economy. One of its most popular forms is the electric curling iron heater. The heater is suspended from an ordinary electric-light socket, thus avoiding damage to furniture which might possibly be caused by an apparatus mounted on a stand, set on a table or stand. This appliance is now very much used by ladies in traveling. The connection is made in a moment, and there is no necessity for stringing a long flexible cord to the table. In order to obtain the highest economy, the heating resistance is inserted in the curling tongs; this insures the application of the heat at exactly the right place, and when the tongs are ready for use, which takes about half a minute, the current is gradually reduced by means of a compensating resistance. The regulation of the heat is thus entirely within the control of the person using the iron. The electric curling iron is the only appliance yet devised that will effect its purpose without running the risk of burning the hair.

ELECTRIC CLOCKS.—It is rather a difficult thing to realize that it is possible for the whole population of the largest city to tell the time of the day without a single clock in the place, but nevertheless "clock works" are no longer a necessity, and clock-winding will soon be out of date. The "self-winding" clock is an ordinary clock in which the winding is done by an electro-motor at regular intervals, the contact controlling the magnet being connected with some moving part of the clock. The great difficulty hitherto has been the unreliability of this contact, owing to the small amount of power available for making it, but by new devices absolute certainty of action can now be insured. But while it is possible for every one to have his own automatic clock-winder, a system, called the "synchronome," has been introduced which still further simplifies the regulation and operation of time-keeping devices. This system consists of one pendulum, kept in motion by means of two wheels and an electro-magnet, which derives its energy from a small dry cell. The object of the pendulum is to transmit electrical impulses at regular periods along a single wire to any number of clock faces, whether in a house, a public building or a church-tower, the hands being "synchronized" forward by each of these impulses. It thus becomes possible with both winding and clock works. If desired a house or building can be supplied with its own synchronizer, which controls its own circuit. In this way every room in the house can be supplied with the time of day to within a variation of one second per month. The device is usually placed in the hall and the actuated dials can either be placed on the mantel shelves of the various rooms or suspended on the walls with flexible cord, as the absence of mechanism enables them to be treated artistically, and suggests their combination with drawing-room art work in wrought-iron and wood-carving. The electric movement can be fitted into any existing clock-case, and striking or chiming may be accomplished by all or any of the dials. The wiring is very simple, consisting of the connection of one dial with another by a single line. For putting forward the hands of all the dials a push button is provided on one of them. For setting back it is sufficient to move the hands of this dial only and all will be altered.

THE UTILITY OF LIGHTNING RODS.—Alexander McAdie has collected some interesting statistics regarding the frequency and severity of thunderstorms. About 260 people are killed annually by lightning in the United States. Of these casualties usually only one death occurs in each of January, February, November and December. In March, 3; April, 13; May, 28; June, 77; July, 63; August, 46; September, 15; and October, 12. The annual loss by fire due to lightning strokes is estimated at two and a half million dollars. Of the annual number of 575 buildings set on fire, according to last year's weather returns, 370 were barns, stables and granaries, 24 were churches and 131 were dwellings. The region of greatest frequency of thunderstorms in the United States is in the southeastern portion, extending from Georgia to Mississippi, where, on the average, forty storms occur each year. In the northern part of the United States the number is only twenty and on the New England coast but ten. To the west and southwest of the Great Lakes thunderstorms occur most frequently in May or June, and to the south and east in July and August. The general direction of approach in the United States is from the west; but in Southern Florida the storms approach from the east, thus following the direction of the general movement of the atmosphere. Mr. McAdie recommends that lightning rods should be either of copper-tape weighing six ounces to the foot, or of iron rod or tape weighing thirty-five ounces to the foot. The top of the rod should consist of clusters of points, which have been plated to prevent corrosion or rust. The grounding of the rod should be in damp earth or running water, and independent grounds are preferable to water or gas main pipes. In spite of all that has been calculated or suggested on the point, there is no definite area of protection depending on the height of the rod. The risk of a lightning stroke is about five times greater in the country than in the city. In fact, it is hardly necessary to place rods on the ordinary block dwelling-houses of the city.

NEW TO-DAY.

TO-MORROW MORNING

When you wake up, ask yourself first of all as to whether you are quite fit to do your day's work as you ought to be, and if you are, turn your attention to your wife; she needs it. If either of you feel unequal to doing a good hard day's work, your first duty after dressing is to go and get a bottle of **Dr. Henley's** Celery, Beef and Iron, and having procured it——Open the Bottle
And take a wine glassful at once.

IN THE AFTERNOON

If you are wise you will look carefully over both your own and your wife's health. If either of you are suffering from indigestion, dyspepsia, nervous or general debility, insomnia, "that tired feeling," "the blues," or any other ailment, you must continue your medicine regularly, and don't neglect to order **a case**, for you have probably neglected your health for a long time, and you should not expect one bottle to cure you any more than you would——Take a Swallow when first seen to be a certain sign of summer.

IN THE EVENING

Just devote a few minutes to considering how much money you spend on stimulants which do you harm, rather than good. One glass of bad whiskey will upset your stomach, muddle your head, and unfit you for business. **Henley's** Celery, Beef and Iron will stimulate your entire system, and do you **unmixed good—not harm.** And when you have seen how much good you get from the first bottle you will be so delighted at the benefit you have received that you will order another · then a case——Then One More

EVERY DAY

Proof is forthcoming as to the splendid work that **Dr. Henley's** Celery, Beef and Iron is doing. It contains celery to make your nerves perfectly sound; beef extract to stimulate your entire system; iron in the exact proportion to purify and enrich your blood without blackening your teeth or disturbing your stomach.

THE GRANDEST TONIC AND STIMULANT ON EARTH
TAKE NO SUBSTITUTE