with the celestial hues of liquid gold of the disk and rings, and the creamy tints of the belts that cross the disk with the lightness and grace of scudding cloud bands. The sphere seems almost to stand upright within the encircling rings, only a small portion of the planet being seen beneath them We have fallen upon favorable conditions for a view of Saturn, for his rings are opening to their widest extent, his northern declination is increasing, and he is approaching peribelion.
Jupiter is the next object to est the space annibilating power of the instrument. The Prince of Planets is superb, larger than the full moon, though but little larger than we have seen him many times in a telescope of eiglit inches aperture. He is, however, much brighter, and though by no means às magnificent as Saturn, we have the pleasure of feeling that we see him on a much larger scale. He seems so near that we are impelled to put our hands behind the glass and touch him. His broad belts are delicious in col oring, now suffused with pale rose, or mottled with soft gray, while shades of purple, brown, and delicate green are interspersed. Never before did we behold the variety of tone and tint, the flood of light we see this night. Never did our giant brother seem so near, so grand in proportions, so symmetrical in equipoise. His four satellites are brightly beaming on his left, and bear testimony to the power of the telescope by presenting disks instead of points. The famous red spot is wanting in the view. We mourn its absence, for since 1878. its well known features have become as familia and firmly fixed as if they were a permanent feature on the planet's disk.
What shall we see next? is the question now discussed, for the extreme cold has congealed the oil, and the monster refuses to move. His eye is turned to the meridian, and no effort will make himswerve one inch to the right or left. In this emergency, a member of the party volunteers to mount to the top of the pier and lubricate with fresh oil the joints of the giant. The plan is successful, and with many a shriek and groan, the lower end of the tube rises and the upper end falls, until the Cyclopean eye points to the great Nebula in Orion.
The little wisp of cloud haze visible to the naked ere is transformed into one of the most glorious visions that ever breaks upon the entranced eye of the observer. The most wonderful nebula the northern sky reveals lies before us, filling the whole field of view and suffused by a light that never was on sea or shore. Now we appreciate the power of the great telescope, the triumph of the optician's art. For definition is of little consequence in observing the shadow ebula. Light is needed, and ligbt comes.
The delicacy of the celestial glow that pervades the scen is beautiful beyond comparison. The central point of inter est is the famous trapezium, consisting of four brigbt stars and two smaller ones. Around this sextuple group radiate what seem to be the head and branching horns of some huge animal, the trapezium occupying the open mouth, and sur rounding a space of sky within which reigns the blackness of darkness. Spiral curves of nebulous haze fill in the field of view, the radiating mass being of a delicate green tint, while dotted over the shadowy haze are many brilliant stars, tbrowing an element of life into the formless void and help ing to light up this scene of loveliness and grandeur which no pencil may paint nor pen describe. We feel, while with reverent eyes we gaze upon the picture, that we are looking within the eternal gates, and enjoying a glimpse of the glory to be revealed, that "eye hath not seen or ear beard."
It is said that no one can look upon the Apollo without standing erect and feeling a sense of the divinity inherent in human nature. But what is tbis masterpiece of Greek art, chiseled by human hands from a block of marble in comparisol with this creation from Nature's fashioning band brought near to mortal eyes by telescopic art! Where but in the heavensshall we find such an exhibition of majesty, vastness, and celestial grace as is symbolized in the grea Nebula of Orion, beaming with suns, peopled with ghosily shadows, and glowing with light that is hundreds of years when it reaches us! Our earth and her brother planets will have cooled down to dead worlds, the sun's fires will be quenched in utter darkness, when the star dust on which we are now looking will quicken with the pulse of physical life throw off its concentric rings, and concentrate into beaming suns and systems to take the place of those whose race is run, whose mission is fulfilled

## Photo-chemical Action of Ferric oxalate

Victor Jodin has observed that when 1625 parts (one equivalent) of percbloride of iron, and 63 parts of crystallized oxalic acid, dissolved in a liter of water, are exposed in the sunlight, carbonic acid gas is set free in such quantity as to supply the requirements of plants inclosed in the vesse with it, the absorption and decomposition of carbonic acid by the plant being likewise a photo-chemical action, because it requires sunlight to aid it.

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TABLE OF CONTENTS OF
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## No. 379,

For the Week ending April 7, 1883.
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 ECHNOLOG P.-Richard's Registering Apparatus.- 6 figures.
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II. AGRICDLTURE.-How Nature Sweetens Our Fruits. ill. natural history.- - A Land Sink.
I. Astronomy.-Astronomy for 1888
x. MISCRLLANEOUS. Said I to myself.-A poem....................... 6 653

## THE TOTAL SOLAR ECLIPSE OF MAY 6.

A total eclipse of the sun occurs on the 6th of May, that presents features of special interest. It is greatly to be regretted that this sublime and awe-inspiring phewomenon marks its path over a portion of the globe where there are so few to witness it. The line of totality lies entirely in the South Pacific Ocean, and as ingeniously avoids habitable land as if its purpose were to confine the spectacle to the smallest possible number of spectators.
There are, however, within the narrow path of total obscuration, two eligible points where the eclipse may be seen to great advantage. These points are two small islands, named Caroline Island and Flint Island. Caroline Island, the larger of the two, is about ten miles in circumference, and was, when visited in 1874, inhabited by a few natives and an Englishman. It is situated in $73^{\circ} 20^{\prime}$ west longitude from Washington, and in $9^{\circ} 40^{\prime}$ south latitude. It does not belong to the group known as the Caroline Islands, situated farther west. The duration of totality in Caroline Island will be five minutes twenty seconds.
Flint Island is five or six miles in circumference and is uninhiabited. It is situated in $73^{\circ} 40^{\circ}$ west longitude from Washington, and in $11^{\circ} 30^{\prime}$ south latitude. The advantage it possesses lies in the fact tbat the totality here continues tive minutes and thirty-three seconds, thirleen seconds longer than in Caroline Island.
The eclipse of May next is especially favorable to observation ou account of the exceptionally long duration of the total plase. The longest time a total solar eclipse can last is a little less than seven minutes. The average time is about two minutes. In the present case, the totality will continue between five and six minutes, which is a rare event.
Three expeditions are already on the way to these lone islands of the Pacific, for the purpose of observing the eclipse. The American expedition is sent by the United States Government, five thousand dollars having been appropriated for the purpose. The National Academy of Sciences, the Naval Observatory, and the Coast Survey all send representatives. The party consists of six members. Prof. Holden, Director of the Washburn Observatory, at Madison, Wis. ; Prof. Hastings, of the Johns Hopkins University, of Baltimore, and Mr. Rockwell, of Tarrytown, New York, nominated by the National Academy of Sciences; Mr. Preston and Mr. Upton, sent by the Coast Survey; and Ensign Brown, sent by the Naval Observatory. Prof. Holden has charge of the expedition.
The astronomers started from New York on the 1st of March, reached Panama on the 9th, and Callao on the 22d. From Callao they will be conveyed by a government steamer
 25th of April. They will spend the intervening time till May 6th in preparation for their work. After the eclipse, the government steamer will take the voyagers to Honolulu, Sandwicl Islands; thence they will return by steamer to San Francisco, and arrive in New York about the 1st of July. This is the programme of the American exploring party, and on account of the isolation of its members from the rest of the world it will be impossible to obtain tidings of the result of their work before the 1st of June.
British astronomers are but meagerly represented on the occasion. The Royal Astronomical Society has sent two representatives, who, joining the American observers at Panama, will go with them to Caroline Island. They will take charge of the photographic work.
The French expedition, under the charge of M. Jannsen, is also on its way in pursuit of the same object. It will probably observe on Flint Island, or, divided into sections, may occupy both islands.
Thus, three of the most enlightened governments of the world send men of science to this far-away spot to "take notes" on the day when the light of the sun is hidden for less than six minutes. What do these astronomers hope to accomplish that will reward them for the privations endured in traversing many thousand miles by land and sea, and for the possibility that intervening clouds may hide the grand phenomenon from view ?
They hope to learn sometbing on three important points, two of which are connected with the surroundings of the sun, and are never revealed except on the rare occasions" of a total eclipse. In the first place, they will make a study of the corona, the silvery halo that surrounds the sun, and comes into view the moment his bright orb is covered by the moon. Especially will tbey pay attention to the inmense appendages that branch out from the corona in all directions, and, taking on all manner of fantastic forms, spread in limitless dimensions into the regions of spaces The problem of exceeding interest to solve is v. nether they are dependencies of the coronal atmosphere, or whether they are swarms of meteors circulating around the sun.
In the second place, observations will be made upon the zodiacal light, the glimmering glow of pale gold that, during portions of the year, appears in the west after sunset, and, assuming a cone-like form, rises high among the stars. The possible connection between this mysterious light and the coronal appendages affords material for observation of exceeding interest.
In the third place, careful search will be made for the small intra-Mercurial planets that probably circulate in the immediate neigbborhood of the sun, and can only be seen when making a transit over his disk, or during a total solar eclipse.
Observations on various other points of inte rest connecte
with the sun and the corona will be made during the six ficence than that which should lift such a people out of their precious minutes of veiled sunlight. The contacts will squalor, and surround them by the comforts, the earnings, be carefully noted for the correction of the lunar tables; the corona and its spectrum will be accurately photo graphed; the chromosphere will be examined with the spectroscope both before and after totality; a new polariscope will be tried; and meteorological instruments will be used for studying radiation and other phenomena.
The tropical locality of the place of observation is favorable for clear weather on the momentous occasion. There is every reason to anticipate that discoveries will be made and observations confirmed that will increase our knowledge of the solar surroundings and reflect great honor on the astronomers who braved the dangers of the deep to wrest from the eclipsed sun a few of the secrets at all other times securely hidden beneath the dazzling brightness of his beams.

## ENGLISH NAIL MAKERS AND THEŋR WRETCHEDNESS.

Those who are so apt to jump at the conclusion in the abtract that machinery and invention throw manual labor out f employment, and so encourage pauperism, would do well to take a lesson from some of the industries which are carried on by band work, and study the phases which they present One of these pictures, which quite eclipses the "Song of the Shirt " for squalor and wretchedness, has just been drawn hy Mr. Robert P. Porter, in the Tribune. Mr. Porter was a member of the late Tariff Cummission, and is clearly a close observer of matters concerning industrial labor. From his last letter we gather the following:
The country which Mr. Porter visited was the "Lye Waste " region in the Back Country-a district located partly in Stafford and partly in Worcester, England. Iu this dis trict, situated seven miles from the great manufacturing in dustries of Birmingbam, and dismal beyond description, is to be found an army of 24,000 persons engaged in making nails and rivets by hand. A place where only wreck and ruin, squalor, filth, and wretchedness abound, it is yet peopled by some of the most industrious people in England The work of nail and rivet making is done in little smithies attached to the hovels, which are filthy and horrible beyond description. The father, mother, and children all engage in the indusiry, while the wages of two parents and a daughter say of fourteen, are barely sufficient to keep the family from starving. Mr. Porter puts it in tbis wise: An expert nailer working steadily from Monday morning to Friday night can only make two and a half bundles of iron rodsinto nails, for wbich he gets 6s. $71 / 2 \mathrm{~d}$. per bundle, or for his week's work, 16s. 8d., exactly $\$ 4$. Now, his wife, by working every moment of her spare time and late into the night neglecting the wretched little children-can make a bundle of commoner nails, for which sbe is paid 3 s . 1 d ., and the lit tle balf-starved, stunted girl of twelve, with her brown arms and steady, unerring aim, will hammer out half a bundle, 18. $61 / 2 \mathrm{~d}$. Total earnings of an industrious and hard working family, three at the forge, for the entire week:


But out of this pittance must come 3 d . for carriage of iron rom the "fogger's" and returning the nails, 1 s . for the smilly fire, and 3d. for the wear of tools. Net earnings, $\$ 4.77$ per week-the united earnings of three industrious, sober persons.
The saddest feature of this husiness is that the young women should be allowed to work at the machines called "alives," heavy machines made of iron and working with a treadle, employed in flattening the heads of the large eight inch bolts. *Hundreds of women work at these machines, and do not earn over $\$ 1.25$ a week, and this work has been done in this way for a century. The poor operatives scarcely have an additional comfort over what was obtainable a hundred years ago.
The effect of such work and such surroundings upon the morals of the community are what might he expected. We bave no reason to believe the picture at all overdrawn which describes the young momen as livingmost wretchedly. Not only do they marry early-several girls not over seventeen being pointed out to Mr. Porter as mothers of children two and three years of age-but the London Standard tells a story appalling for its wretchedness. According to that journal, " women within a few days of their confinement have been known to work in the agony of exbaustion, in order to earn a few pence at the 'hearth'-not the 'hearth' of home, but tbe hearth of the 'forge'; they have been known to return to work in a day or two after childbirth, maciated in constitution, weak and weary for the want of simple nourishment. Their children, ragged and ill fed, have bad to lead miserable and wretched lives, with no hope before them but a life of wickedness and vice."
It goes without saying that the remedy for such a state of lavery is emigration. The United States may not be a paradise where gold grows in the streets and diamonds crystallize on trees; but it at least is a country where sucb squalor and wretchedness are comparatively unknown. And in this condition of affairs as is here described some of our large manufactories may find a bint for their supply, and no
form of philanthropy could convey the spirit of a $t$ uer bene-
and, we may add, leisure as well, which are to be met wi
in so many of the industrial towns of the United States.

## HOT AIR FOR BOLER FURNACES.

The use of hot air for feeding the furnaces of boilers for generating steam where the heating of air is accomplished by conserving the heat of the waste products of combustion, and also the exhaust steam from engines and other sources, has been applied with much profit and satisfaction in a large establishment in this city, where its adoption has resulted in a decided saving in the consumption of coal, as indicated by an evaporating power of seventeen pounds of water to the pound of coal. In addition to this, one of the serious troubles and sources of waste in the ordinary methods of firing, viz., the slicing and cleaning of fires, is avoided. In this case it is done ouly at the end of the day. In this apparatus, the draught power of the great chimney is alone sufficient to overcome the friction of the air in passing over the large surfaces of the heaters.
The first increment of heat is received by the air from a large surface condenser, into which the exhaust steam from the various engines and other appliances is discharged.
The temperature of the air after leaving the condenser ranges from $150^{\circ}$ to $175^{\circ}$, varying with the temperature the external air
It then enters the pipes of a flue heater, consisting of a chamber placed between the boiler and the chimney and crossed by a large number of thin cast iron pipes arranged in sections, so that the air cnters at the end next to the chimney, or coolest end of the heater, and emerges at the end next to the boiler, or hottest end; where the temperature as observed by a pyrometer, is found to be from $375^{\circ}$ to $400^{\circ}$ Fahr., at which temperature the air is drawn beneath the grate bars.
At several places, or between the doors, are inserted in the boiler setting a number of pipes with dampers, connect ing the ash pit with the fire chamber, so that a part of the hot air, as regulated by the dampers, can be thrown into the fire chamber for perfecting the combustion of the gases. The pressure carried in this boiler, which is of peculiar construction, is 110 pounds per square inch.
The appearance of the pea coal upon the grate, and the combustion of the gases, as observed through the peep ooles, are highly characteristic of this system.
The coal appears of a dull red color, while the activity in the motion of the gases in the combustion chamber is remarkable.
In this condition of the fire, no clinker is made, while the cal seems to be partially xaporized, and the combustion ompleted above its surface.
The coal is fed in in the usual way, at intervals of one-bal to three-quarters of an hour, in thin sheets; the grate carry ing at no time a greater depth than six inches.
At the end of the day's firing the coal is allowed to burn down, when the fire is hauled from the grate, a new fire being built every morning.
No clinkers are found in the ashes and debris hauled from the grate; the fire bed does not become hot enough to form clinker.

In trials made by alternating a cold draught with the hot air draught, some similar effects were noticed. Upon closing the damper of the bot draught inlet, and also the dampersof the flre chamber convections, and opening the ash pit doors, so as to give the fires a cold draught as in ordinary boiler furnaces, the coal began to brighten and finally became white hot within the mass
The volume of flame in the combustion chamber decreased; the pressure fell in a short time from 110 pounds to 90 pounds, showing very vividly that the combustion was going on within the coal bed instead of above it. In a short time the fires began to clinker, and recourse was had to 60 square feet with eight doors, was no on a grate of
The experiments seem to have fully confirmed the value the hot air draugbt, and to findyyestablish it as an improvement parallel with the bot blast in the iron furnace.
It has been in constant use for several years. Its only objection seems to be the large cost of the heaters.

## SWEARING BY TELEPHONE.

A quite practical question from an ethical point of view has just been decided, involving the morality of the tele-phone-whether one using its facilities is entitled to prostitute them to the furtherance of profanity; in .other words, is a man entitled to swear by,telephone, a nd will the courts protect him in the use of the telephone for that purpose ? case involving this issue came up recently in an Ohio解, where a party who used the telephone was addicted He was repeatedly requested to sease his profanity, but He was repeatedly requested to sease his profanity, but
refused. Then the company attempted to take the instrument away, and suit was brought to prevent them from doing so. The company had a rule prohibiting the use of improper or vulgar language" in telephonic communicaions; and under this regulation they rested their right to emove the instrument. After hearing argument the court held that the company's claim was good, and that they had an unquestioned right to remove the instrument. In rendering his decision the judge said: "The telephone reaches ito many family circles; and it must be remembered that it is possible, from the pecufiar arrangement of the instru-
ment, that a communication intended for one individua each another. All communications should therefore be in proper language. Moreover, in many cases the oper ators in the exchanges are refived ladies, and, even beyond this, all operators should be protected from insult." And so that instrument was removed and that swearer's profanity is not to be spread over the country by electricity. Probably good law, and undoubtedly good morals.

## A New System of Treating Fecal Matter.

At a recent meeting of the a paper was read by Mr. Harry Olrick on the above subject, of which the following is an abstract: The almost universal system of water home sewage adopted when a city is near a river has given rise to a very grave inquiry as to whether this sbould not give place to some other method of disposal and utilization, which will not pollute the rivers. The pail system, apart from a sentimental view of the case, seems to work well in such towns as Manchester, Birmingham, War rington, Rochdale, and others, the board of health of Man chester claiming that since the adoption of this system the cases of zymotic diseases have greatly decreased. They like numerous other towns, are making manure out of fecal matter, besides treating and utilizing the otber large amount of refuse, and although doing a considerable amount of work which does not produce revenue, they are not only self sustaining, but work at a profit. The vew system which the author calls particular attention to has been worked out by Baron De Podewils, of Munchen, and is claimed to be an improvement on otber systems, from the facts that the operations of the factory are comparatively automatic, that no unpleasant odor can arise, since the operations are all performed in closed vessels, that by a system of quadruple evaporation the fuel necessary is reduced to a minimum, and the resultant manure is of high quality, and is sold at from $£ 9$ to $£ 10$ per ton.
A factory has been erected by the Baron at Augsburg, in Bavaria, which is designed to deal with the excrement of about 17,000 inhabitants, or about 7,000 cubic meters per annum. The fecal matters are deposited in air-tight tanks, the gases generated being drawn under the steam boiler and burned. From these tanks the matter is drawn into a mixer provided with revolving arms, where a proportion of sulphuric acid is added; the effect of this is to generate carbonic acid and other gases which are conveyed away to be burned. From the mixer the fecal matter is forced into a fumigating pan; this pan is provided with hollow revolving arms which curve down to the bottom of the pan. Part of the products of combustion from the steam boiler are induced through the fecal matter lyy way of the hollow arms, and pass away, together with the gases generated, through an exhauster to the furnace of the boiler. From the fumigator a monte-jus forces the matter into a series of four evaporators, the vapors of one serving to evaporate the moisture from the next at a lower temperature and helow atmospheric pressure, thus saving 75 per cent of the fuel ordinarily required to produce the same result. These evapo rators have a temperature varying from $140^{\circ}$ to $248^{\circ}$ Fabr. From the evaporators the monte-jus forces the by this time pasty mass into a tank provided with a bucket wheel. This tank is placed above tbe final drying machine, which accomplishes the most difficult part of the whole process, viz., evaporating the remainder of the 95 per cent of moisture originally contained in the fecal matter, when it has reaclied a peculiarly tenacious and sticky stage. This machine consists of steam jacketed ring-shaped plates, on which the pulp is thinly spread by means of a rotating spout attached to a revolving hollow spindle, which conveys the pulp from the overhead tank fed by the bucket wheel

After this layer has remained on the plate a few minutes it is scraped off by knives, also attached to the revolving spindle, and drops into a chute, whence it passes, by means of an elevator, into a disintegrator. This is the end of the process, a manure being produced in the shape of powder containing less than 9 per cent of moisture, 8 to 10 per cent of nitrogen, 3 to 4 per cent of alkalies, and 3 to 4 per cent of phosphoric acid, and consequently worth now as much as imported guano. This factory has been in operation nearly three years, and although laboring under the disadvantage of having to use coal as fuel at 23s. per ton, the proprietor has been alle to make 20 per cent dividends. Another factory has been erected at Stuttgart with equally good results. At Augsburg a pail system is in use. At Stuttgart the cesspool is general. The author calculates that with a population such as England possesses, manure weighing 600,000 tons, and of a low estimated value of $£ 4,000000$, is annually allowed to poison the air and water, instead of being permitted to return to the soil as Nature intended.

## Another Fast Ocean Steamer.

The Fulda is the name of a new ship lately built in Scot land for service between New York and Bremen. She is a magniticent vessel of 5,124 tons gross, built by John Elder \& Co., of Glasgow. The vessel lately went on a run extending over six hours, the trip being prolonged from Cumbrae Light to Corsewall Light, beyond the mouth of Loch Ryan, and back again. Over that great stretch of sea, and the time mentioned. with the tide against her both ways, she attained, says Engincering, the extraordinary speed of 17.803 knots, or upward of $203 / 4$ statute miles per hour, a speed which h s never yet been exceeded by any other great ocean steamer, with the exception of the Alaska and the Stirling, which were also built in Fairfield Shipyard.

