Correspondence.

How to Make Magnets.

To the Editor of the Scientific American:

It is frequently asked, "how to make and charge magnets." It is somewhat a vexed question. The plan of touching the steel to be magnetized to the pole of a dynamo is beset with this difficulty: The field is so large, and the currents so strong, that if one pole of a U magnet is laid on the pole of a dynamo, the influence of the polarity of the dynamo will extend beyond the contacting pole of the U magnet and partly destroy the polarity that should arise in the off or farthest pole of the U magnet. I have devised and successfully used a plan that I give to the readers of the SCIENTIFIC AMERICAN. First, I take good tool steel, harden at the ends, and draw the temper to a bluish straw color or edge tool hardness. Next, take a piece of one inch iron gas pipe, about eight inches long, then fill the hole from end to end with one quarter inch iron rods, filling the interstices with smaller iron wire. Dress both ends smooth. Now, if there is a friendly street car or electric light dynamo in reach, apply *one end of the gas pipe* to either pole of the dynamo, and draw the U magnet at right angles with the end of the pipe that sticks out. Apply the U steel about half way from the bend to the point or pole. Draw the U then down to the point until it leaves the pipe, then draw the U away, and apply in the same manner again, using care not to approach the U any nearer to the dynamo than the outer end of the gas pipe. Then take the gas pipe to the other side of the dynamo and treat *the other pole of the* U in the same way. I made a magnet in this way that held up four and five-eighths its weight, which is esteemed excellent magnetism. ROY A. CRIHFIELD.

[The above plan answers very well, but two rods of iron applied one to each pole would probably prove more effective. It would be necessary to clamp the two bars rigidly to prevent them from being drawn into contact with each other.—EDS.]

[FROM THE SUN, NEW YORK.]

The Starry Heavens in May.

The Lion watches in mid-heaven and Saturn rules the night. At 8 o'clock in the evening at the beginning of May the constellation Leo may be seen upon the meridian, its star-marked figure of a sickle standing upright in the sky near where the sun had been at noonday. Following Leo from the east comes Virgo, made doubly beautiful and interesting at this time because of the presence of the planet Saturn near its chief star Spica. Saturn is the brighter of the two, and is situated about five degrees north of Spica. By 10 o'clock they are so high up toward the meridian that Saturn can be studied to advantage with a telescope. Its rings are slowly opening wider, and the spectacle they present is unmatched in any part of the universe yet brought within the reach of human eyes. The nearest approach to the form of Saturn's rings that I have ever seen in the heavens is presented by a little nebula in the constellation Gemini, which I had the pleasure of viewing through the Lick telescope with Prof. Barnard last autumn. With most telescopes this object appears only as a rather curious planetary nebula, but with the great glass on Mount Hamilton it is seen to consist of a round, nebulous disk, having a star set in its center, and something like half way from the center to the circumference of the luminous disk is a circular division, looking exactly like a narrow black ring encompassing the star, and sharply contrasted with the glow of the nebula within and without. It seems impossible to resist the conclusion that this phenomenon possesses a real resemblance to the rings of Saturn, but in place of a planet it presents a sun, and, instead of a system of meteoritic rings 170,000 miles across, it shows us circles of glowing nebulous matter that may well be hundreds of millions of miles in diameter!

It ought to be the aim of every educated person to get a look at Saturn with a powerful telescope at least once in a lifetime. The first glance may be disappointing, but the second will make an unfading impression. There is no science in which seeing begets thinking as it does in astronomy.

But while Saturn holds the place of honor during the month, its more distant planetary comrade, Uranus, commands attention also. On the third, Uranus, still remaining near the star Alpha in Libra, will be in opposition to the sun, and in the best situation for telescopic observation.

It is a curious fact that all four of the first discovered asteroids, Ceres, Pallas, Juno, and Vesta, are now visible simultaneously, and three of them, Ceres, Pallas, and Vesta, are in the constellation Leo. Juno is in Serpens, just above Libra, and some 15 degrees from Uranus. Unfortunately none of them can be seen with the naked eye. These are the little planets whose discovery early in the present century led to the theory, now generally abandoned, that they were the fragments of an exploded world. The largest of them, Vesta, is probably not less than 300 or more than 500 miles in diameter. But since the discovery of the original four several hundred smaller asteroids have been found, and now celestial photography is adding dozens of them to the list every year. Some of these are, no doubt, only five miles or less in diameter. On a 5-mile world, if it had the same average density as the earth, a 200-pound descendant of Adam would weigh only two ounces; and a cannon ball dropped from his hands would require a quarter of a minute to reach his toes; and it wouldn't hurt when it hit. He could hurl a stone that would weigh a ton on the earth with such velocity that it would escape from the attraction of the little world and never come back to it.

The May moon begins its career on the 5th at 9:42 A. M., attains first quarter on the 12th at 1:21 A. M., fills on the 19th at 11:43 A. M., and reaches last quarter on the 27th at 3:04 P. M. Its visible course lies through many interesting constellations. As it emerges from the sun's rays it enters Taurus, meeting Jupiter and the Pleiades on the 6th. From Taurus it enters Gemini, passing on the way through a part of Auriga. On the evening of the 9th it will be near the celebrated twin stars, Castor and Pollux, and will serve to point them out to those who do not already know them. Crossing Cancer, with its strange glimmering "beehive," and its sprawling lines of stars outstretched in true crab fashion, the moon will enter Leo and be near the bright star Regulus on the evening of the 12th. Having traversed Leo, it will be found on the 15th in Virgo, south of the great Field of the Nebulæ, where those mysterious objects are scattered like thistle down over the face of the sky—an unfinished corner of creation which might well represent that wild abyss of chaos through which Satan took his flight when, as described by Milton, he went in search of the newborn earth:

> Fluttering his pinions vain, plump down he drops
> Ten thousand fathom deep, and to this hour
> Down had been falling, had not by ill chance
> The strong rebuff of some tumultuous cloud,
> Instinct with fire and nitre, hurried him
> As many miles aloft; that fury strayed,
> Quenched in a boggy Syrtis, neither sea,
> Nor good dry land, nigh foundered on he fares,
> Dreading the crude consistence, half on foot,
> Half flying, . . .
> O'er bog or steep, through strait, rough, dense, or rare,
> With head, hands, wings, or feet, pursues his way,
> And swims, or sinks, or wades, or creeps, or flies.

Unfortunately the light of the moon renders the observation of nebulæ exceedingly difficult, and the reader who wishes to explore this wonderful region with a telescope must wait until the end of the month, when, in moonless nights, the pale gleam of these unhoused ghosts of the sky, these uncreated worlds, will tantalize the sight, and awaken in him a new sense of the mystery of the universe.

Having passed close to Saturn on the 16th at noon, the moon will cross from Virgo into Libra, and will, on the morning of the 18th, pay its respects to Uranus. Thence on into Scorpio Diana's course will lie, and as, on the morning of the 20th, she passes Antares, that great red sun, which conceals a smaller bright green luminary in its blaze, her form will show the first evidence of decay; from the full moon phase she will have begun to decline toward last quarter and toward extinction. On the 21st she will be in Sagittarius, wading through the broad shallows of the Milky Way, which there spreads wide and divides into currents and pools interspread with islands of stars. On the 24th she will be in Capricorn; on the 27th in Aquarius, and at 3 o'clock in the morning of the 28th she will be very close to the planet Mars. From Aquarius she will pass into Pisces and Aries, and her fading form, become now a very thin crescent, will disappear in the rays of the morning sun at the opening of June, until, rejuvenated, she shines again in the sunset glow, the celestial queen of the month of roses.

Both Mars and Venus will remain morning stars during May, but Venus is fading, and Mars has not yet come into a position to command general attention. Next summer and autumn the eyes of the world will be upon him. Then the poet's dream will come true:

> And the first watch of night is given
> To the red planet Mars.

Mercury will be hidden in the sun's rays during the month, but it is interesting to follow that little world with the mind's eye, for on the night of the 22d Mercury, then on the opposite side of the sun from us, will be in perihelion, or at its nearest approach to the sun. This means a great deal more for Mercury than it does for the earth. Our distance from the sun varies only about 3,000,000 miles, which cuts no great figure in a total distance of more than 90,000,000. But Mercury, whose average distance from the sun is only 36,000,000 miles, is at perihelion 14,000,000 miles nearer to the solar furnace than at aphelion! When furthest from the sun that planet endures a degree of heat more than four and a half times as great as the earth receives, while when it is nearest to the sun, as it will be on May 22, it broils under a temperature eleven times as intense as that with which the sun warms the earth. All the water must be steam on the planet Mercury, except, perhaps, around the poles. As the summer heats come on we may possibly find some comfort in thinking how much worse it would be if we lived on Mercury. This world of ours evidently does not deserve the evil reputation that some people would fasten upon it. Our worst discomforts assume a pleasant aspect when compared with roasting on Mercury or freezing on Saturn.

But there is another thing to be considered about Mercury: apparently it is not blessed like the earth with the rapid alternation of day and night. Signor Schiaparelli, the authority of whose eyes is great among astronomers, says Mercury keeps the same side always facing the sun. If so, that world has a day hemisphere and a night hemisphere. Which is inhabited, if either? Can people live where the sun never shines? Can people live where the sun always shines? If they can endure the unending night on the sunless side, they may have some compensations; they can see Venus and they can see the earth, both more brilliant in their sky than any star or planet ever is in ours. On the other hand, if they choose to live on the sunward hemisphere of their world, their lot cannot be altogether a happy one. Accustomed as they may be to a greater heat than we endure, they yet have to face most trying alternations of temperature. They are now rushing toward perihelion with fast increasing velocity, for Mercury travels 35 miles in a second at perihelion and only 23 at aphelion, and we may well pity them as they whirl along out of our sight behind the sun, for three weeks from before the end of May they will be broiling under a temperature much more than twice as hot as that from which they suffered only three weeks previously.

But if this picture is unpleasing to the imagination, we can substitute for it another, in which Mercury appears as a barren rockbound globe—hot, dry, and hard-baked by the close and unclouded sun. And, indeed, the latest results of investigation favor the view that Mercury is a lifeless planet. But has it been always so? GARRETT P. SERVISS.

Sand as a Filtering Medium.

Dr. G. Gore has communicated to the Birmingham Philosophical Society the results of an experimental research on the "Decomposition of Liquids by Contact with Powdered Silica." By placing a solution of an acid, salt, or alkali, of known composition, which had no chemical action upon pure precipitated silica, in a stoppered bottle, adding to it 50 grains of the silica, thoroughly agitating the mixture, and after sixteen hours analyzing the portion, he found the chemical composition of the film of liquid which adhered to the powder to be stronger in the chemical than the solution itself. The amount of solid abstracted from the solution varies with the kind of powder employed, its degree of fineness, the kind of dissolved substance, the proportion of powder to it, the kind of solvent, the proportion of solvent to powder, the proportion of dissolved substance to solvent, and, in a small degree, with the temperature. The union takes place quickly, and prolongation of the immersion has but little influence. Finely precipitated silica possesses the property in the greatest degree, and alkaline substances are the most affected; with very dilute alkaline solutions more than 80 per cent of the dissolved substance was abstracted by the silica. The results appear to throw some light upon the purification of water by filtration through the earth and upon agriculture, and to show that the alkaline constituents of soils are retained much more by the silica than by the alumina. The effects of silica upon weak solutions of potassium cyanide indicate that the great loss of the latter substance in the commercial process of extracting gold and silver from powdered quartz is largely due to the "adhesion" of that salt to the silica. The results obtained with a very weak solution of iodine indicate a possible method of extracting the latter substance from solutions.

Limit of Employers' Liability.

An employe of the Buffalo Car Company was injured four years ago by the breaking of a belt on a planer, one eye being destroyed. He sued for damages in the Supreme Court before Judge Childs, in 1890, and the case was dismissed without the defense being heard. A new trial was granted by the General Term. This was held before Justice Ward in 1892, and resulted in a verdict of $3,000 for the injured man. The car company appealed and the judgment was sustained. The case was then carried to the Court of Appeals, which has just decided in favor of the car company. In the review of the case this statement is made:

"The master does not guarantee the safety of his servants. He is not bound to furnish them an absolutely safe place to work in, but is bound simply to use reasonable care and prudence in providing such a place. He is not bound to furnish the best known appliances, but only such as are reasonably fit and safe. He satisfies the requirements of the law if, in the selection of machinery and appliances, he uses that degree of care which a man of ordinary prudence would use, having regard to his own safety, if he were supplying them for his own personal use. It is culpable negligence which makes the master liable, not a mere error of judgment."