THE MOON'S FORCE.

After getting somewhat accustomed to the greatness and strength of a bar of solid steel 16¼ ft. square, imagine one which is one mile square, 5,280 ft. wide and as many thick. If it lay on the ground near the Catskill mountains, its upper surface would overtop their highest summit by more than 1,000 ft. It would be equal to 102,400 such monster bars as the last. Its lifting power would be nearly 240,869,000,000 tons. The mind is utterly unable to grasp such figures. The whole globe contains 1,200,000,000 inhabitants. If each man, woman and child could pull with a force of 100 lbs.—a large estimate—to move such a weight would require the united efforts of the inhabitants of 2,000 such worlds as this.

As I shall have frequent occasion to speak of the load which such a bar could sustain, I shall, for convenience, call it in round numbers 240,000,000,000 tons, neglecting the other figures, because the number is so inconceivably great that taking from it a billion or so of tons will alter the result less than one-half of 1%. This bar is to be the unit of measure, which I shall for the present employ, and with its help I shall attempt to give some idea of the influence of the sun in holding the system together, and of the attraction exerted by the planets upon our earth, and by the earth upon the moon; and, lastly, by the fixed stars upon the sun and upon each other.

We begin with the moon because it is nearest to us, and, with the exception of the sun, is to us the most important of all the heavenly bodies.

If a half dozen persons were asked how large the moon appears, they would give as many different replies: "The size of a cart wheel;" "Twelve inches across;" "The size of a dining plate;" "As big as a man's head;" etc. Probably no one would mention a smaller measure, yet a cherry held at arm's length much more than covers its disk. It is difficult to believe that so small a body exerts any considerable influence on the earth which seems so immensely larger. It is easy to admit that the earth holds the moon in its orbit; but that to do this, to bend its course into a nearly circular orbit, requires any great outlay of force, is not so clear. Our credulity would be taxed were we asked to believe that the moon in its efforts to move in a straight line would break away, although held by a bar of steel one ft. square, for that means a force able to lift nearly 9,000 tons. An astronomer would grant it, making first a mental calculation to see if he was justified in doing so; but even he would hesitate, and perhaps would deny that it was possible the moon could pull asunder one of those great unit bars one mile square, and equal to more than 27,000,000 bars each one ft. square.

But he would have no hesitation in saying "Impossible!" if told that, rather than change its course from a straight line to its present curve, our willful little satellite would snap like pack-thread not one, nor two, nor three of those unit bars, but the united strength of 10,000—or, in other words, one gigantic bar whose section is 100 miles square. Yet more than eight such bars, or more precisely, 87,500 unit bars, would but barely deflect the moon into its present path*.

* The non-astronomical reader may, perhaps, need to be reminded that the moon does not move easily and naturally in a circle—or ellipse—but that its path, if left to itself, would be a straight line—a tangent to its orbit. Consequently, the moon requires to be forced into a curve.

—*Popular Science Monthly.*

AN ADJUSTABLE LENS.—Dr. Cusco, of Paris, has invented a lens of variable focus, in which the pressure of transparent liquid is made to alter the curvature of the flat faces of a cylindrical cell of brass closed with thin glass discs; the pressure can be regulated by a manometer gauge to any required degree within the limits of working.

FILES AND FILING.—The following information may be found useful to some of our readers. A new file should always be used with light pressure on the work until the needle-like points of the teeth are worn away; after this a much heavier pressure may be used with much less danger of breaking off the teeth at their base. Many new files are violently diminished of half their efficiency by a few careless strokes when first applied to the work. Do not use a file on the chilled and gritty skin of castings, or on a weld where borax or any vitreous fluxes have been employed—no file can endure such usage. Every filer should keep a worn file with which first to attack the rough, gritty, or oxidized surface of iron work, and thereby pave the way for more efficient work with his sharp files. A piece of gritty or chilled casting that would rapidly destroy the cutting qualities of a new file would produce scarcely any damaging effect to a worn one. In filing steel, better results can generally be obtained by using files of a grade not coarser than "2d cut;" finer grades being employed according to the finish and delicacy of the work under manipulation. Users of files should always seek to discover the fitness or adaptability of cut and form of files specially suited to their work. No one should expect the best results from a file on brass or spelter which was intended for use on iron and steel. Care should be taken when purchasing files to see that the manufacturer furnishes full weight articles. This is always a desideratum, and especially in case re-cutting is desired. A full-weight file can be re-cut two or three times, while a light weight will hardly bear one re-cut and give satisfaction.

LIABILITY FOR INJURIES TO RAILWAY EMPLOYEES.—In connection with the discussion in England of the Employers' Liability Bill, the advocates of that measure have issued a paper describing the laws in force in France and Germany. It states that in Germany an Imperial law, passed June 7, 1871, and extended in 1872 to Alsace-Lorraine, contains a provision "that if any person is killed or hurt in the working of a railway, the proprietor is liable for the injury inflicted, so far as he cannot prove that such injury was inflicted by a higher power or by the fault of the person so killed or injured." A similar system exists in regard to mines and manufactures, and it is said to be common in portions of Germany for employers to club together to form accident insurance societies for the purpose of insuring the lives of their workmen. In France a general law applicable to employers, which also governs the operations of railway companies, contains a provision that "A person is responsible not only for the injury caused by his own act, but also for that which is caused by the act of persons for whom he is bound to answer, or by things which he has under his care." The French railway companies have established provident institutions for the benefit of their employees; but it is stated that even this precaution has not prevented frequent litigation in cases where men have been injured while engaged in the performance of their accustomed duties.—*Railway World.*

A CHEAP HAMMOCK.—Take a piece of Manilla matting from two or three yards long and a yard and a half wide, bind or hem the ends firmly, then fasten each end to a piece of timber. These pieces should be 5 ft. long, 2 inches thick, and should have holes bored about three inches apart the whole length. The matting is fastened by passing heavy twine from matting to hole, back and forth, really sewing the matting to the wood. For each end of the pieces of wood larger holes are bored, through which pass ropes to hang the hammock between two trees. This makes a cheap, comfortable and safe hammock. Being hung from four corners there is no danger of rolling out, and half a dozen children can swing in it at pleasure. —*Journal of Chemistry.*

TENDER MEMORIES.

The following lines will touch a sympathetic chord in many hearts: "I saw my wife pull out the bottom drawer of the old bureau this evening, and I went softly out and wandered up and down until I knew she had shut it and gone to her sewing. We have some things laid away in that drawer which the gold of kings could not buy, and yet they are relics which grieve us until both our hearts are sore. I haven't dared to look at them for a year; but I remember each article. There are two worn shoes, a little chip hat with part of the brim gone, some stockings, pants, a coat, two or three spools, bits of broken crockery, a whip and several toys. Wife, poor thing, goes to that drawer every day of her life, and prays over it, and lets her tears fall upon the precious articles, but I dare not go. Sometimes we speak of little Jack, but not often. It has been a long time, but somehow we can't get over grieving. Sometimes, when we sit alone of an evening, I writing and she sewing, a child in the street will call out as our boy used to, and we will both start up, with beating hearts and a wild hope, only to find the darkness more of a burden than ever. It is still and quiet now. I look up to the window where his blue eyes used to sparkle at my coming, but he is not there. I listen for his pattering feet, his merry shout, and his ringing laugh, but there is no sound. There is no one to search my pockets and tease me for presents, and I never find the chairs turned over, the broom down, or ropes tied to the door-knobs. I want some one to tease me for my knife, to ride on my shoulder; to lose my axe; to follow me to the gate when I go, and be there to meet me when I come; to call "good night" from the little bed now empty. And wife she misses him still more. Here are no little feet to wash, no prayers to say, no voice teasing for lumps of sugar, or sobbing with the pain of a hurt toe, and she would give her own life, almost, to awake at midnight and look across to the crib and see our boy there as he used to be. So we preserve our relics, and when we are dead we hope that strangers will handle them tenderly, even if they shed no tears over them.—*Rochester Union and Advertiser.*

STEAM DREDGING FOR OYSTERS.—Geo. M. Graves, of Oyster Point, New Haven, has now in process of construction an oyster boat designed for steam dredging. She is 71 ft. long, 17 ft. beam and 6 ft. deep, her engine 30-horse power and her screw propeller 53 inches. The boiler is on board and the work is being pushed as rapidly as possible. There is an over deck from 7 to 9 ft. high made water tight. In the sides of this over deck, in a line with the main hatchway, are openings, 6 by 8 ft., which when dredging open inwardly and are hooked to the ceiling. Through these openings the dredging is done by steam, saving the weary "back breaking" that attends dredging in the ordinary sailboat. Forward is the forecastle in which are berths or bunks for the crew. Directly over this is the pilot house, and back of this the captain's quarters. The expense of running this steam is for fuel not over $1 per day, 6 men at $15 to $20 per month for each. She will dredge in a day from 700 to 1,000 bushels, taking at each lift 12 or 15 bushels, while the sailing boat at each lift will not get more than a bushel or two at once, and during the day will be doing extremely well if she gathers 40 or 50 bushels.—*Sea World.*

MAKE YOUR OWN BAROMETER.—A sheet of paper, dipped in chloride of cobalt, when the weather is to be dry and pleasant will become blue, when wet weather approaches it will become pink. The barometer flowers of France are thus manufactured.

CUSTOMERS on a milk route in New Haven, Conn., are supplied by a woman who in all sorts of weather drives her rounds with unfailing regularity.