(represented in perspective in Fig. 4), the action is such as to cut and bruise the straw and, at the same time, extract the grain. The relative position of the two cylinders is horizontal, instead of vertical. The grain passes to a stepped iddle, from which the chopped and bruised straw falls to a econd one, and travels forward towards the front end of the macbine, dropping the grain still contained in it until (by the time it has reached the end, where there is a third roller for further bruising the straw, if desired) all the grain has been separated, and has fallen in the system of riddles beneath where it is exposed to the action of the blast, and is treate as in an ordinary machine.

## Corrsspoudence.

## The Relative Atraction of the Earth and the Sun

 To the Editor of the Scientific American:A correspondent suggests, on page 68 of your current volamp, the construction of scales, of the capacity of several tuns and of the utmost possible delicacy, in order to decide whether really the solar attraction causes, under the equator, a difference in weight at midday and midnight, and if so, to ascertain whether astronomers have not miscalcnlated the relative masses of the sun and the earth. This suggestion calls for a few remarks.
In the irst place, most delicate scalesare not those of great capacity, but those of comparatively small size. As the woight of any piece of machinery or structure in general increases as the cubes of the dimensions, very large scales
have a great deal of their, own weight to carry, which of have a great deal of their, own weight to carry, which of
course interferes with their relative sensitiveness. The proposition to make a scale of 10 tuns capacity, able to show a difference of some 34 lbs . more or less, suggests a delicacy of only 24 in 20,000 , or $~ ¢ \frac{1}{3} \frac{1}{3}$ rl part, and when weighing to within drams, a delicacy of one ten-thousandth part, of the oad. It is doubtful if large scales could be made of suc sensitiveness: while, on the other hand, the auperior kind of large sized chemical scales eazily indicate differences in
weight of a one millionth part of the load. Therefore, in weight of a one millionth part of the load. Therefore, in
place of taking 10 tuns, we mustrather make the experi ment with 100 grammes, and may then easily find the diffr ence to within a milligramme, which is the hundred-thou sandth part of the load.
But it must not be forgotten that the ordinary scales can cot be used for such an experiment, as the diminished gray itation will act equally on both sides, and the equilibrium when once esteblished, will not be disturbed by any change in the amount of gravitative attraction. In order to ascer tin the latter, we must counteract gravitation by other forces, for instance, those of springs; and if we suspend weight by a proper system of springs (spiral springs would be best) and notice the differentamounts of extension, under different conditions hut at the same temperature, we may arrive at some kind of measurement of the changes in th attraction of gravity. Such an arrangement was man years agn proposed by Sir John Herschel in order to practi cally verify the existence of the increased gravitative ac traction when nearing the terrestrial poles; he did not, how ever, propose to use it as an instrument of measure, but a a simple rough indicator; for mathematics applied to mechan ics give all the data for calculating these amounts to any de sired degree of accuracy. It is so with the subject in ques tion; the difference in the amount of solar attraction on errestrial bodies under the equator at midday or midnight has not only been settled, but, being the cause of one of the great tidal waves (the other wave being due to the moon) has been submitted to a series of rigorous calculations and observations. The result of these calculations, combined with some other considerations, has been that we have al ready come to the conviction that the mass of the sun, a hus far adopted, has been overrated nearly one tenth, and it distance one twenty eighth part; and that therefore al our astronomical tables have to be reduced by these two coeffic:ents, except the table of the elements of the moon, which is correct. The reason that this has not been done already is that thera is still a slight uncertainty in these coefficient of correction, which will be definitely settled this very year by the observations on the transit of Venus, by which we shall be able to aciomplish a full and precise settlement of this important question, and ascertain the distance of the sun and consequently its mass, with an accuracy far surpassing anything which could passibly be accomplished by experi ments on gravitation, which, at the very best, can demonstrate nothing more than the reality of the changes in the solar at raction, but not, with any available degree of accuracy, the amnunts of the eame
P. H. Vander Wetde.

New York city.

## Towers and Spires.

To the Editor of the Scientific American:
There is an admirable illustration in your paper of Janu ary 24 , showing the hight of some of the most famous struc tures in the world, in comparison with the iron tower whic it is proposed to ere at Piniladelphia as a centennial monu ment. It has occurred to me, however, that your readers might infer from the picture, or from the depcription of it, eat the epire of Cologne cathedral has already reached its pr jected hight of 501 or 507 feet. The fact is that it ha isen (or rather they have risen, for there are to be two of these lifty steeples at the west front of the church) only little abore the ridge pold of the edifics, which is about 250 feet high. The only completed spire is a slender ironone a the junction of the nave and transepts. I do not know the xact hight of this light and graceful pinnacle, but it cannot much exceed a hundred feet above the roof. The other
spires, which are marvels of Gothic grandeur and beauty, are $\$ \$ 128,258,655$ remained as net profit, so that as nearly as pos slowly working upward, and it may be many years yet before again in 1872 and the progress made in the interim was ap parently but slight
I may add that there are several very lofty spires that do not appear in your picture. The hight of the central spire of Rouen cathedral is a little greater than that of Strasbourg being $482 \mathrm{f} \in$ et, according to good authorities. It is an ugly affair of iron lattice work, built a few years ago to replace he ancient wooden steeple, burned in 1832. It forms a fearful contrast to the beautiful old towers of the west front, of which, by the way, there is an excellent picture in Black burn's "Normandy Picturesque," lately reprinted by Osgood \& Co. The author remarks: "The central spire in the back ground is really of cast iron, and stands out, it is fair to say much more sharply and painfully against the sky, than in much more sharply and painfully against the sky, than in bring himself to copy with literal truth this disfiguring lement in the building.
Another of the loftiest spires of Europe, and a really fine ne, is in Bruges, in Belgium. It is the steeple of the ven orable church of Notre Dame, which dates back to the 12th century. The spire, propenly $\varepsilon$ called, was rebuilt a few jears since, the original one having begun to lean and threat. ening to fall. Its hight is given by Baedeker, in the first edition of his "Belgium and Holland," as 442 English feet but in the second edition (1870) it is put at 468 feet. I have een it elsewhere stated as 450 feet. Taking the most mod. rate of these figures, it is certainly one of the two or three allest steeples in Europe or the world. It looks taller than the Strasbourg spire, probably because there are no very high buildings near it. Like many of the Belgian steeples, it is built of brick, and, though it lacks the profusion of Gothic rnament that makes the Strasbourg spire so beautiful, it is emarkably graceful in itsoutlines, and altogether one of the most admirable structures of the kind that I have seen. The chancel is the one that contains the tombs of Charles the Bold and his daughter Mary, world-renowned as works of monumental art.
The highest spire in Great Britain is that of Salisbury ca hedral, commonly put at just 400 feet; but the tallest rections of any kind are two chimneys in Glasgow, which are respectively 450 and 468 feet in hight.

## Application of Dr. Vogel's Recent Discovery in Photography.

To the Editor of the Sciencific American
The interest which you and some of your readers take in photograp hy may render the following worthy of note:
Dr. Vogel has discovered that a sensitive collodion film of odide of silver, when covered with some coloring matte which obstructs certain rays of light and does not interere with other rays, becomes sensitive to those other rays, hat is, those rays which ars obstructed act photo graphically upon that film, just in proportion as they re obstructed. If the yellow rays are stopped, then the film becomes sensitive to yellow light, and yellow objects which have heretofore been considered non-actinic, can thus be photographed as easily as blue objects have been. If this be so, then it is one of the most important discoveries that ave been made in photography since the discovery of that art. It will enable us to depict objects of all colors, the inability to do which has been a great stumbling block in the way of photography. I need not mention the numerous ways in which it may be applied: suffice it to say that hereofore only one of the four primary colors has been considred to be actinic, that is, the blue. As to the theory of the bo ve, you are well a ware that there are two theories regard ng the action of light on the sensitive film, one called the chemical, the other the physical theory. In the first, it is laimed that the reduction of the silver is done while the ight is acting upon the film. In the second. it is claimed that a tremulous or vibratory motion is communicated to the film by the vibrations of light; and that when the devel oping solution is applied, the reduction takes place. In either ase, it is the vibration of the light that does the work. The eason why iodide of silver is more sensitive to the blue ray is, it is thought, that the wave length of that ray coin cides more nearly with the size of the particles of the iodide of silver, thereby disturbing or tearing them apart more. I a sensitized iodide of silver film be held before white light, it will be seen that the only color apparent is the orange and that blue objects appear black when viewed through it showing that the blue rays are all obstructed. That film is therefore sensitive to blue light. Again, suppose we give that film a blue color, then the orange or yellow rays are stopped. As action and reaction are equal, the amount oi resistance exerted by the film is equal to the amount of light stopped; and the ray which is then most obstructed has the reatest action on the film. Taking this view of the matter it keems to me quite reasonable that any ray may be made
D. C. C. actinic
New York city.
The Railways of Great Britain
The leading featuras of the railway systom of the United Kingdom, at the end of 1872 , may be thus summarized: A otal sum of $\$ 2,845,236,730$ had been expended on 15,814 miles of railway, or nearly $\$ 180,000$ per mile. There wer 0,933 locomotive engines, or about 1 to every $\frac{2}{3}$ of $q$. mile and 337,899 vehicles, or about $21 \frac{1}{3}$ per mile, besides the wagons of traders and companies other than railway companies. By the running of trains for $190,920,719$ miles $\$ 256,520.570$ wero received during the year, of which $\$ 128$, 61,915 were expended in working and maintenance $\$ 128$,
ble one half the gross receipts were expended in earning them. There were 422,874,822 passenger journeys, besides 272,342 season ticket holders; and $179,302,121$ tuns of rood and minerais were conveyed. The average rate of dividend on ordinary capital was 514 per cent, and upon the total capital 4.95 per cent, including $\$ 164,507,380$ of ordinary capital, part of $\$ 212,913,135$ of total capital, which rectived no interest or dividend. The average cost of working each train was 64.64 cents, per mile, and the average rectipt from each train was $129 \cdot 12$ cents per mile; so that the average net profit from each train was 4.58 cents per mile; while the total cost of working was $\$ 8,110$ per mile, and $\$ 16,220$ per mile was received.

## ASTRONOMICAL NOTES.

Obselivatory of Vabsar Colleqe.
For the computations of the following notes (which are approximate only) and for most of the observations, I a Postitions of Planets for February, 1874.

Mercury.
Un the 1 st Mercury rises at 7 h .24 m . A. M., and sets at $4 \mathrm{~h} .58 \mathrm{~m} . \mathrm{P}$. M. On the 29 th , Mercury rises at 7 h .26 m . A. M., and sets at 7 h . 18 m . P. M

It should be looked for after sunset during the latter part the month, as it reaches its greatest angular distance from the sun on the 2d of March.

## Venus.

Venus rises on the 1st at 7 h .6 m . A. M., and sets at 4 h . 42 m . P. M. On the 28 th it rises at 6 h .50 m . A. M., and sets at 5 h .48 m . P. M.

Venus is very unfavorably situated for observation保 ith the sun, and its apparent diameter is very small

Mars.
Mars rises on the 1 st about 9 A. M., and sets before 9 ए M. On the 28 th it rises about 8 A . M., and sets before 9 P.M. It will be seen that it is above the horizon during the day ime, and can be seen only for a few hours after sunset.

## Jupiter

Jupiter is coming into better and better position. It rises on the 1 st at 9 h .15 m . P. M., and sets at 9 h .25 m . A. M. On the 28 th it rises at $7 \mathrm{~h} .16 \mathrm{~m} . \mathrm{P} . \mathrm{M}$., and sets at 7 h .30 m . on the morning following.
The various changes of the moons of Jupiter can be seen with a small telescope. On the 17th, (according to the American Nautical Almanac) the largest of these satellites will pass between the planet and the earth, and seem to traverse the disk of Jupiter. A powerful telescope will show it projected upon the planet's disk for several hours in the evening, while to glasses of low power Jupiter will aprytar to have but three moons.
The same phenomenon can be seen on the 24tl!, but at a later hour of the night, and again on the 3 d of March, as this satellite revolves around Jupiter in about 7 days.

Saturn.
Saturn is above the horizon in the day time, rising at 6 h . 59 m . A.M. on the 1 st , and setting at $4 \mathrm{~h} .35 \mathrm{~m} . \mathrm{P}$. M., while on the 28 th it rises at 5 h .20 m . A. M., and sets at 3 l .5 m . P. M. It will be seen that it is useless to attempt to make observarions upon this planet.

Uranus.
On the 1st Uranus rises at 4 h .44 m . P. M., and sets at $\mathrm{i}_{\mathrm{h}}$ 9 m . A. M. On the 28 th it rises at 2 h .52 m . P. M., and sets at 5 h .16 m . A. M. of the next morning. As its northern de clination is about $19^{\circ}$, it attains an altitude of about $i_{i}^{\circ}$ when on the meridian, which it passes at midnigbt on the 31st of January, and near midnight during the first half of the month. It is among the stars of Cancer, can be readily found with a telescope of moderate power, and will be known from a star by its showing a measurable disk.

## Neptune.

Neptune can be seen well only by means of a powerful elescope at any time, and at present is not well situated. It mes to meridian on the 1 st at 4 h .51 m . P. M. and on the 28th at 3 h .7 m . P. M.

## Barometer and Thermometer.

The meteorological journal from December 14 to January 7 gives the highest barometer, January 17, 3048 , the lowest barometer, December 28, $29 \cdot 33$; the highest thermometer, January 4, at 2 P. M., $52^{\circ}$; the lowest thermometer, Jaruary 17 , at $7 \mathrm{~A} . \mathrm{M} .,-1.5^{\circ}$

## Amount of Rain.

The snow and rain which fell between the morning and vening of December 19 amounted to 0.27 inchee.
The rain which fell between the morning and evening of anuary 2 amounted to 0.3 inches
The rain which fell between the afternoon of January 5 and the evening of January 7 amounted to 3.2 inches.
Auroras were seen on the evenings of January 15, 16, and 17.

## Sun Spots

The record extends from December 17 to January 19, inclusive, observations being omitted during the holidags on ccount of the absence of the observer. The clear days of the remaining time were the 15th and 17th of December, the 9 th, 10th, 17 th, and 19th of January. Spots have been small and generally few. Those of the 9 th aud 10th were identical in appearance, their positions only differing by the motion of the sun on its axis. On January 19, eleven were scattered over the disk, eight being in pairs, the remaining three solitury. Some of these were identical with those of the 17th. Facule have been unustally scarce.

