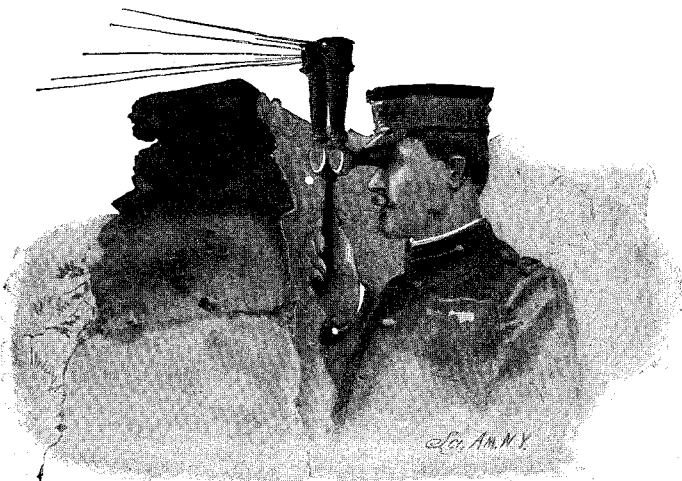


at a time without waiting for the gas to blow away. If they fired more, their position might be discovered by a cloud of gas and dust, sufficient to make them visible."

A SAFETY SPY-GLASS.

MODERN optical devices will not enable one to see through a stone wall, but they are quite equal to the task of seeing over one without making it necessary to raise the head above the top. This is quite convenient when the presence of sharpshooters on the other side makes sudden death the penalty of rashness in this regard. *The Scientific American* describes (January 5) a new military spy-glass that seems to fulfil all the



THE FIELD-GLASS IN USE.

Courtesy of *The Scientific American*.

requirements of the officer who values his safety and yet wishes to look at his enemy. It says:

"The ordinary telescope and spy-glass which military officers have used for more than a hundred years is gradually giving place to an instrument far more powerful and less likely to expose an observer to the long-distance fire of an enemy. The list of dead and wounded sent home from South Africa shows that the modern high-power magazine rifle has rendered the lot of the commanding officer far more hazardous than it once was. This increased danger and the great ranges at which modern battles are fought have been the chief reasons why the ordinary spy-glass has been found inadequate by the modern army officer.

"The new instrument consists of two tubes hinged together and carried by a central handle. Each tube is provided with an objective and with an eyepiece. By means of a system of total reflection prisms the image formed by the objective is so deflected that the eyepiece, mounted at right angles to the tubes, may properly present it to the eye.

"When the instrument is open, the distance between the two objectives is about sixteen inches. The lenses and tubes are so arranged that a stereoscopic effect is obtained.

"In order to make use of the stereoscopic spy-glass, the eyepieces are first purposely focused. Since, in the majority of cases, both eyes of the same person are not equal, the two eyepieces are focused independently. The instruments are regulated for a 26-inch spacing of the eyes, which is the average. For persons having eyes differently spaced, there is a very simple mechanism for regulating the apparatus. A marking arrangement permits of making such regulations once for all.

"The stereoscopic spy-glass may be employed in two different positions of the telescopes, one nearly horizontal and the other nearly vertical.

"The first position increases the spacing of the eyes through an optical illusion. In this position of the telescopes remote objects situated in different planes can be seen. The second position increases (artificially likewise) the stature of the observer. In both cases, the observation may be made from a place of concealment. For the horizontal position of the telescopes, the observer merely takes shelter behind a tree and allows the ends

of the instrument to project behind the sides of the tree. The observer [in illustration] can calmly make his observations while concealed behind a wall, with the two extremities of the apparatus carrying the objectives projecting above the obstacle."

The writer remarks that it is hardly necessary to dwell upon the utility of the instrument from a military point of view, and he quotes as follows from a report made by Lieutenant-Colonel Becker, of the Swiss army:

"With a common ordnance field-glass we observed, at a distance of about two miles, a trigonometric signal situated at the same height as ourselves and on the verge of a forest. It was impossible to recognize whether this signal was upon the very outskirts of the forest or remote therefrom. Upon making the same observation with the stereoscopic spy-glass, the signal appeared remote from the edge of the forest, and it was possible, besides, to estimate the distance that separated it therefrom at 40 or 50 feet. The artilleryman will at once recognize the advantages that may be derived from so precise an observation."

The writer concludes:

"The instrument under consideration magnifies ten times and embraces a linear field of 65 yards. Its weight is about a pound and a half, and it may be easily carried in a case."

CENTER OF POPULATION OF THE UNITED STATES.

ACCORDING to the official announcement of the Census Bureau, the center of population of the United States is still moving westward, tho at a decreasing rate. It has gone fourteen miles farther west since the census of 1890, and this movement is the smallest in any decade during the past one hundred and ten years. Says the *Pittsburg Post* (January 9): "The journey of this interesting little star, as it stands on the census map, tells a whole story in itself of the general movement and distribution of the nation's population in the one hundred and ten years which have followed the first enumeration." It gives the following table and comment:

Year.	Approximate Location.	Decade's Distance Westward. (Miles.)
1790,	23 miles east of Baltimore.....	..
1800,	18 miles west of Baltimore.....	41
1810,	40 miles northwest by west of Washington.....	36
1820,	16 miles north of Woodstock, Va.....	50
1830,	19 miles southwest of Moorfield, W. Va.....	39
1840,	16 miles south of Clarksburg, W. Va.....	55
1850,	23 miles southeast of Parkersburg, W. Va.....	55
1860,	20 miles south of Chillicothe, O.....	81
1870,	48 miles northeast of Cincinnati.....	42
1880,	8 miles southwest of Cincinnati.....	58
1890,	20 miles east of Columbus, Ind.....	48
1900,	7 miles southeast of Columbus, Ind.....	14

"The exceptionally long distance the center traveled from 1850 to 1860 was due to the rush to the California gold-fields following the discovery of gold in that State in 1848. The present comparatively small movement westward since 1890 tells of a large Eastern growth of population when read between the lines."

This announcement of the continued Western movement of the center of population seems somewhat surprising to those who have noted that the States east of the Mississippi made most of the large gains in the past decade. Such a movement, therefore, does not seem consistent with the known changes of population in the last ten years. The explanation, we are told by the *Cleveland Leader* (January 8), is to be found in the method adopted by the census authorities in finding the position of the "center":

"The Census Bureau does not get at the center of population merely by ascertaining the dividing lines, east and west and north and south, on each side of which half of the people of the United States live, and fixing the center of population at their intersection. If that method had been followed, the official bal-

ancing-point would always have been far east of the places where it has been located, and the changes of the past ten years would have resulted in an eastward, not a westward, movement. More than half of the gain in population has been east of the point taken as the center of population in 1890.

"The Census Bureau system is to take account of distance as well as numbers. The center of gravity, so to speak, is located by counting every person living 2,000 miles away as equal to ten persons only 200 miles distant. The gain of 100,000 population in Oregon or Washington may offset an increase of half a million in New York. That is what keeps moving the official center of population westward, and it is the only reason why there has been such a change in the past ten years.

"But even under the government system of computation the westward progress of the central point of the nation, in the sense of numbers and distance together, has been less in the decade just ended than it was in any earlier like period. . . . The indications are that the end of the movement is about reached. Henceforth the region east of the present official center of population will almost certainly increase much faster in the total number of inhabitants than the part of the country which lies west of the point where the national center of gravity is now located.

"Already the growth of the eastern half of the country is far outstripping the progress of the western part, and there is no reason to suppose that the future will change this state of things. The course of empire is not so much westward as it used to be, and many young men born in the West are reversing Greeley's advice and going East to grow up in the part of the country which has given the greatest and most impressive proofs of vitality and continuing development."

BACTERIOLOGY AND RELIGIOUS RITES.

MORE than one time-honored religious rite is the reverse of hygienic, and this has been particularly realized by scientific men since the recent development of bacteriology. A writer in *The Lancet* (London, December 1) says that the fact that bacteriology is a modern science, whereas religious rites and ceremonies date back as far as historical records will allow us to go, sufficiently explains the want of harmony between them. He adds:

"It would, indeed, have been a proof of marvelous prophetic intuition if those who first initiated religious ceremonies had foreseen and prepared for discoveries to be made many centuries later. Several of our correspondents have expatiated on the risk attending the promiscuous use of the communion-cup. This, however, is far from being the only risk of this description. The holy water in Roman Catholic churches is quite as serious a matter. The shallow, shell-shaped receptacle is placed barely three feet or so from the floor, so that the dust stirred up by the feet or shaken off from the persons who pass by readily falls into it. Innumerable fingers, not always scrupulously clean, are dipped into the water. Also, it is just at the moment of danger and trouble that the faithful are most prone to resort to their church for prayer and consolation. Coming straight from the sick-bed of some loved parent or friend, can we expect that the hands are always thoroughly disinfected before they touch the holy water? In Spain especially, and during the great cholera epidemic of 1885, we have noted that the holy water was absolutely dirty and living organisms could be seen with the naked eye, so what the microscope would have revealed may well be imagined. Now the fingers convey this water to the forehead and breast of the devotee, and of course the mouth might also be touched with the same fingers. But we do not see that there would be any lack of reverence shown if this holy water was changed more frequently, nor are we aware that it would be a sacrilege to mix with it some strong antiseptic solution. Again, at the Ahmed Mosque of Constantinople there is a small piece of the black stone brought from the Kaaba of Mecca. Against this piece of stone the true believers come and rest their heads for a considerable time. By so doing it is supposed that various illnesses can be cured, and as there are certain affections that can be favorably affected by the force of suggestion the results sometimes attained seem to

confirm this superstition. But tho a hard stone is less dangerous than water and germs of disease deposited upon its surface would soon be oxidized, still patients following each other in rapid succession might convey to one another pathogenic microbes. The same may be said with regard to the kissing of the toe of the bronze statue of St. Peter at St. Peter's, Rome. Would it be too much to ask that this stone, this bronze toe, and other similar objects of reverence and adoration should be frequently wiped with a rag moistened in an antiseptic solution? Why should science and religion be divorced one from the other? If we have been endowed with the intelligence to foresee a danger, may we not, with all due reverence, take the necessary precautions to ward off this peril? With regard to the communion-cup, Count Leo Tolstoy, in his recent novel 'Resurrection,' describes the celebration of the liturgy in the chapel of a Russian prison. Here the priest cuts the bread into little pieces and dips them in the cup containing the wine. Then with a spoon he places the piece of bread and wine into the penitent's mouth. Thus there is no drinking out of the cup, and it would be much easier to have a clean spoon for each communicant than a separate cup. This is the general practise of the Orthodox Greek Church, and one which lends itself better to sanitary precautions than that of the English Church and her sister communions, as we have already pointed out."

Bees and Mathematics.—The construction of geometrically perfect cells is not the only mathematical operation performed by bees, according to Abraham Netter, who has just read an interesting paper on the subject before the Paris Academy of Sciences. *The Revue Scientifique* reports that he brought out the following facts:

"Not only is the construction of the cells carried on by mathematical rule, but many other operations of the insects also; for instance, the collection of the maximum amount of honey in the minimum time, and the division of the workers among the plants proportionally to the number of plants of the same species. In the hives, the number of bees engaged in ventilation is almost rigorously proportional to the daily increase of weight of honey, etc. Facts of this order relate to arithmetical proportion, while those having to do with cell-building relate to geometric ratios."

M. Netter is of the opinion, however, in spite of this show of apparent intelligence on the part of the bees, that "all their movements, without exception, are of the nature of reflexes"; that is, performed without conscious action, just as we close our eyes instinctively when a motion is made toward them.—*Translation made for THE LITERARY DIGEST.*

SCIENCE BREVITIES.

A SURGICAL case that has been exciting much attention is that of Miss Rockefeller, daughter of the president of the Standard Oil Company. As described by Dr. Isidor Müller, a celebrated specialist of Vienna, in a lecture reported for the New York *Herald*, the left ear was "affected by the growing together of the 'hammer and anvil' bones. The trouble originated during the dentition period of infancy, and was so far advanced when the treatment began that the bone was partly destroyed. The left ear was apparently entirely deaf and the right was sympathetically affected. After a treatment of twenty weeks the affliction was partly cured, a new drum having been built and the old one entirely destroyed. The 'hammer and anvil' bones were separated by the insertion of gold plates, this measure enabling the drum to grow freely in places where this would have otherwise been impossible.

"NATURAL gas in the United States, according to the last annual report of the United States Geological Survey, has sunk to about one third, in its fuel value, of what it was a few years ago," says *Cassier's Magazine*. "In 1899 the production of natural gas equaled in consumption the heating capacity of 5,400,000 tons of coal. Ten years ago, when this industry was at its height, the equivalent of the heating output of natural gas was equal to about 15,000,000 tons of coal. Both the great gas-producing fields are reaching extinction. The Ohio division, which once had 480 pounds to the square inch, has now no rock pressure whatever. The original rock pressure in Indiana, once 325 pounds, averages now 165 pounds, showing that two thirds of the product has been taken out and consumed. Over a very considerable area of Indiana, covering an area of about 1,500 square miles, industries which were using natural gas are either discontinued, working at a disadvantage, or substituting coal. The effect of this is plain in various directions, particularly in reduced business and opportunities for labor in part of the State. The aggregate value of the gas produced in 1899 was \$20,024,864, a gain of \$4,730,051 over 1898. This is in part due to a slight increase in the cost, but still more to an increased demand."