The first section of this new cable was opened late in the evening of January 1, when the splicing of the deep sea portion to the shore end on the island of Honolulu was accomplished. The cable steamer "Silvertown," after successfully laying the 2,400-odd miles of cable in the depths of the Pacific Ocean, was obliged to stand by for several days and wait for a sufficiently calm sea in which to lay the Honolulu shore end, before the final splicing could be made. The laying of the shore end on the island was much more difficult because of the nature of the bottom, on which are many coral reefs; and if a calm sea was necessary to accomplish this successfully on the sandy San Francisco shore, it was imperative on the Hawaiian coast. As the shore ends of a cable are the most difficult portions to lay, the method of procedure being much the same, however, in every case, a brief account of the opening of this great enterprise by the laying and christening of the San Francisco end of the new cable, will be of interest.

An attempt was made on Friday, December 12, to bring the cable ashore, but this was frustrated by the strong currents and heavy surf breaking on the beach.

On Saturday, December 13, a piece of the cable, the total length of which is 2,413 miles, was cut off and coiled up on the deck of a light draught steamer, the "Newsboy." This piece used for the connection was 6½ miles long. As the "Silvertown" could not approach any nearer shore on account of her heavy draught—28 feet—it was necessary to employ a smaller steamer for laying the first six miles of cable.

Soon after 5 o'clock on Sunday morning, December 14, the "Newsboy" steamed out of San Francisco Harbor; and a little after 7, the anchor was dropped about half a mile to the south of Cliff House and about one-third of a mile from the ocean beach, to the west of the city of San Francisco. The morning was bright and full of sunshine, and the surf rolled in lazily in three lines, breaking gently. A boat of the United States Life-Saving Service rowed out through the breakers, carrying a light line, one end of which was given to the "Newsboy." This line was bent to a heavier line, to which the cable was attached. At 9:15 A. M., the end of the cable, with a balloon buoy attached to it, was dropped into the ocean, and a team of twelve horses began to haul it ashore. As the cable was paid out from the "Newsboy," balloon buoys were attached to it at intervals of ten fathoms, seventeen of them intervening between the vessel and the line of breakers.

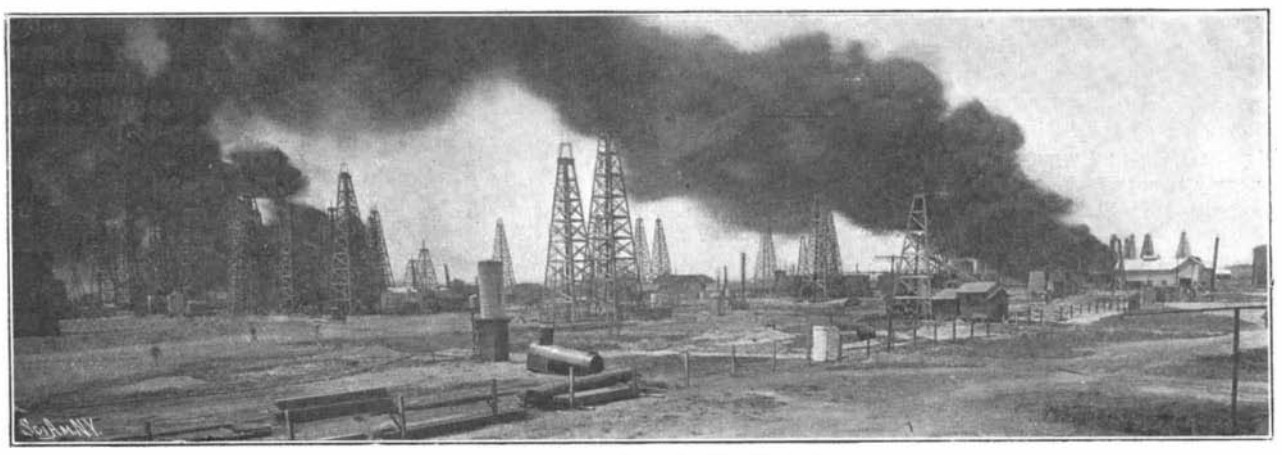
Shortly before 10 o'clock Mr. Clarence Mackay, Mr. Gage, the Governor of the State, his daughter, and others reached the beach, and the end of the cable was dragged out of the ocean on to the sand, and Miss Gage then christened the cable, dedicating it to the memory of Mr. John W. Mackay. The end which had just been brought ashore was then spliced to the end already in position. Meanwhile the steamer "Newsboy" was making her way out to the cable-ship "Silvertown," paying out the 6½ miles as she went. When all was paid out, the end was attached to an anchor buoy and dropped overboard till the "Silvertown" should be ready to pick it up and begin the work of splicing it to the main cable. It was past 6 o'clock in the evening before this work was finished and the "Silvertown" had started on her voyage to the Hawaiian Islands. At 8:55 P. M. a message from Mr. Benest to Mr. Mackay announced that all was well. During the whole trip, the cable was tested, night and day, in a cable hut built on the sand dunes about two blocks distant from the spot where the cable was landed.

A Typical Pipe Line, and an Open Ditch for Conveying Oil to the Earthen Reservoir

OIL FIRES IN THE SOUTHWEST.

BY DAY ALLEN WILLEY.

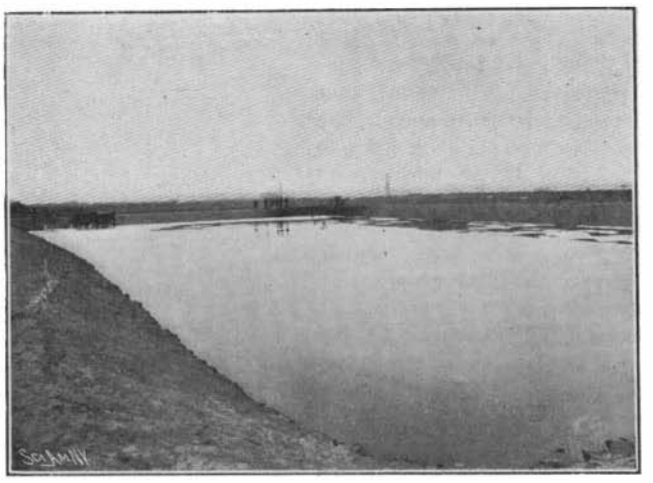
Since the discovery of oil in large quantities in the Southwest several of the principal districts have suffered great damage by fire, conflagrations being started by carelessness of employes of the oil companies as well as others, which have spread over an extensive territory and have proved very destructive to not only derricks but the pumping plants and reservoirs. Several fires of unusual magnitude have occurred in the Spindle Top district, while a few months ago one of the largest wells in the Jennings, La., region caught fire, the flames only being extinguished after several weeks had elapsed from the time the fire started.



A Fire in the Spindle Top District.

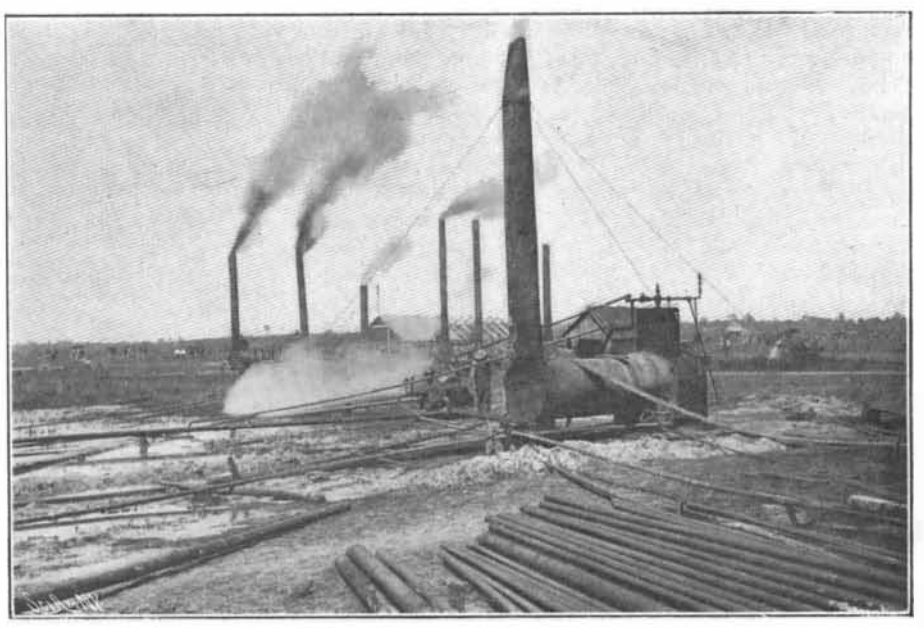
The conditions, especially in the Beaumont district, are such that the utmost precaution must be taken, owing to the highly inflammable character of the plants, also to the fact that much of the soil is literally saturated with oil. At present it is estimated that about 220 wells are being operated at Spindle Top, but fully three times as many derricks have been erected, some of them so close together that the end

A Lake of Oil.



The Great Higgins Reservoir in the Beaumont District.

Fighting the Jennings Oil Fire.



Boilers Used at the Jennings Fire, Showing Connections with the Pipe Lines.

HOW OIL FIRES ARE EXTINGUISHED.

of one framework almost touches another. The area of Spindle Top is comparatively small, and for two years oil has been secured through a natural flow and by pumping. When the gushers were first brought in, it will be remembered that so much enthusiasm was manifested over the great yield that some were allowed

to discharge their contents into the air merely in order to allow people to witness the spectacular display, which attracted crowds from the vicinity and advertised the region throughout the country. It would be impossible to estimate the immense quantity of oil which was wasted in this way, for no effort whatever was made to force the supply into tanks or even earthen reservoirs. It spread over the surface of the ground, filling the natural depressions in the prairie and even covering the beds of streams in the vicinity. It was stated that some of the great wells, like the Lucas gusher, flowed fully 50,000 barrels in 24 hours, but as there was no means of gaging the flow, these statistics are merely guesswork. There is no doubt, however, as to the enormous quantity which was wasted, probably aggregating over a million barrels.

After the flow had been controlled and the work of providing storage for the fluid was under way, months elapsed before sufficient reservoir capacity was afforded to provide for the yield, while the pipe lines to the seacoast were not finished until nearly a year after the discovery of the Spindle Top field. Not only were large tanks of sheet metal constructed, but reservoirs dug in the prairie and surrounded with merely earthen embankments to keep the oil from escaping. While some of these were served by pipe lines, a very large quantity of the oil was conveyed to them through narrow trenches dug in the prairie, ranging from a foot to four and five feet in width and from two to six feet in depth. They were not completely filled with oil, but such a proportion of the overflow from the wells was diverted to them that the quantity conveyed in these ditches at times was far more than that carried by the pipe lines. One of the earth reservoirs, known as the "Higgins," covered several acres in extent, and in fact was a lake of oil, in some places being nearly twenty feet in depth, while tanks were built ranging from 1,000 barrels upward.

Such has been the abundant yield of the fluid that gross carelessness has prevailed, especially in the Spindle Top district, in husbanding the supply. Much of the oil has escaped through leaks in the trenches; the pipes have frequently burst, discharging their contents over a large area, while many of the tanks have been so hastily constructed that they were not tight. In short, the oil has saturated everything, and merely the flame of a match thrown upon the ground has been sufficient, in several instances, to start disastrous fires. The first great fire in the Texas field is said by people in the vicinity to have been caused by a man going into a settling tank with a lighted lantern, the door by which the wick was ignited being carelessly left open. The flames coming in contact with vapor in the tank caused an explosion which immediately set fire to the interior. Another explosion threw burning oil against several derricks, which ignited, according to the statements of spectators, as if composed of tinder. Sparks were carried to a 4,000-barrel reservoir, which, in a few hours, was reduced to a mass of twisted metal. This fire practically destroyed property covering ten acres of the most valuable territory, and raged for two weeks. The greatest fire in the history of the Texas field was undoubtedly that in what is known as the Hogg-Swayne tract, which occurred in September last. At one time fifty wells were ablaze, and over one hundred derricks were destroyed, while twenty workmen employed in the vicinity lost their lives before they had time to escape.

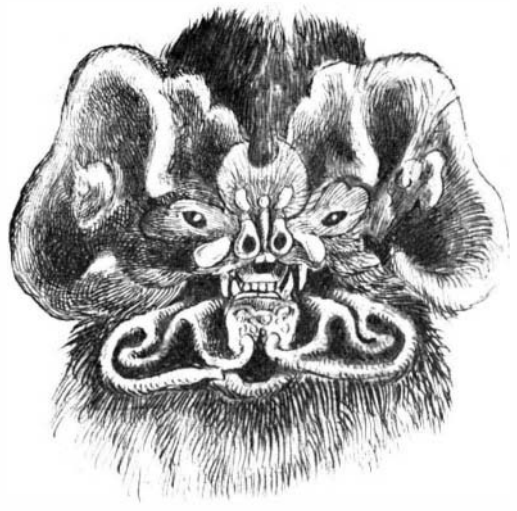
The great damage done by the first oil fires in the Southwest was in a measure due to the ignorance of the best means of fighting them. At first water was tried, but it merely made matters worse by spreading the burning liquid, having no effect whatever in extinguishing it. Then earth was used to confine the flames to a certain district. The "Ten-acre fire," as it is still called, was finally confined in this manner, several hundred men throwing up a bank of earth about the burning area which kept it from spreading to other portions, and finally the fire became exhausted for want of material on which to feed, when the embers were smothered by shoveling earth upon them. Soon after the drilling of the first gushers at Spindle Top, fire broke out during an exhibition near one of the small derricks. Fortunately it was extinguished by the spectators, who realized the great danger, and not only threw earth upon it but in some instances stamped it out with coats and blankets.

In recent attempts at fire fighting in Texas and Louisiana, however, steam has been used to good effect, and it appears to be the only effective means of extinguishing oil flames, as the earth is useless except after the fire has died down sufficiently to allow the shovelers to approach closely to the burning area. It was first tried near Beaumont by John Ennis of that city, the steam being applied through an iron pipe hastily laid and connected with the boiler of a portable engine removed to a safe distance from the fire. After the Jennings fire had raged for over two weeks Mr. Ennis was sent for to plan some means of extinguishing it, for, on account of the quantity of oil in the burning wells, it threatened to continue indefinitely. The nearest towns were searched for boilers which could be brought to the location, and twelve were secured in all, ranging from 20 to 30 horse power. They were set up in a semi-circle and a group of three or four connected to lines of iron pipes, which were laid to points as near the burning area as the men could venture in safety. Then fires were lighted in the furnaces and a full head of steam generated, which was turned upon the flames in jets. One group of boilers was continually held in reserve, so that its jet could be used when it was necessary to suspend operations in another group. In this way steam was continually applied to the fire for several days until the flames were so reduced in volume that they could be smothered with earth. Since then steam has been used in a number of instances, but in the Jennings fire the horse power of the combined boilers was far greater than in any other case.

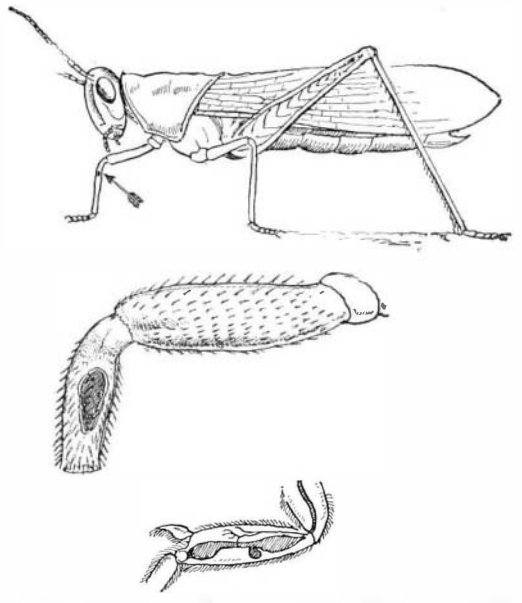
ARE THE SENSES OF THE LOWER ANIMALS SUPERIOR TO OURS?

BY J. CARTER BEARD.

It will at once be recognized that as we can possess no other knowledge of external things than that



Head of Bat (Mormopos blainvilli) showing peculiar sense organs.



Upper figure.—Grasshopper, whose ear is in his foreleg. Middle figure.—Ear of grasshopper, showing thigh and part of the tibia containing the ear. Lower figure.—Tibia of ant, showing an organ of hearing analogous to that of the grasshopper, but formed to hear sounds inaudible to the human ear.

Male and Female Mason Bee, marked with a drop of white paint for identification.

founded upon the reports which our five senses elect to bring us, our information must necessarily be bounded by their limitations.

But, although we cannot have any true or adequate conception of sense discernments belonging to regions beyond the powers and jurisdiction of our own perceptive faculties, we know that such regions exist, and it is demonstrable that they are, in certain cases, to a greater or lesser extent, accessible to many of the lower animals.

It is not easy perhaps to appreciate, in any just degree, the imperfectness of the few faculties we possess of perceiving external things, until a comparison is made between them and the perceptive capacities developed in other animals.

A multitude of living creatures, far below us in the scale of animated existence, might justly consider our senses, as contrasted with those they themselves possess, the veriest rudiments of such powers; an osprey, for example, which from the height of more than a hundred feet discerns beneath the wind-roughened water fishes no larger than the palm of a man's hand, and accurately measures with its eyes the distance its quarry swims beneath the surface; a barn owl, which chases and captures in the dark, bats whose irregular flight your eyes can hardly follow in the early twilight, would doubtless, could it compare our power of vision with its own, appraise it at so low a rate it might be scarcely worthy of the name; a bat, whose wonderfully constructed microphonic ears, nerve-netted wings, and strange foliated face organs, enable it, without coming in contact with the objects shrouded in utter darkness, to perceive and avoid them in its flight, must necessarily, could it know the extent of our powers of hearing and of our tactile sense, consider them extremely deficient; or a dog, which can unerringly select by its sense of smell any one particular duck out of a hundred, were he able to contrast the olfactory capacities of men with those of dogs, might have reason to pronounce the former almost entirely lacking.

The careful study of the sense organs of the lower animals and of the functional power and character of such organs, which has now been carried on for a number of years, has arrived at results that are not only very interesting in themselves, but which form extremely valuable and important data in the sciences of comparative physiology and psychology.

There is a wonderful analogy between the way in which waves of sound affect the ear and the way waves of light affect the eye. A ray of sunlight shining through a prism, and separated into the succession of colors called the spectrum, is only visible in part to human vision. Below the red at one end, and above the violet at the other, as we all know, are rays which are invisible to us.

The lowest tones audible to us correspond to the red end of the spectrum. Like the waves of light which constitute the red rays, those which fall upon our ears as the deepest are the slowest, while notes answering to the rapid, luminous vibrations composing the violet rays, are the lightest and shrillest the ear can distinguish. The possibilities of human color vision are limited to the seven rays of the spectrum, and those of human hearing to sound waves of between thirty (the slowest the ear can distinguish) to forty-five thousand to the second. Beyond these limits we are blind and deaf to sensations, of the existence of which, although our eyes and our ears are not of a nature to distinguish them, there can be no doubt.

A series of experiments was made, several years ago, with light of different wave-lengths on ants, to discover, if possible, whether or not the limits of vision in these insects were the same as in ourselves. After a number of observations demonstrating the fact that ants are sensitive to the ultra-violet rays which lie beyond the range of our vision, the question arose how two media, identical in color to our eyes, but one of which transmitted and the other intercepted the ultra violet rays, would affect the ants. A solution of iodine in bisulphide of carbon, and also one of roseine, carmine and indigo, combined in such proportions as to produce the same shade of the same color as the former, were prepared. To human sight the two liquid solutions were identical; but, in point of fact, the ultra-violet rays, shut out by the bisulphide mixture, passed freely through the other. Exactly equal quantities of these solutions in flat-sided glass bottles of the same size and shape were placed over a nest of the European black ant (*Formica fusca*). In no less than twenty observations the ants showed so decisively a power of discriminating between the two, and so decided a partiality for gathering under the bottle which shaded them from the ultra-violet rays, that no doubt remains that a radical difference between the two solutions was recognized and sensibly felt by them.

This series of experiments, taken in connection with many previously made and described, shows conclusively that the limits of vision in ants are not the same as in ourselves.

Now as every ray of homogeneous light is seen as a separate color, rays of light beyond the violet must reveal to ants a color differing from any we know, as these differ among themselves, a color of which we can form no conception.

Again, as the combination of all the colored rays