After one season the cottonwood branches used for posts took root and began to grow

At the end of the second season the fence became a dense growth of cottonwood saplings

A Protective Ditch Fence

TROUBLED with floods caused by storm waters continually overflowing and breaking out the banks of an emergency drainage ditch, the city engineer of Redlands, Cal., solves the problem at small cost by his ingenuity.

He noted that the City Park superintendent was trimming the cottonwood trees of Redlands and conceived the idea of utilizing the tree wood to build a fence along both sides of the troublesome ditch. The cottonwood trunks were cut in convenient lengths for fence posts and set three feet deep along the ditch banks. Some discarded railroad ties were also used in the work. To these posts wire netting was tacked and brush thrown behind the fence to keep the water from cutting the banks.

During the first winter floods the protecting fence had to be watched to prevent the rushing stream inundating it, but by the second year the cottonwood posts had sprouted roots and started growing firmly rooted into trees, which precludes them ever being washed away in the future.

Our Useful Servants: Magnetism and Electricity

By Professor J. A. Fleming

IN his third Christmas lecture at the Royal Institution Professor J. A. Fleming gave a description of some of the varied achievements of "The Electric Current as a Heater and a Chemist," commencing with some information regarding the measurement of electric force, declaring that the measurements depended on the power of the current to decompose compound substances. Then he showed them how to decompose water into oxygen and hydrogen, and after they had seen the hydrogen flare, as it might, on a larger scale, in a Zeppelin, they settled down to the mysteries of amperes, volts and watts. Silver-nitrate, which had an interest as a factor in photography, was also taken to pieces, and a deposit of silver was seen to pass from one plate to another. Silver, said the lecturer, was the best of conductors, its resistance being only one-twenty-fifth of that of platinum. It was through the resistance of wires that they became red-hot, so that heat was obtained for purposes of cooking and for warming rooms. But only a few metals would stand the temperature created by high resistance to the current. Platinum was too expensive and iron became destroyed by the oxygen of the air. Fortunately, however, an alloy of nickel and chromium had been discovered, and this it was that gave utensils an efficiency, equal to about 95 per cent. of all the heat employed. The different response of high and low resisting metals to the current was shown in a wire constructed of alternate sections of iron and copper. Iron, offering six times as much resistance as copper, quickly became red-hot, and gave six times as much heat.

The hottest place on earth, said Professor Fleming, was the crater in the positive carbon of an arc light. By means of the lantern and screen the audience was enabled to see how the arc sprang from one carbon rod to the other, and to appreciate the bright violet light, due to carbon vapor, also the blue vapor from boiling iron in the crater. With these carbon rods enlarged to a foot square in the arc furnace, which in different forms was illustrated by pictures, it could be imagined that the temperature of the hottest place was

indeed intense, and the value of the furnace in steel manufacture and for other uses could be realized. These furnaces and their purposes, one of which was the production of aluminum for framework of aeroplanes, were described, and the lecturer gave an account of storage batteries, stating that they were now used for driving submarines while under water, but the boats had to come up at intervals to recharge from dynamos driven by oil engines, and it was then "we got at them."

ELECTRICITY AS AN ILLUMINATOR AND DOCTOR

In his fourth lecture, on January 3, Professor Fleming dealt with "Electricity as an Illuminator and Doctor." Before electricity could be adopted as an illuminator, he explained, the properties of light must be understood, and, as light was transmitted in waves, it was necessary to comprehend these also. Above all, it was needful to know what electricity itself really was—a question to which, as the lecturer said, there was scarcely any answer twenty years ago. Electrons, whose relation to atoms was as that of a pin's head to the dome of St. Paul's, and which darted to and fro like gnats at 60 miles a second, produced a current

Protecting fence as first laid out

between the atoms, and, through bumping up against them, radiated light and heat; also, when they were stopped suddenly they propagated waves. This lesson was enforced by some pretty experiments. The hues of the prism as they revolved on the screen were seen to disappear until only a white disc remained, for white light was a combination of all the colors. The trouble was to get them all into the bulb. Red made a prompt appearance, but blue was shy, and demanded a higher temperature. Yet if the temperature was raised the wire fused unless it were of an expensive material like platinum, and therefore Edison made a carbon wire out of a strip of bamboo which he heated in an iron box. Other filaments were tried, and eventually success came with the use of tungsten, which was drawn to wire so fine that it could scarcely be seen.

Professor Fleming exhibited and explained various kinds of burners, showing how by automatic regulation the wastage of the positive carbon in the arc light was overcome, and evoking special interest by an account

of searchlights. He described high-frequency currents, which had virtue for medical purposes, and gave them illustration by the production of a miniature aurora-borealis in the form of a lovely ring of pink light. Finally, he dealt with the Roentgen rays, and, having shown how they were produced, demonstrated their uses in the treatment of wounds and for other purposes by the exhibition of a number of pictures, illustrating the transparency, not only of living creatures and their limbs, but of such solid objects as his own spectacle case, through which the spectacles could be seen. An unexpected faculty of the rays proved to be the detection of false diamonds, a real diamond being transparent to them, while the counterfeit was opaque, for it was not made of carbon but of silicate of lead.

ELECTRIC DYNAMOS, MOTORS, TRANSFORMERS AND RAILWAYS.

In his fifth lecture on Saturday last, Professor Fleming exhibited various dynamos on the screen which had been perfected with a steady current about thirty-five years ago, and explained how the difficulty of coupling the engine direct to the dynamo for the electric supply of ships had been overcome. It had been accidentally discovered that the dynamo was a perfect reversing machine, capable of converting the electric energy induced by steam back into mechanical power. Small electricians could now recognize that to all the intricate additions and modifications that had improved the dynamo was due the power of transmitting electric energy over long distances. Pictures of the great power station at Niagara, with its dykes and wells carrying the water from the upper river, transformers, and two-phase alternating machines were appreciated. Of three million horse-power running to waste at Niagara, 100,000 was now being transmitted for industrial and domestic use, so that electricians of the future could see that there was plenty for them to do. As we had no such sources of water-power, observed the lecturer, it behooved us to conserve our coal. Our system of many stations supplying different areas was wasteful, and we could economize by establishing super-power stations in a few areas. The American found it economical to use large machines, one of which, of 50,000 horse-power, was equal to ten of our stations put together. Professor Fleming also explained electric traction, and showed a picture of the electric shovel used in the excavations for the Panama Canal. This was so tractable that a child could work it, and altogether the audience carried away the gratifying impression that electricity was a very docile force when once the wire entanglements conducting alternating currents had been unravelled, and all the calculations for the measurement and application of energy had been worked out.—*English Mechanic*.

Flameless Photographic Lamp

THIS interesting little lamp works on the incandescent principle, and is specially useful for tourists. Any alcohol lamp, or a small bottle provided with a round wick, is used. The wick is spread out in a bunch just above the opening of the bottle, and when wet with the alcohol, place upon it the Barden "photo-incandescent cone," then light the wick, burn for five minutes, blow out, and the small piece of the substance will continue to absorb the alcohol and burn with a red glow without being consumed.