### The Government Work for Good Roads.

The work of the Office of Public Road Inquiries, under the direction of Gen. Roy Stone, has been marked during the past year by steady progress along its well-established lines. A great deal of work is accomplished by correspondence and by the gathering and disseminating of important information relating to various phases of the road subject. Many thousand copies of "good roads" literature have been distributed among farmers and other persons interested, and important road conventions have been attended by representatives of the Office, and many State legislatures have asked for and received assistance in framing new road legislation. Examples of steel road tracks have been completed in a number of different localities, and these experimental sections of steel road clearly demonstrated their usefulness for the Western States and for other places which are but sparingly supplied with good stone and gravel. When steel becomes cheap once more, the manufacturers can take the matter up and make a series of special shapes. The object lessons furnished by sample roads have been extensive, and sections have been built in several parts of the country. As a result of the investigations, the Office considers that for local needs as well as for our material development and prosperity a well-regulated system of public roads through the whole country is, day by day, becoming more necessary. While we have the most perfect railway system in the world, our public highways are and always have been inferior to those of any other country in the civilized old world. As our public roads are the veins and arteries of our agricultural, commercial, and social life, they are not yet receiving the consideration that their great importance deserves. Much has been done in the United States toward road building during the last few years, but much more needs to be done.

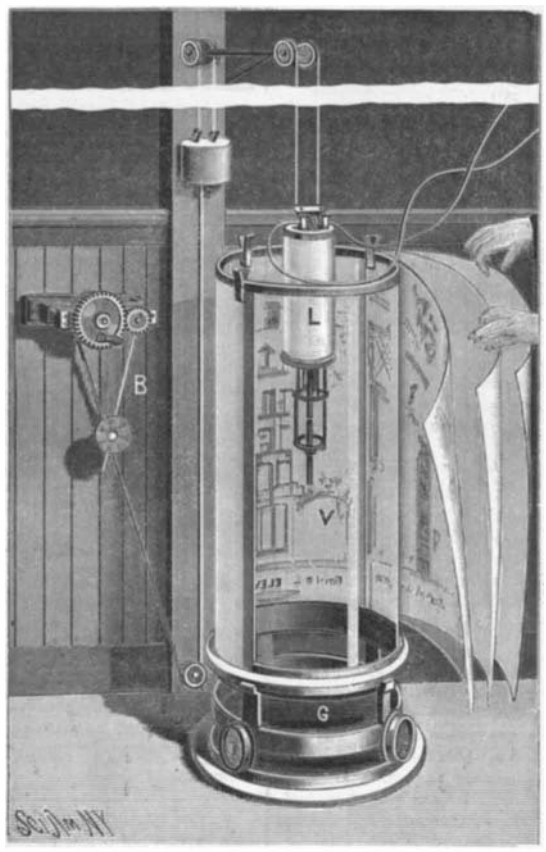
### REPRODUCTION OF WORKING DRAWINGS.

In the industries, there is a constant need of quite a large number of copies of drawings. In the building of an engine, for example, every piece is the object of a separate drawing that must be placed in the hands of the workmen who are to take part in its production. The original drawing would be quickly destroyed were it to pass in succession through the various shops, and it would be still worse with tracings, which it costs considerable to make. It has, therefore, become customary to make hasty photographic reproductions called "blue prints." For this photographic operation, neither camera nor objective is used. The drawing is traced, and the tracing serves as a negative. The printing is done in a frame through simple exposure to light, as in ordinary photo-copying. The paper used is sensitized with salts of iron, which are cheaper than those having silver as a base. The papers most widely used are those prepared with red prussiate of potash and ammoniacal citrate of iron. The solution is spread over the paper and allowed to dry in darkness. After exposure to sunlight under the negative, it suffices to wash the print with a large quantity of water in order to cause the drawing to appear in white lines upon a blue ground. The manipulation is, therefore, very simple, and so such paper is manufactured in large quantities for use in the industries. There are, moreover, varieties of which the composition is a little more complicated than that of the kind we have just mentioned, and which are more sensitive and require a shorter time of exposure. It will be readily understood, in fact, that in large manufacturing establishments rapidity of printing is a factor to be taken into consideration, and that, in winter, the want of sufficient light often causes much inconvenience. Besides, frames are always cumbersome and expensive, and become quickly deteriorated, since they are often handled without much care and are exposed to humidity as well as to the mid-day sun. In certain works, the electric light is used; but the ordinary flat frames do not lend themselves well to this kind of printing.

In the Panhard establishment, so celebrated for its automobile carriages, a very large number of blue prints is required, more than two hundred a day sometimes being made for the use of the different shops. As these must be made whatever be the state of the atmosphere, the house uses the electric light exclusively, but along with it an interesting apparatus of English manufacture that permits of easily turning out daily the number of prints above mentioned.

This apparatus consists of a cylinder, *V*, formed of two semi-cylindrical sheets of thick glass mounted in a metallic frame. The whole rests upon a base, *G*, provided with wheels that roll upon a circular rail. The tracing of the drawing to be reproduced is applied against the exterior surface of the glass cylinder and over it is placed the sensitized paper. The whole is then surrounded with a cloth which is fastened tightly with buckles. In the interior of the cylinder, is suspended an electric lamp which serves as a weight for actuating a simple clockwork mechanism, *B*, fixed to the wall. After the card has been wound around the drum of the mechanism and the drawings have been put in place, the pendulum is set in motion, and the lamp, *L*, then gradually descends in the cylinder, thus lighting the entire surface uniformly. The lamp is made to move more or less quickly, according to the degree of translucency of the tracing and the sensitiveness of the photographic paper, by regulating the position of the pendulum bob. It may also be made to travel up and down a second time if it is found that the impression is not sufficient.

The lamp employed operates with 10 amperes, and 120 volts. Two sheets of paper, 29·52 × 41·33 inches, are



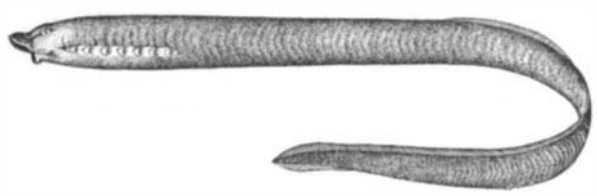

APPARATUS FOR PRINTING WORKING DRAWINGS.

printed at the same time, and forty prints can be made per hour. For the foregoing particulars and the illustration, we are indebted to La Nature.

### THE THREE-TOOTHED LAMPREY.

BY HUGH M. SMITH.

The fascinating pastime of photographing living animals is now receiving an unusual amount of attention and is contributing not a little to a knowledge of their habits and peculiarities. A class which has great attractions, and at the same time presents special difficulties is the fishes, which have been made the subject of recent photographic experiments in the United



THREE-TOOTHED LAMPREY.

LAMPREYS ASCENDING WILLAMETTE FALLS, OREGON.

States and Europe. Most of the camera studies of fishes have necessarily been addressed to fish in aquaria, as the opportunity rarely presents itself for getting satisfactory views of fish in a wild state. How many really good photographs of fish in the native waters have been made?

Some years ago, while fishing for salmon at the Falls of the Willamette River, near Portland, Oregon, the writer was able to take an instantaneous view of a group of curious fish-like animals which were endeavoring to surmount the falls; these were three-toothed lampreys, and the photograph is here reproduced.

The three-toothed lamprey (Entosphenus tridentatus) which is called "eel" everywhere on the west coast, inhabits the waters of the Pacific States from the Aleutian Islands to Southern California, and is a large anadromous species, especially abundant in the basin of the Columbia River. It is not eaten, but is considered a good bait for sturgeon, and was at one time extensively used for this purpose.

The lampreys in spring and summer ascend the Columbia in large bodies, and push their way to the headwaters of many of the tributaries for the purpose of spawning, many being then caught in salmon wheels. The furthest point to which they have been known to migrate is Lower Salmon Falls, Idaho, on the Snake River, 1,000 miles from the ocean. They are frequently seen at falls, dams, and other obstructions, which they assiduously endeavor to surmount, clinging to the rocks and so engrossed with their efforts that they are oblivious to the presence of man and may be picked off by hand.

In June, 1894, the rocks in the particular part of the Willamette Falls where the salmon are wont to ascend were at times completely covered with large-size lampreys. In places where the force of the water was least, they formed a slimy, wriggling mass several layers deep, and at a short distance the rocks looked as though covered with a profuse growth of coarse seaweed. A lamprey dislodged by the current or by an angling rod, or forced to give up its hold by exhaustion, would sometimes carry half a dozen others with it to the bottom of the falls. At the side of the cascade, where the rocky walls were quite steep, numbers of lampreys, to avoid the current, had drawn themselves entirely out of the water or remained hanging from the rocks with only their tails in the water; some of these are shown in the engraving. In the turbid water beneath the falls hundreds could be seen trying to secure a position on the rocks, some being those which had been swept down in previous attempts and some fresh arrivals from salt water. This noteworthy run had been in progress for about a week. It seemed to the writer that only a very small part of the run could ever surmount these falls, over which salmon must have been able to pass with the greatest difficulty. The bodies of many of the lampreys showed the effects of their trying ordeal; the posterior part of some of them was worn off fully one-fourth the body length by being whipped against the rocks while their heads remained fixed; and numbers were seen to lose their hold and float away, emaciated, covered with ulcers and fungus, and apparently dead. During a number of hours, not more than two or three were seen to reach the crest of the falls and disappear over the edge.

The upward progress of the lampreys was accomplished by fastening themselves to the rock by means of their suctorial mouth and gradually working their way upward by loosening their hold for an instant while propelled by a sudden springing movement of the body. In the face of such a torrent of water, their upward course was necessarily very slow, as their hold on the rocks could be relaxed for only the briefest period.

Associated with the species are the names of a number of persons prominent in the early exploration of the great Northwest. The first specimen known to science was obtained at the Falls of the Willamette about 1830, by Dr. Meredith Gairdner, an employee of the Hudson Bay Company at Fort Vancouver (Wash.), whose manuscript description of the species was published by Sir John Richardson in 1836. About 20 years later, Dr. Charles Girard, the ichthyologist of the great Pacific Railroad surveys, redescribed the species from Astoria, naming it in honor of John Jacob Astor.

### The Current Supplement.

The current SUPPLEMENT, No. 1267, has as a frontispiece a view of the foyer of the Théâtre Français at Paris. "The Facilities Afforded by the Office of Standard Weights and Measures for the Verification of Electrical Standards and Electrical Measuring Apparatus" is an important paper. "A Simple Illumination Photometer" gives working drawings. "The German Antarctic Expedition" is a very full paper.

### Contents.

(Illustrated articles are marked with an asterisk.)