

## ROENTGEN PHOTOGRAPHY.

The fish shown in the cut is a most beautiful example of Roentgen photography. It was taken by Prof. Vicentini, of Padua, Italy, and has been aptly commented on as looking like a fossil fish. It is worthy of comparison with the best that has yet been done.

We have received two exquisite examples from the Case School of Applied Science, Cleveland, O., due to Prof. Dayton C. Miller. One represents a hand and half of the forearm, with wonderful distinctness, every bone being clearly and sharply brought out. We regret that want of space prevents our reproducing it. Another shows an aluminum medal. Twenty minutes and five minutes exposure respectively were required for them, with a spherical Crookes tube, and six inch induction coil, with three amperes at twenty volts in the primary. The arm was held in place by bandages, the plateholder was closed with pasteboard slides, and the tubes were twelve inches from the wrist. A number of other important results have been obtained by Prof. Miller at the Case School, largely in the direction of physiology.

Flames have been tested in the X rays and have proved almost transparent. Flame, it is interesting to remember, is also almost transparent for light waves. In the article on this subject, on page 103 of the present volume of the SCIENTIFIC AMERICAN, the use of a fluorescent compound for the emulsion was suggested. Dr. Pupin, in this city, and others have done work upon this line. A phosphorescent plate was tried in the plate holder, phosphorescent zinc sulphide was applied to the plate, and other variations on the same theme were tried with results at least of interest. In the light of these experiments, it is of interest to note that Capt. Abney, the eminent English authority, has gone so far as to hold that the X ray effect is due possibly to phosphorescence or else to some unknown action produced by the X rays upon the glass within the plate holder.

The rays have been found by Prof. J. J. Thomson, of Cambridge University, England, to operate powerfully to discharge electrified bodies, and the electrified plate has proved a far more delicate test for the presence of X rays than is the phosphorescent one. The rays seem to convert non-conductors into conductors, as no dielectric can prevent the discharge; no direct discharging power can be attributed to the rays in Prof. Thomson's opinion.

Prof. Dewar has produced results going to show that transparency to the rays varies in an inverse ratio with the atomic weight, instead of with the specific gravity. Their use has been suggested for distinguishing true from false precious stones. It is reported that diamonds are relatively transparent and that true pearls are opaque. The diamond test as detailed bears out Prof. Dewar's theory.

Elihu Thomson has tried some interesting experiments in getting manifold photographs by superimposing a number of layers of sensitized photographic papers, with the result that a photographic plate could receive an impression through a number of sheets of bromide paper, each of which also would develop a feeble photograph. He also strongly recommends intensification.

Nikola Tesla has worked upon the subject with fine results, getting photographs of the shoulder, foot and head with exposures ranging from 15 minutes to an hour. He also has worked at most remarkable distances, one very clear example being produced at a distance of eleven feet from the source of the rays and through a wooden cover with half an hour of exposure. He has found that a feeling of sleepiness is produced when the head is exposed to the rays in being photographed.

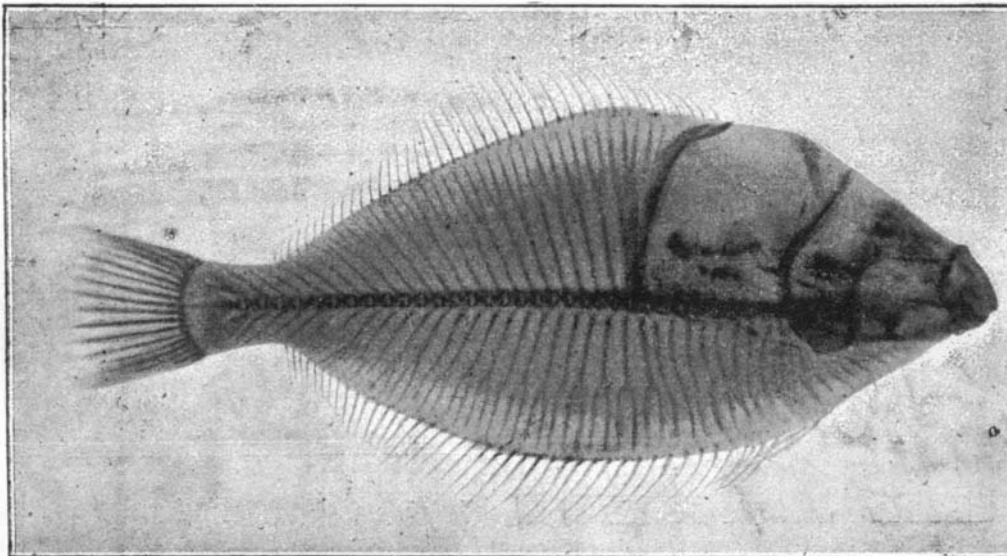
In the article in the SCIENTIFIC AMERICAN already alluded to, the gravitational aspect of the rays is spoken of. This aspect has been somewhat fully considered in an elaborate paper by Prof. Oliver Lodge, of England, with naturally somewhat negative results.

It is impossible to resist the conclusion that our views of the great mystery of gravitation may yet be somewhat clarified by our study of the new non-refrangible, unreflectable X rays.

## Commerce Across Behring Straits.

Dr. Benjamin Sharp, at a recent meeting of the Academy of Natural Sciences, Philadelphia, gave some suggestive information about possible ancient commerce across Behring Straits. The distance is about forty miles and in the middle are the Diomed Islands, say twenty miles from each shore.

On the American side there is abundance of wood from which canoes, etc., might be made, but there is none on the Siberian side. The skin boats used by the Siberian natives, made from walrus hide, could



X RAY PHOTOGRAPH OF A FISH, BY PROF. VICENTINI.

not have been sewed sufficiently tight by bone needles to have served to cross the strait. The distance is bridged by ice about once in five years, but the passage across is considered quite dangerous, and nothing but the love of tobacco will induce a native to venture. The inhabitants of the Asian side appear to have been more influenced by the Eskimo arts than the reverse.

These facts and the general bearing of Dr. Sharp's observations are unfavorable to an extended early communication from the Siberian coast to the American.—Science.

## DR. PUPIN'S X RAY PHOTOGRAPH OF A WOUNDED HAND.

The X ray view of the wounded hand which we give our readers is one of the most recent achievements in X



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DR. PUPIN'S X RAY PHOTOGRAPH OF A HAND CONTAINING SEVENTY-TWO SHOT.

ray photography, and is interesting not only from the unique subject, but from the fact that it has been executed in this city as a guide to surgical treatment. The victim is a person well known in New York, and is a member of one of the leading law firms of the city. He was injured by the accidental discharge of a small gun while shooting over a friend's preserve in England. In the grass or bushes he saw a small cannon. When stooping down to examine it the weapon was discharged, probably by his foot catching or touching an invisible wire attached to its lock and lying in the

grass. He was in the act of reaching forward with his hand when the explosion took place, and the entire charge entered his hand when only some two feet from the muzzle. The cannon had been placed there by gamekeepers with a view to arresting poaching, and it had been their design to load it with a blank cartridge, but by accident a loaded cartridge was inserted.

The sufferer, after having his hand treated, returned to America, and being a personal friend of Dr. Pupin, of Columbia College, the latter took special interest in producing an X ray photograph of the hand. Not only was the subject one of the most interesting that had ever presented itself to Dr. Pupin, but it appeared possible that the photograph might be a

valuable guide for surgical operations.

This extraordinary and successful photograph shows with great distinctness some seventy-two shot embedded in the hand, which shot are, of course, more easily counted in the large photograph than in the diminished reproduction given here. Several of the pellets have already been extracted, but it is believed that with the aid of this photograph the operation of relief may be carried on with great certainty and precision.

The Crookes tube used in producing the photograph was a spherical one; the time of exposure was twenty minutes; a powerful induction coil operated by the incandescent lighting circuit, with a rotary circuit breaker, was employed to excite the tube. The circuit breaker was actuated by an electric motor.

It is not going too far to assert that Dr. Pupin has produced in this example one of the most interesting examples of X ray photography that has yet been produced. Its value from the surgical point of view is obvious. Other examples of his work were of almost equal interest; one especially of a hand showing a long standing dislocation of the thumb joint should be cited.

## Another Dark Star.

The star catalogued as 70 Ophiuchi, by Flamsteed 117 years ago, was discovered by William Herschel to be an unequal double. Its period as then apparent was 93 years. The star is now known to be behind time. Left to itself it would have completed its circuit in 88 years. There exists in the system some unknown disturbing force. After many unsuccessful attempts to account for the erratic motion of the star, Dr. See offered an explanation. The star had hitherto been treated as a binary, whereas it should have been treated as a ternary. An obscure disturbing body must be present in the system. This amounted to a discovery. There is now no doubt that 70 Ophiuchi is a triple star composed of two suns linked with a dark body; the latter with the shining satellite describes a very eccentric orbit around the chief star in 88 years, while it revolves around its companion in 36 years; hence the mass and dimensions of the system are at once known. The three bodies taken together possess 2.8 times the gravitative force of the sun, and the mean radius of the subordinate pair is 28 times the distance of the earth from the sun, that of the orbit Neptune being 30 times the same unit.

Miss A. M. Clerke, from whose article in Knowledge we condense the above, says that "the conditions in this system are such that an actual collision would be no improbable event."

TUBES differing from the ordinary Crookes tubes are now for sale in London. They are called "X ray focus tubes," and are intended for taking the Roentgen photographs.