DOWSON'S GAS PRODUCER.

We annex illustrations of the latest form of gas producer designed by Mr. J. Emerson Dowson, of 3 Great Queen Street, Westminster, and especially adapted for supplying gas engines.

The engines of this kind made by Messrs. Crossley Brothers, of Manchester, are known to have a very high efficiency. The power required at these works will probably be 200 to 300 horse power, and Messrs. Crossley have decided not to employ steam, but to drive all their machinery and tools with gas engines. Several preliminary trials were made with the gas produced in the Dowson apparatus, and the results were so satisfactory that it has been adopted for permanent work, and already nearly all the gas producing plant for 150 horse power has been laid down.

An engine, indicating from 27 to 30 horse power, has been working regularly with this cheap gas over two months. During this time tests have been made to determine the actual fuel consumption, and the following are the results obtained, so says *Engineering*:

1. Time allowed to get generator fire in order for making good gas, 45 minutes.

2. Fuel consumption per 1,000 cubic feet passed into gas holder, 13·2 lb.

3. Gas consumption per indicated horse power per hour, 109 cubic feet.

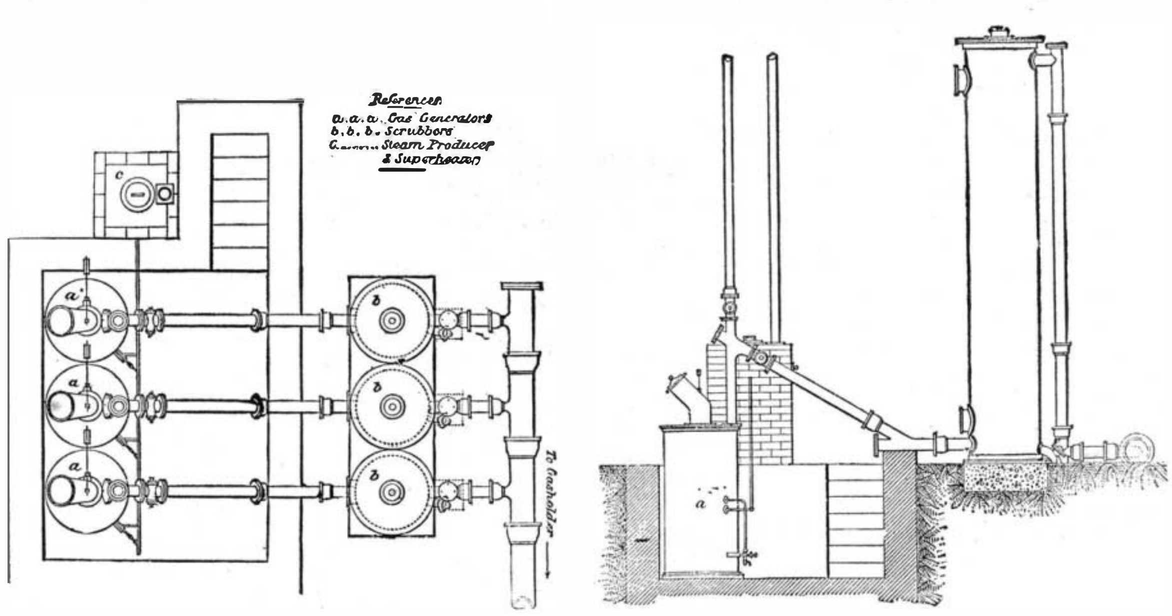
4. Fuel consumption per indicated horse power per hour, 1·4 lb.

These results confirm the tests made by Mr. D. K. Clark, for the Committee of the Smoke Abatement Exhibition, with a 3½ horse power Otto engine worked with the cheap gas. He gave the following: 1. Gas consumption per indicated horse power per hour, 110·3 cubic feet. 2. Fuel consumption per indicated horse power per hour. 1·4 lb.

The engine now working with this gas at Messrs. Crossley's new works is driving the foundry blower, which delivers an average of about 4,000 cubic feet of air per minute, and a mercury gauge indicates with accuracy the steadiness of the driving. The fuel used in the gas generators is small sized anthracite from South Wales, costing 3s. 3d. a ton in truck at the pit.

It will be seen that the fuel consumption is remarkably low, even with so small an engine as a 3½ horse power, as reported by Mr. D. K. Clark. The wages of the firemen for the gas generators are not more than for a set of steam boilers. It should also be mentioned that the gas can be conveyed to any part of the works without condensation, that separate engines can be used for different lines of shafting, and that this not only effects a saving in the cost of shafting, but any department working overtime can have its engine supplied with gas from a single gas generator.

The arrangement of the plant will be understood from the drawing, in which *a a a* are three producers, cylindrical iron chambers, lined with ganister, closed at the top, and provided with grate bars near the bottom, on which the anthracite, fed in from the hoppers at the top, is consumed. Steam is generated in a coil contained in the square furnace, *c*, and is led away by the steam pipe shown, provided with jets discharging into each producer, and drawing with this a considerable quantity of air. The gases generated are led off to the pump gear, *c c c*, and then to the holder (not shown in the drawing). From this holder the supply is delivered as required to the gas engines.



DOWSON'S GAS MAKING PLANT.

The Girls should Exercise.

Dr. Alice F. Freeman, of Wellesley College, says that the cause of the breaking down of the girls in institutions of learning is the lack of proper physical care before entering. Experience shows that in the boarding schools where exercise is compulsory the students improve in health, but college is not a place for invalids, and those with weak constitutions and nervous prostration are likely to become ill. Girls have not as vigorous a physique as boys, but they are capable of greater endurance, and with proper care can sustain as thorough a course of mental training with benefit rather than detriment to their health.

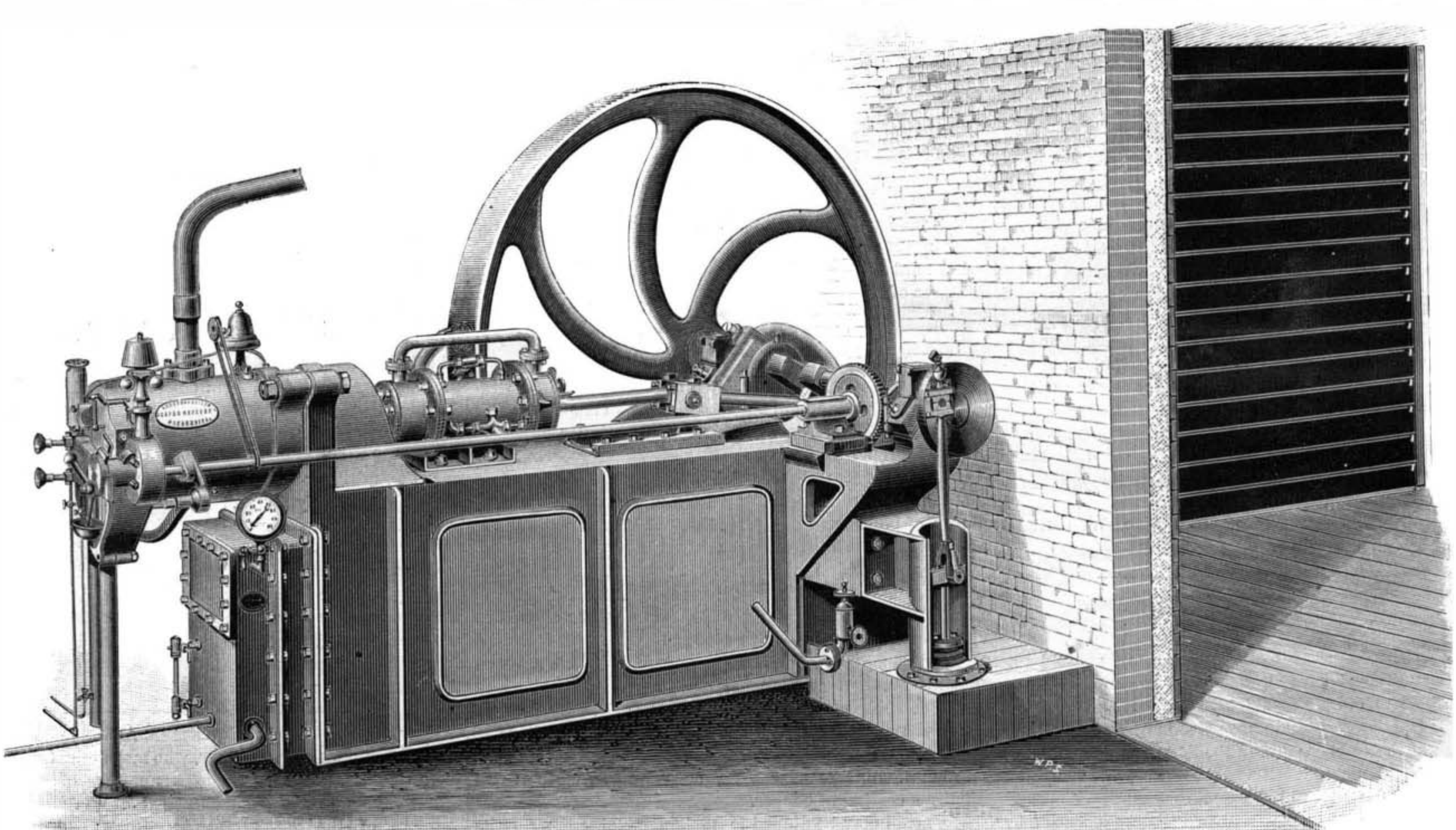
COMBINED GAS MOTOR AND REFRIGERATOR.

Our engraving shows a perspective view of the apparatus, together with a portion of the cooling chamber. The machinery which has to be driven is of the well-known Bell-Coleman type, and we need only here observe that the essential feature of the process consists in drying the air before expansion. This is carried out by passing the moist air, while in a state of compression, through a series of tubes placed in a colder atmosphere, or waste air current from the chamber, which causes the moisture to deposit on the surface of the tubes, whence it is removed by automatic traps before entering the expansion cylinder. The pipes have also the effect of considerably reducing the temperature of the compressed air below the temperature of the cooling water, and, consequently, when permitted to expand, it produces proportionably lower terminal temperatures, thus giving greater efficiency per indicated horse power.

On reference to our engraving, it will be seen that an air compressor is placed on the top of the bed frame, and the gas motor cylinder is placed on the same line as the compressor at one end of the bed frame, which it overhangs, as is usual in the Otto engine. The piston of the gas motor cylinder is on the same rod as the piston f the compressors, and this rod is connected to the crank shaft by a connecting rod. On one end of the crank shaft there is a fly wheel, and at the other end of the shaft a crank disk, to which is attached at right angles the connecting rod and piston of the cylinder, in which the compressed air (after having been deprived of the heat produced during compression) is expanded in the act of doing work. The valve gear of the gas motor is that usually adopted in the Otto engine. The process may be briefly described as follows:

Atmospheric air is taken into the compressor, and therein compressed to about 4½ atmospheres absolute, or say 50 pounds above atmospheric pressure. A considerable amount of heat is produced in this operation, which is removed from the compressed air by water, and to such an extent as to make the temperature of the air, after compression, about the temperature of the water used in cooling, which is generally from 60° to 80° in ordinary practice. The object is effected by forcing water partly into the compressor and partly into the air immediately after leaving the compressor, the operation being completed and the surplus removed in the usual way in a chamber connected with automatic water traps. The compressed air, now free from mechanically suspended water, and still under compression, is led through horizontal pipes fixed in the sole plate, and which are surrounded by cold air returning from the room being refrigerated. The pipes act as heat exchangers, and also as moisture depositors, as they reduce the temperature of the compressed air considerably below that of the water.

The compressed dry air, which in ordinary practice is now generally of a temperature of 50° above zero, is taken to the expanding cylinder, constructed on the type of a steam cylinder, where it is expanded, and power is developed by the expansion, the power being utilized in the driving of the whole machine through the crank shaft, the air at the same time being reduced from 50° above zero to 50° below zero. The machine which has been erected in Leadenhall Market is employed in cooling a chamber which contains poultry and game. The compressor of this machine is 8½ inches diameter and 12 inches stroke; the expansion cylinder is 6 inches diameter and 9 inches stroke. It delivers



COMBINED GAS MOTOR AND REFRIGERATOR.

cold air at the rate of about 5,000 cubic feet per hour, at a temperature 50° below zero, when working at a speed of 140 to 160 revolutions per minute, which is capable of being continuously maintained, provided the water supply and lubrication are attended to.

The chamber with which this machine is connected is 15 feet long by 20 feet broad and 9 feet high, and in the hottest days of the late summer its temperature was easily reduced to from 30° to 40° Fahr. by six or eight hours' working. There can be no doubt but that this machine will be found exceedingly useful for the preservation of food and other perishable goods in places where steam power is inadmissible, but more especially in the climates where high temperatures prevail.

We are pleased to note this practical advance, which has been made by Mr. J. J. Coleman, who was the first to make mechanical refrigeration a success on board ship, where it is now very extensively employed. Scarcely three years and a half have elapsed since he sent out to New York the first cold air machine successfully used in bringing meat across the Atlantic. At the present time machinery on the lines designed by Mr. Coleman and partners, and known as the Bell-Coleman machines, are fitted up in various parts of the world, their steam cylinders being capable of indicating in the aggregate 4,000 horse power, and their cooling capacity being equal to the freezing of 200,000 tons of meat per annum. These machines are working not only between America and Great Britain, but also between Australia, New Zealand, and India, and this country.—*Iron.*

THE ELECTRIC LIGHT IN SURGICAL DIAGNOSIS.

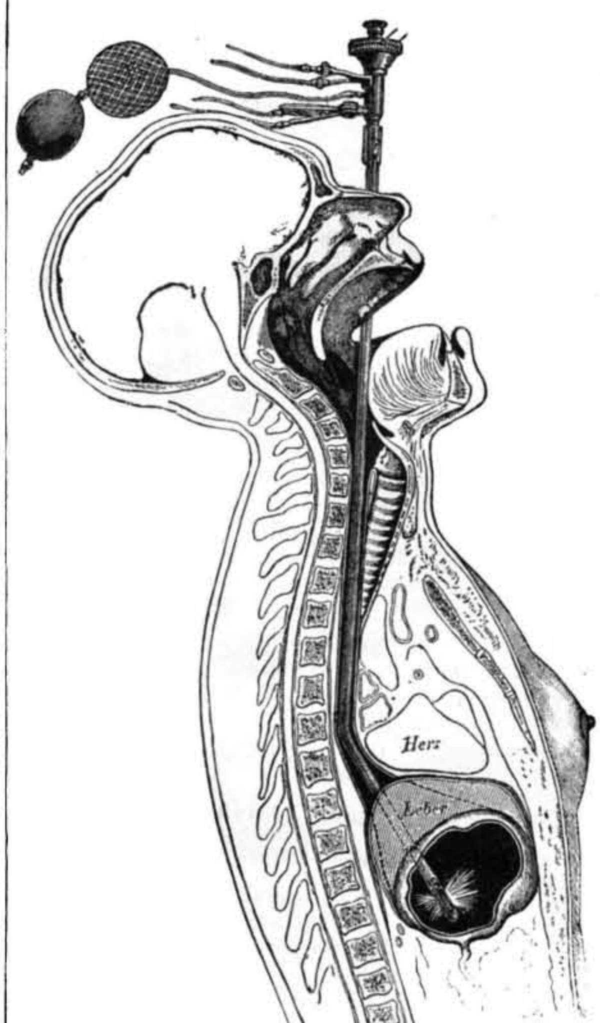
We find in a recent number of *Annals of Anatomy and Surgery* a very interesting contribution by Dr. Roswell Park, of Chicago, in which he describes the most recent applications of the electric light for surgical purposes. It appears that Josef Leiter, a well known instrument maker of Vienna, has at last succeeded in producing electrical instruments by which the interior portions of the human body may be strongly illuminated by the electric light, and thoroughly examined by the eye of the surgeon.

The accompanying engraving shows the application of one form of these new instruments, called the gastroscope, an instrument for the examination of the stomach. It consists of a bent tube, which contains a window at one end, electric wires, tubes for the introduction of a water circulation, by means of rubber bags, for the purpose of keeping the tube cool while the electric light is burning; also for the introduction of water into the stomach, to distend the same. The lower extremity of the tube is provided with a platinum wire, which is made to glow under the electric current, which is produced by a battery. The tube is also provided with reflector prisms and lenses, for directing the light through the tube.

The eye of the surgeon is applied at the upper end of the tube, after it has been inserted in the stomach in the manner indicated in our sketch.

As preparation for the use of the gastroscope, it is necessary that the patient shall have gone for some hours without eating. Half an hour previous to its use a hypodermic dose of morphia, say one-third grain, should be administered. Just prior to the examination the stomach should be washed out. The patient is then laid upon the left side on a table, having a head support, which shall keep the neck in its axial position. A small receptacle is placed under the mouth to catch the saliva which cannot be swallowed. The head is then thrown well back, and the instrument, which has previously been lubricated with vaseline or glycerine, is guided by the finger of the left hand and passed downward with a gentle sweep.

Previous practice on the cadaver with a hard rubber sound of the same dimensions and flexure as the gastroscope will



THE ELECTRIC LIGHT IN SURGICAL DIAGNOSIS.

easily teach the necessary manipulations. The instrument being in place, the stomach is inflated to the desired extent, but not sufficient to distress the patient. The pointer on the rheostat being turned slowly, the metal blind is drawn (at J), and the observer has the field before him.

By the curve in the tube not only is the introduction of the instrument facilitated—it having been found impossible to pass a perfectly straight tube so far as is necessary for this purpose—but it will be seen that with partial rotation of the tube about the long axis of the straight portion, the extremity carrying the window and the light makes quite an excursion, and permits the view of a much more extensive surface than would be possible were no such excursion made.

Moreover, as it is provided with an optical system, it obtains that as the instrument is rotated toward a given point of the mucous membrane its image is enlarged; while as it is further removed the image is diminished, while the field is enlarged. At a distance of two centimeters the image is of natural size. The "definition" of this system is excellent, and, granted a tolerance of the instrument on the patient's part, and the requisite skill on that of the observer, a very satisfactory examination can be made.

A variety of other instruments are made, which are operated substantially in the same general manner as the one described. For example, we have the laryngoscope, for examination of all parts of the throat; the œsophagoscope, for the gullet; the otoscope, for the ears; the urethroscope, for the bladder; the cystoscope, etc. The invention of instruments marks another step in electrical progress. They promise to be of utility and importance to the medical profession, for by their use many parts of the human system heretofore hidden from the eye may now be brilliantly lighted and examined, and their condition in disease and health ascertained.

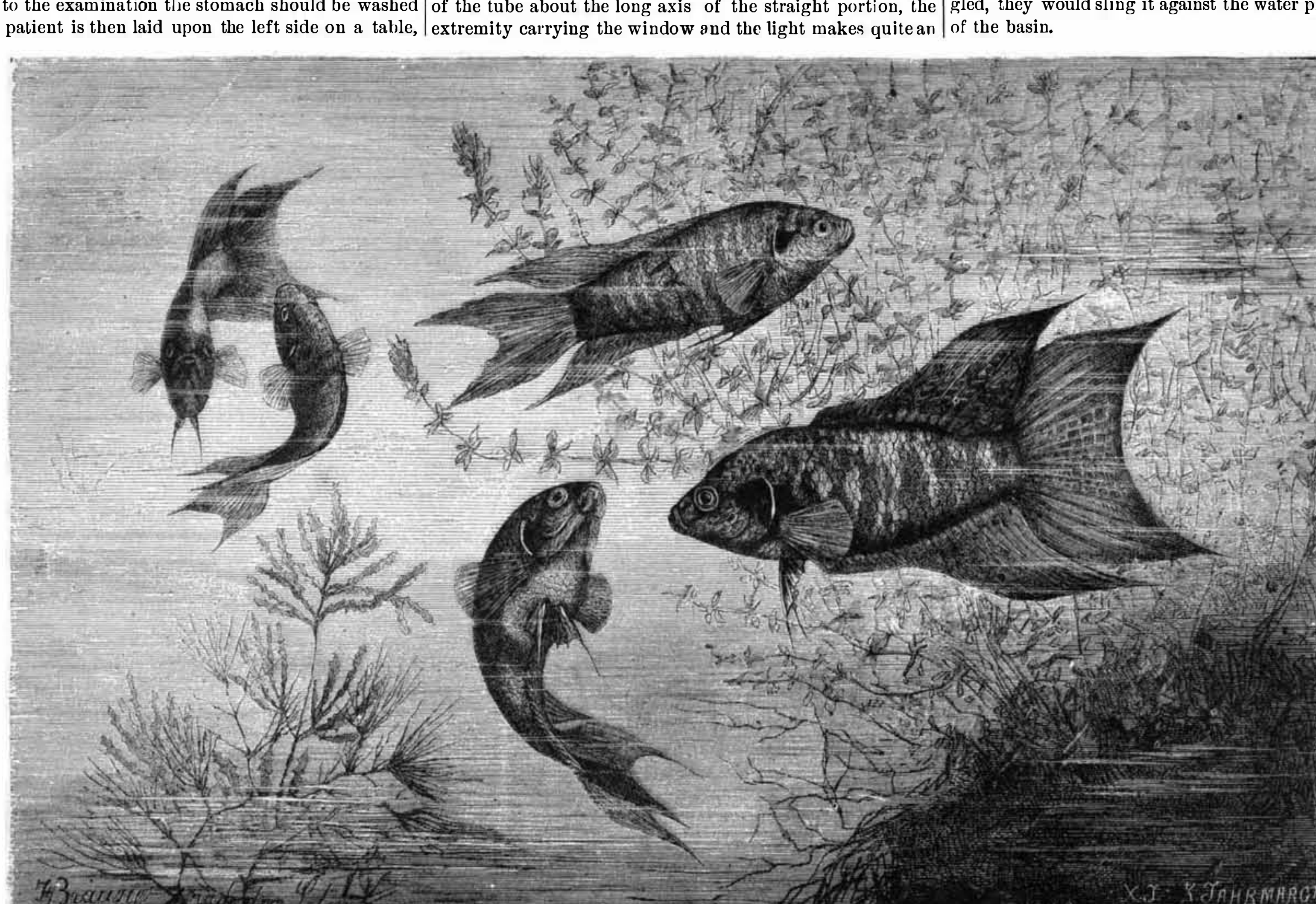
THE PARADISE FISH.

The paradise fish is a representative of the family *Macropus.* These fish have very large fins, less developed in the female. The brownish color of the upper side changes into a greenish gray on the lower side; the markings consist of changeable yellowish green or blue and red cross lines. Their length is from eight to nine centimeters.

Very little is known of these fish in their free life. They are universally kept in captivity in China, and treated as our gold fish, but are more easily propagated in a limited space.

They are better adapted for household pets than other fish of this class, as they can live in a much less quantity of water, and can remain out of the water for twenty minutes and more without injury. Giraud brought one hundred of these fish from China, and although during the tedious journey he was not able to give them sufficient room or the necessary care and nourishment, twenty-two of them lived.

Benecke says that "in May of the year 1878 he obtained a pair of paradise fish. They were placed in a basin containing about forty liters of water. They immediately went to work to devour the small crawfish and larvæ of insects which had been placed in the vessel. After these were consumed two crawfish, water fleas, and mussels were put in. The mussels they had not received before, and evidently had never eaten them, for at first they only took hold of the little animals and then released them with a shake of the head, but after a day or two they only ate the mussels, leaving the water fleas placed in the basin unmolested. One day no mussels could be obtained, and they ate greedily not only small but very large angle worms from five to eight centimeters long and two millimeters thick. They always rejected the intestines of the worms. When the worms were put in the basin, as they were taken from the ground, they would shake them two or three times, then let them go, then throw them around in the water, in order to shake off the dirt before eating them. If the worm struggled, they would sling it against the water plants or the sides of the basin.



THE PARADISE FISH.