The Great Drydock at Pearl Harbor, Hawaii.

BY ELMER MURPHY.

The drydock at the naval station, Pearl Harbor, Hawaii, is to be the largest ever constructed by the Navy Department. Its over-all length is 1,195 feet, whereas the longest dock previously constructed, which is at Philadelphia, is 799 feet over all, and the Puget Sound drydock, recently contracted for, is 863 feet over all.

The width between coping will be 130 feet, and the depth over flue blocks at mean high water, 32½ feet. An innovation, so far as American docks are concerned, is that there will be four caisson seats, two, as usual, at the entrance to the drydock and two others near the middle of the dock, dividing the main structure into an inner and outer dock. There will be two steel caisson gates, and the arrangements will be such that, with a ship in the inner dock, the outer dock may be filled and emptied independently, thus allowing the ship upon which the most extensive repairs are to be made to remain in the inner dock, while ships with minor repairs are being docked in rapid succession in the outer dock. By floating the inner caisson from the drydock, ships of greater length than any now in existence or planned could be docked. A trapezoidal form of head has been designed for this dock, different from any hitherto considered. It is arranged so that three destroyers may be docked side by side, extending to the very head end of the dock, and leaving room for three other small craft in the inner dock.

The draft over sills at mean high water will be 35 feet, which is more than any other dock excepting the one at Puget Sound, where the great variation in tides required a draft of 38 feet. The conditions of depth at Pearl Harbor are such that the largest battleship may enter the dock at any stage of the tide. Concrete will be used throughout in the walls and floor. Granite lining will be used only at the caisson seats, at the coping at entrance and at the material slides. The conditions for the use of concrete are believed to be more favorable at Pearl Harbor than at any point in the United States, on account of the equable climate and absence of frost.

A marked improvement over all previous docks has been developed in connection with the dock for Pearl Harbor, in that the working floor will be absolutely level from end to end, giving a level working surface, free from the usual obstructions, such as bilge block slides, docking keel-block bearers, bilge-block chains, temporary electric wires, temporary compressed-air lines, etc. The attempt has been made many times previously to accomplish this object, but never with success. It has been accomplished in this case by an entirely new design for bilge-block bearers and docking keel-block bearers. The bearers are made in the shape of cast-iron boxes imbedded in the dock floor, with top flush with the concrete. The wide flanges on the top form the bearers for the keel blocks and bilge blocks, and a slot is provided through the top of the box to take the anchor bolts for the keel blocks and the holding-down device for the bilge blocks. The cast-iron box is large enough also to take the chains for the hauling of bilge blocks across the floor of the dock while a ship is being placed. Another most important function of the cast-iron boxes is to drain the floor. The water passes through the slots, and flows along the sloping bottom of the boxes, and is discharged into four large longitudinal sub-floor drains. These, in turn, carry the water into the drainage chambers near the middle of the dock. The inner dock and outer dock each have an independent system of longitudinal drains and a drainage chamber. Three 54-inch pipes with gate valve pass from each drainage chamber into a common wet chamber outside of the drydock structure. The four 54-inch suction pipes from the pump well, which is close by, open into the wet chamber, thus removing water which flows in from either one or both of the drydocks. The slots, cast-iron boxes, and drains have been so designed that the velocity of water while being pumped will be sufficient to remove any silt which may have collected.

The system of cast-iron boxes with slots and longitudinal floor drains will also be used for filling the dock. Four filling culverts, two on each side of the drydock, having inlets in the quay wall at the entrance of the dock, are connected with the longitudinal drains in the inner and outer docks in such a manner that either dock may be filled independently of the other. The water will be discharged into the dock body through the slots, having thus an upward velocity on entering and being uniformly distributed over the entire floor. This is much superior to having the water enter at the ends or sides with a velocity sufficient to cause harmful movements of the ship. Sixteen flights of stairs extend from the coping to the floor. This number is liberal, in order that the workmen may enter and leave the drydock with expedition. There will be 539 keel blocks, extending from the entrance to the head of the drydock. These are for the purpose of carrying the weight of the ship when the dock is pumped. Two lines of docking keel blocks will extend on either side of these to take the weight of turrets, etc., of battleships. The pump well will be located near the middle of the dock and about 30 feet away. It will be of octagonal shape, and will contain four 54-inch pumps.

A track for a 40-ton crane will be built around the drydock structure, with the inner rail close to the edge of the coping. The total length of the rails in this track will be within a few feet of one mile. The construction of the dock will necessitate the disposal of 350,000 cubic yards of material. This will be utilized in filling some of the low areas on the station property. The depth of the excavation will be 58.5 feet. This is more than the height of an ordinary four-story building. The total amount of concrete to be used in the dock is approximately 120,000 cubic yards.

THE PHYSICAL ENERGY OF THE HOUSE-FLY.

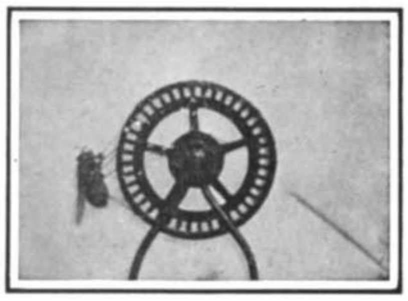
BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Mr. Frank P. Smith, a member of the Quekett Microscopical Club, has added to our knowledge of the fly by a series of highly interesting moving-picture films,

Bluebottle fly balancing a cork ball upon which another fly is simultaneously preserving its balance.

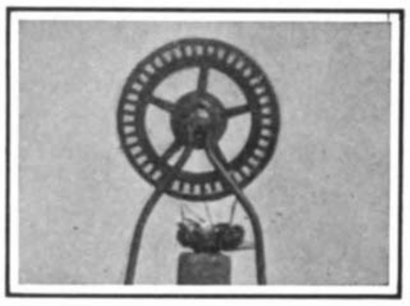
which pictorially give some idea of the highly-developed organism and the physical energy of the common house-fly.

Although Mr. Smith makes no claim to being able to train the domestic fly, yet at the same time he has



A fly walking up a revolving wheel.

succeeded, as the accompanying illustrations testify, in causing it to accomplish some curious evolutions—a result due not so much to any development of intelligence as to the deception of the insect. The flies used for the purpose of chronophotographic investiga-



Bluebottle fly turning a revolving wheel.

tion were especially bred and reared to secure large, clean, newly-merged insects.

Flies and kindred insects are equipped with a highly-developed breathing apparatus. Instead of depending upon a single tracheal tube, as do human beings and

Eating honey from a pin held in the hand.

THE PHYSICAL ENERGY OF THE HOUSE-FLY.

animals, for the inhalation of air, these insects are provided with a complex network of passages extending to all parts of the body. The outcome of this arrangement is a very rapid oxygenation of the blood fluid, with an attendant enormous development of physical energy.

To demonstrate the extent of this development, a series of popular photographs were secured, some of which are of a humorous character. The species illustrated is the familiar domestic bluebottle, which, because of its size, is more particularly suited to the purpose. In one case the fly is seen lying on its back or seated in a diminutive chair, supported or held in position by a thin band of silk passed round its waist. In this position it held and played, or juggled, with a number of articles of relatively large size, such as small dumb-bells and weights, or nursed a smaller fly without any apparent effort. A certain degree of restraint was imposed, but in the case of revolving the small wheel, the insect was allowed complete freedom. In order to revolve the wheel, the fly was made to try to walk along its periphery. An ingenious device was prepared, the object being to cause it to desist from its natural inclination to fly, and to induce it to walk up the side of the wheel. A dark box was fitted with a small door of very thin glass attached to an escapement similar to that of a pendulum clock. When the fly was first imprisoned in the box, it instantly attempted to effect an escape through the glass door with a frantic buzz. Every time it struck the glass it received a slight tap on the head from the escapement. At first such results only increased its fury, but in a short while, owing to the continued tappings upon its head, it would become more tractable. Finally, instead of attempting to escape by flying, it would make an effort to achieve its object by walking up the wheel. While in this tractable condition the photographs were secured. The entomologist, however, found it quite impossible to depend upon the results of the incarceration in the box, since very often a fly that had been under instruction for several days, upon removal to the wheel outside immediately took advantage of its liberty and flew away.

In another instance the fly is shown lying on its back supporting and turning or juggling a ball three or four times its bulk, upon the upper side of which is another fly, which also maintains its balance upon the moving spherical surface. This action, as well as that of turning the wheel, Mr. Smith attributes to the insect's illusion that it is really walking upon a fixed surface. In another instance the fly is shown merely balancing a cork ball. It is noticeable in these various accomplishments that the fly brings its wonderful proboscis into play for the purpose of guiding and partially of preserving the balances of the various moving substances. This is strikingly shown in the case where one bluebottle prone on its back is supporting another balanced acrobatically upon its upturned legs.

The Current Supplement.

Erichsen's tragic Greenland expedition is made the subject of a handsomely illustrated article which opens the current SUPPLEMENT, No. 1727. Major George O. Squier contributes an article on ships in air and water, and shows the general relations between the two. Franklin Van Winkle in an article entitled "Pressure of the Atmosphere on Liquids" writes on the conditions of equilibrium in liquids of the same and different densities. The psychogalvanic reflex is a peculiar physical manifestation of mental processes in the form of a change in the electrical properties of the skin. This change occurs whenever the subject feels emotion, and it can be detected and measured with a sensitive galvanometer. By this method the irritability of the human mind may be electrically measured. James H. Baker contributes a good article on chain and chain making. The ultimate internal combustion motor and its probable fuel is discussed by Thomas White. An interesting process of color photography has been brought about by Chéron in Paris. The process is described and illustrated by our Paris correspondent. In a review of the eleventh Paris Automobile Salon, the general tendencies of the construction for 1909 are summarized, and particulars are given of some of the most notable models exhibited. H. B. Macpherson writes instructively on protective mimicry in bird life.

Fuel gas analyzers have been investigated by the committee on power generation of the American Street and Inter-urban Railway Engineeering Association, which recently reported that they were of unquestionable value where continuous records are kept. In order to get the best indication of furnace conditions, the committee recommends putting the gas collector as close as possible to the point where combustion ceases in the line of circulation. The collector should be a ¾-inch or 1-inch pipe, with the end capped and provided with ⅛-inch holes at frequent intervals along the side, but not so many that their combined area equals that of the pipe. Experience indicates the best results are secured with a recording analyzer in the main flue, supplemented by an indicating instrument connected into the breeching of each boiler, and so placed that the fireman can read it. The most common error in the operation of furnaces, which a CO_2 recorder shows, is stated to be the admission of too much air.