Building a Moving-Picture Camera

A Serviceable Home-Made Machine for \$6.50

By E. H. Williamson, Jr.

THE interest in moving pictures is practically universal, and it is probable that there is not a village of any size in the United States which does not have its moving picture palace and a corresponding group of "fans." No doubt many of the readers of the SCIENTIFIC AMERICAN have wished that they owned a camera, while witnessing some thriller such as "The Illusions of Ida" or "The Pranks of Patricia," but when they came to get prices on such cameras, they decided that it would not be worth the expenditure. However, a camera suitable for the use of an amateur can be built for the sum mentioned in the title, even with the inflated price of all materials, if the reader possesses some mechanical ability and handiness with tools. Of course, an outfit at that price necessitates a very inexpensive lens and any departure from the text in this direction will of course increase the price accordingly. To those who do not understand the mechanism of a moving picture camera, the following short explanation will be in order. Moving picture film is like any other film except that it is sold in lengths of many feet and is perforated at the edges. The standard film is $1\frac{1}{8}$ inches wide, and the perforations are $\frac{3}{8}$ inch from center to center, making four to the picture, the latter being $\frac{3}{4}$ inch high by 1 inch wide. This film is wound on a reel either inside or outside the camera and runs down through a framework which holds it in the focal plane of a short focus lens, usually three inches or less, in focal length. In taking the pictures, the film is mechanically wound through this frame to an empty reel located below or beside the other, but the movement is intermittent and at the rate of 16 per second, this having been found the proper speed to avoid flickering when the picture is thrown on the screen. This movement is obtained by the use of a pair of claws which engage in the perforations, and are geared to a train of wheels turned by the crank of the camera. A revolving shutter connected to these wheels makes an exposure at each period of rest between the movements of the claws which draw down the film.

The camera to be described is shown clearly in Fig. 1 which gives a view of the interior from the right hand side; and Fig. 2 which shows a perspective of the other side. The box (A) is made from straight grained poplar free from knots, finished on both sides, the top and bottom pieces being $\frac{3}{4}$ inch thick and the back, front, sides and partition being of $\frac{1}{4}$ inch stuff. The outside dimensions of the box are 10 inches long, 10 inches high and 8 inches wide, not counting the $\frac{1}{4}$ inch thickness of the sides. It is fastened together with screws to allow of being taken apart if desired. The blocks (B) and (C) which support the train of wheels and the reel spindles,

may be made of one piece of wood or built up of 1 inch board, (B) being 5 inches long, 2 inches high and 2 inches thick, (C) is 5 inches long, $2\frac{1}{2}$ inches wide and 2 inches thick. (C) rests on top of (B) and is fastened to it with an angle iron and the combination is set 1 inch inside the edge of the box and screwed to the back and baseboard.

The large gear wheels (D), (D') are 2 inches diameter, 32 pitch, $\frac{3}{16}$ inch face, and a $\frac{5}{16}$ inch hole. The spindle of (D) is of $\frac{5}{16}$ inch round, mild steel bar 5 inches long, the gear being set in the center. The inner end of the spindle is threaded for $\frac{3}{8}$ inch and the outer end is threaded for 1 inch.

The spindle of (D') is 3 inches long and threaded for

The camera as it appears in operation

$\frac{3}{8}$ inch at the inner end, and the gear (D') is driven on for half an inch at the other end, and next to it is driven the $\frac{1}{2}$ inch gear (E) of the same pitch and thickness as (D'), the hole in (E) being reamed out to make a driving fit. In case any of the gears do not make a tight fit on the spindles the surface of the latter should be nicked lightly with a cold chisel. The gear (E') is the same size as (E) and is driven for $\frac{1}{2}$ inch on a $\frac{1}{8}$ inch spindle 3 inches long, the inner end of this being threaded as in the other cases. On the projecting end of this spindle is driven one of a pair of $\frac{1}{2}$ inch brass miter gears (F), (F'), having $\frac{1}{8}$ inch holes. The gear (F') is driven on the end of 4-inch spindle, $\frac{1}{8}$ inch diameter supported in

bearings on the block (G) which is 2 inches high, 3 inches long and $\frac{5}{8}$ inch thick. It is screwed firmly to the base, and the bearings (H), (H') which are of brass strip $\frac{1}{2}$ inch thick by $\frac{1}{2}$ inch wide and $1\frac{1}{2}$ inches long are screwed to the sides of (G) in such a position as to allow the gears (F), (F') to mesh easily and the spindle to revolve freely in the bearings. The outer end of the spindle projects through the partition and terminates in a 12-tooth brass sprocket wheel (b') the use of which will be taken up later. The train of gears is supported in the brass strips (H²), (H³), which are $\frac{1}{2}$ inch wide by $\frac{1}{8}$ inch thick, and 5 inches long, and are screwed to each side of the block (B), $\frac{1}{2}$ inch below the top, holes, $\frac{1}{8}$ inch in diameter being drilled through the wood to allow free passage to the spindles. The block (C) is provided with similar bearing strips (H⁴), (H⁵) which support the spindles of the reels (K), (K'). The lower spindle is $\frac{3}{8}$ inch diameter and $5\frac{1}{2}$ inches long and on the end is driven a gear (J) $\frac{3}{4}$ inch diameter of the same pitch as the gear (D) with which it meshes. The inner end of this spindle is threaded for $\frac{1}{2}$ inch as are both ends of the upper spindle (I), which is of $\frac{1}{8}$ inch mild steel, $5\frac{1}{2}$ inches long. The reels (K), (K') are made of wood, the barrels being turned to $1\frac{1}{2}$ inches diameter by $1\frac{1}{2}$ inches long and the flanges are made of cigar box wood, 3 inches diameter. Two pulleys (L), (L'), shown in Fig. 3, $\frac{3}{8}$ inch thick and $1\frac{1}{2}$ inches diameter with conical grooves, are turned from poplar and nailed to the flanges of the reels as shown. At the centers of the other flanges are screwed 1-inch disks (M), (M') of $\frac{1}{8}$ inch brass drilled in the center to receive the spindles. To the lower disk is soldered a brass nut, threaded to fit the spindle, and this can be screwed firmly to the latter so that the reel will turn when the spindle does. The nut of the upper reel is not soldered to the disk, as the reel turns freely on the spindle. If the spindles have been tapped to an $\frac{3}{8}$ thread these nuts may be taken from disused dry batteries. The claw movement which pulls the film is shown clearly in Fig. 2. To the inner end of the spindle of gear (E') is screwed the crank (N), which is a strip of brass $\frac{1}{8}$ inch thick, $\frac{1}{2}$ inch wide and 1 inch long. Two holes are drilled in this, $\frac{1}{2}$ inch apart from center to center, and tapped with an $\frac{3}{8}$ thread. Into one of these the end of the spindle is screwed and into the other, the crank pin (O) which supports the claws. It is of $\frac{1}{8}$ inch mild steel, 2 inches long, threaded for $\frac{1}{8}$ inch where it screws into the crank and for $\frac{3}{8}$ inch at the other end. The shape of the claws (P), (P') is shown in Fig. 2. They are $1\frac{1}{2}$ inches long, $\frac{3}{8}$ inch wide at the widest part, and the points are $\frac{1}{2}$ inch long. They are drilled out to turn easily on the crank pin and are connected a little above the center by a cross-

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

bar (Q) of $\frac{1}{8}$ inch brass rod, 2 inches long, which is soldered to both claws. It engages in the slotted guide strip (R), of brass strip which is 4 inches long, the slot being $2\frac{1}{2}$ inches long and a shade over $\frac{1}{8}$ wide. This is screwed to the side of the block (B) at an angle of 20 degrees with the perpendicular, and gives the claws an eccentric motion, and enables them to enter the perforations of the film, draw it down for $\frac{3}{4}$ inch and then withdraw themselves and repeat the motion.

Figure 4 shows a large view of the box which contains the lens and the guide or gate as it is called through which the film travels.

It is made of cigar box wood and the inside dimensions are $1\frac{5}{8}$ inches wide, by $2\frac{1}{4}$ inches high, and $2\frac{1}{8}$ inches deep. This will receive the inner mechanism of one of the little box film cameras, the smallest made. This camera has a meniscus lens of $2\frac{1}{2}$ inch focus, which is stopped down to f. 16, but as the picture to be covered is little over two-thirds of that regularly covered by the lens, this stop may be increased to f. 8 without marked loss of marginal sharpness. In Fig. 4, the case is shown, cut away to show the position of the film camera and the arrangement at the back. The slot at the top and bottom of the box is $1\frac{1}{2}$ inches long by $\frac{3}{8}$ inch wide. A strip of heavy black paper (T) is glued and tacked across the back of the box at the inner side of the slot so that the rear of the little camera lies against it, and in the center is cut a window 1 inch by $\frac{3}{4}$ inch through which the film is exposed. The inner face of the back board (U) is lined with a strip of black velvet $1\frac{1}{2}$ inches wide, to prevent scratching the film, and the other edges of the slot are likewise protected.

Where the case rests against the partition it is surrounded by a light frame of cigar box, (V) which makes a light tight joint. The case (S) is supported on the pillar (W) which is 4 inches high, $1\frac{3}{4}$ inches wide by $1\frac{1}{2}$ inches thick, and is nailed to a base board of cigar box wood as this makes it easier to shift it around and be certain that the film slit is directly in line with the claws (P), (P'). The film guide (X), is composed of two T-shaped pieces of cigar box wood 2 inches wide at the bottom, 1 inch wide at the top and $1\frac{3}{4}$ inches high. They are separated by narrow strips of wood so as to leave a $\frac{1}{16}$ inch slit between them, $1\frac{1}{2}$ inches wide, the inner faces being lined with black velvet as with the case (S). It is set on a block nailed to the side of the pillar (W) at such a height as to clear the lower ends of the claws in their revolutions, and must of course, be directly under the slot in the case, so that the film enters it vertically. We now turn to Fig. 5 which shows the shutter and the chain gear which drives it. A 1-inch round hole is bored in the partition, opposite the center of the camera case (S), and over this is tacked a square of black cardboard (Y), 3 inches by 4 inches with a $\frac{3}{4}$ inch hole in the center. The shutter (Z) is 5 inches in diameter and cut from a thin piece of the black japanned iron called "Ferrotypes" which is sold by photographic supply houses. A window is cut in this a little less than half the area of the circle, leaving a narrow rim of metal all around to stiffen it. To the center of the circle is rivetted or screwed a $1\frac{1}{2}$ inch brass disk (b), $\frac{1}{16}$ inch thick and to this is soldered, centrally, the hub of a brass sprocket wheel, the same size as the wheel (b') on the end of the miter gear shaft.

The shutter and sprocket revolve on a steel pin which is screwed firmly into the strip (c), which is screwed to the partition.

The two sprockets are connected by brass ladder chain so that the miter gear shaft and the shutter revolve simultaneously. It is very important to adjust the revolution of the shutter so that the lens opening is covered by the latter at the beginning and during the whole period that the claws are pulling down the film, and opened during the entire period of rest. This will require some experimenting but when once found will be

Fig. 6

Fig. 7

Fig. 8

permanent. The sides of the camera are of $\frac{1}{4}$ inch poplar, the left hand side, facing the camera being attached with screws so that it can be easily removed to give access to the machinery. The other side is attached with hinges so as to allow the removal of the reels. On the inside of both side pieces are nailed two rebates as shown in Fig. 6 one fitting into the main body of the camera and the other into the space between the partition and the front board of the camera. The crank by which the mechanism is driven is shown in Fig. 3 and also in detail in Fig. 7. A sleeve (d) of brass tube, $1\frac{1}{2}$ inches long and $\frac{1}{4}$ inch inside diameter is threaded to fit the projecting end of the spindle of (D).

The crank (e) is cut from $\frac{1}{4}$ inch brass and filed to the shape shown in the figure. It is 4 inches long and is fitted with a turned wooden handle (f) fitting loosely on a 2-inch stove bolt screwed into (e). The sleeve (d) runs through a bearing disk (g) screwed to the side of the camera, and the hole in (g) is just enough bigger than the sleeve to allow it to turn freely. To further shut out light, a brass flange (h) which is 1 inch diameter, $\frac{1}{16}$ inch thick is soldered to the sleeve close to the disk (g).

In the front board of the camera, opposite the lens opening, is cut a $1\frac{1}{2}$ -inch hole, and over this is tacked a 3-inch by 4-inch piece of cigar box wood (i) in which a trifle larger hole has been cut, and in this hole is fitted a 1-inch length of cardboard tube (j) which projects inward towards the shutter, and shuts out extraneous light. This tube is closed when the camera is not in use, by the plug (k) which is attached by a chain to the front board. The arrangement is shown clearly in Fig. 1.

The entire interior of the camera must be painted a dull black, using a matte varnish and the brass work must be likewise blackened either by pickling or with black lacquer, in which case the lacquer must not be allowed to get in the teeth of the gears or clog the bearings. If it is not convenient to blacken the metal parts, they may be shut off from the film by a cardboard partition made of heavy photo-mount and tacked to the sides of the wooden blocks (B) and (C). In this case, holes must of course be cut for the various spindles. The camera may be given a coat of lustrous black varnish outside or covered with leather cloth, the latter being preferable.

The sides and front board should be covered separately and attached with screws with the heads outside the cloth. As a view finder is necessary it may consist of a direct vision finder attached to the upper front edge of the camera as shown in the photograph, or may be simply a rectangular wire frame, fitted with cross wires, through which the view may be centered and limited. In either case it should be directly over the lens. On the case of the little camera will be found lines which show the view included by the lens, and these may be transferred to the big camera as guides. The reels of the camera will contain about fifty feet of negative film which is thinner than that used for projection. It is a good scheme to obtain a few feet of discarded film from a supply house and use it in adjusting and testing the mechanism, and it is also a good idea to use a piece of this film at each end of the negative film, cementing the ends with quick drying film cement, as this allows the old film to be fed through the machine when starting the latter, without using up

good film. To load the camera, the upper reel is removed and wound full of film, the inner end being secured with a tack. The end is then slipped through the film gate in the box (S) down past the claws to the guide and so to the lower reel. A short amount of slack is left where the film leaves and enters the reels to allow of free running and after this is done the belt of rubber band is slipped over the pulleys. This work must of course be done in a safe red light and having been completed, the camera door is closed and latched, and the plug inserted in the lens tube. The camera may now be taken out in daylight and put to use. As it is very necessary that the camera be used on a firm support, unless the reader has a large view camera tripod, it is better to make a tripod specially for this use by procuring three wooden strips 1 inch by 1½ inches and 5 feet long, and fastening the ends of these to the bottom of the camera with strong iron hinges. The hinges are placed so as to form a triangle and the lower ends of the sticks are provided with sharpened nails to avoid slipping. As the camera lens described is not a rapid one all pictures should be taken in bright sunlight and very rapidly moving objects would be avoided. The crank should be turned at the rate of two turns per second which will give 16 pictures per second.

The cost of materials is shown in the schedule below but may vary some in different parts of the country.

WOOD	
¼ inch poplar 5 feet long 10 inches wide, finished both sides	} \$1.00
¾ inch poplar 2 feet long 10 inches wide, finished both sides	
1 inch by 3 inches poplar 2 feet long, finished both sides...	
GEARS	
2 spur gears, 2 inches diameter, ⅜ face, ⅜ in hole.....	.84
2 spur gears, ½ inch diameter ⅜ face, ⅜ in hole.....	.24
1 spur gear, ¾ inch diameter, ⅜ face, ⅜ in hole.....	.18
2 ¼-inch miter gears, ⅜ face, ½ in hole.....	.60
2 10 tooth brass sprocket wheels, ½ in hole.....	.48
1 foot of ladder chain brass for above.....	.10
1 foot each of ½, ⅜ and ⅜ inch mild steel for spindles....	.30
2 feet brass strip ½ inch wide, ½ inch thick.....	.30
Brass tube, sheet, bar chain, etc.....	.40
Small Film Camera.....	.75
1 square yard of Buffalo grain leather cloth.....	.50
Varnish, black velvet, glue, nails, screws, etc.....	.60
Total.....	\$6.29

The film for moving picture cameras costs four cents a foot and is sold in rolls of 100 feet or more. For first experiments it is best to try and purchase a shorter piece of negative film from a studio, as they sometimes have pieces left over.

The photograph shows the camera in action. When loading the camera for the first time, it is necessary to see that the film travels freely in its guides and that the claws operate accurately, striking in the holes in the film each time. It may be necessary to bend the claws slightly for this. There should be little or no 1 st motion in the movement of the claws. After the film has been exposed, it is better to have the development and printing on positive film done by a professional as the apparatus required is not generally found in an amateur's workshop. If the reader desires to do it himself, the method can be found in any of the standard works on moving pictures.

As it is not much use to take the pictures unless one can exhibit them himself, I will go on to describe how the camera itself may be utilized as a projecting machine. Figure (8) shows the idea clearly. The lens box (S) with pillar and base board see Fig. (1), are temporarily removed from the camera and a similar device is built, the camera box being of the same height and width as (S) but one inch longer. The front end is open and the rear is closed with a piece of heavy cardboard with a round hole in it, 1¾ inches in diameter. To the inner side of this is glued a small condensing lens such as come in certain types of electric torches. A slit is cut in the top and bottom of the box of the same dimensions as in (S) and lined with velvet. The slits must of course be lined up with the film guide below. The upper film reel is removed from its spindle and mounted on a similar spindle in a wooden block set on the top of the camera. The position of the reel is determined by that of a slit cut in the top of the camera, directly over those in the box within, to allow the film to run straight down from the reel. The edges of this slot are rounded and edged with velvet. The illuminant is a 100-watt nitro-filled "Mazda" lamp, called a "stereoptican" lamp and it is set in a wall socket at the rear of the camera. The side of the lamp rests against a circular hole 1½ inches diameter, cut through the back board of the camera, exactly in line with the center of the box and condensing lens.

The filaments of these lamps are very compact and give a very bright light and the lamp must be so adjusted as to height that the filament is opposite the center of the hole. The shield or lamp house which keeps the light from showing in the room may be made in any conven-

ient way, the easiest perhaps is to take a length of four-inch black stove pipe one foot high, cut a circular opening in one side opposite the hole in the camera and nail it to the block which supports the lamp socket. At the top is set an elbow which throws any light backward, and allows of plenty of ventilation. The projection of the pictures may be done with an ordinary folding camera of which the back can be removed. This is set on a block so that the lens is opposite the center of the front opening of the moving picture camera. A rectilinear lens will work satisfactorily but of course an astigmat will pass more light and make a brighter picture.

If the cheap grade of lens has been used in the moving picture camera it is better not to attempt too large a picture on the screen on account of the inevitable coarseness of detail. Five feet is about the limit for a pleasing effect. If a fine astigmat lens of very short focus has been used the picture may be much larger. When it is desired to use the camera for taking pictures again the box (S) and support are replaced, as well as the reel and the slots are covered with pieces of cigar box wood, stained black and screwed in place.

Practical Wartime Shell Making*

So many foolish statements have been made in regard to the manufacture of munitions and the possibility of automobile factories, implement works or other equally ill-adapted shops being turned, upon very short notice, into shell factories that it seems well to consider of how little value for the manufacture of munitions is the equipment of the average shop. Outside of the already existing munitions plants, the equipment that manufacturers brought to the business of shell making consisted mostly of their money and credit and the nucleus of an organization. The machinery and tools were more than 90 per cent new, and the greatest success has been made by these companies that were not even owners of machine shops of any kind. All the equipment, enumeration and listing that has been going on may be of some use and the so-called "educational" orders may do some good, but the only thing we are sure of is that very little of tradition, precedent or theory is observed in the conduct of a great war.

The suggestions made here for emergency factory construction are to be understood as applicable strictly to emergency conditions, to meet a demand for an unusual amount of ammunitions with the least possible delay and in no way as suggestions for permanent private or government arsenal construction. In the construction of the plant, the first point to be considered is the locality with reference to labor supply and transportation. Within easy reach of all our large centers of population may be found level, unoccupied, naturally well-drained acreage that is suitable for the purpose and is grid-ironed by railroads; these are the sole requirement for such a plan. Final inspection, cleaning, painting, toolmaking, etc., will be provided for in fully enclosed one-story buildings at the delivery end of the plant; but the large part of the work will be performed with the lightest kind of shelter over machines, operators and transfer track, and circumstances probably will not always justify even this shelter.

The dimensions of the plant should be determined by the size of shell to be manufactured. Units of a given hourly capacity should be located between and perpendicular to two lines of railroad siding at the ends of the plant; one track will be a receiving track and the other a shipping track. The distance between the tracks will represent the proper length of each unit to avoid congestion and afford the simplest movement and transfer of produce. Each unit, commencing at the rear of the plant, will start with an unloading platform and will extend in a double row of opposed machines for the different operations toward the finishing end, where the machinery installation will be replaced by hand operations and inspection, to the packing and shipping track. All machine tools will be horizontally belted, but since space is not considered, the convenience of having all transmission machinery within easy reach is a consideration.

In the construction of the plant, lines of concrete piers will carry the lineshafter; storm-water drains will be placed parallel to these; concrete foundation walls for the machine tools will come next; and transfer tracks will be between the machine foundations. A cutting-compound drain will extend the length of each machine-foundation wall to a sump and pump at the end of the line or at intermediate locations. From each concrete pan under or at the machines, there will extend a chip channel, having a slightly raised bottom, connecting with covered chip tanks sunken in the ground, but readily removable by the cranes. Between each two rows of

*Abstract of a paper read before the American Society of Mechanical Engineers, at Cincinnati, May, 1917, by Lucien I. Yeomans of Chicago, Ill.—From *Machinery*.

machines there will be an industrial railway upon which platform cars will be operated; at each machine, car-floor-height platforms will be placed. Such a plant can be erected and operated to capacity within sixty days from the time authority is given to build it.

A complete series of machines for all shell-making operations can be designed along lines that will permit of their construction in immense quantities within thirty days from the time when the necessity for them arises, and at a rate of output that will supply any conceivable demand within the following 60 days. The practicability of such performance has been definitely proved in the last two years; one company accepted orders for hundreds of machines on the guaranteed deliveries of "Commence in 30 days and ship five per cent of any sized order every working day thereafter."

The United States Government can easily be prepared to deliver such machines in the desired daily quantities within 30 days by the following method: In each selected industrial center establish a government plant in which will be stored the necessary patterns, jigs and equipment to make such machines; and in which will also be kept a list of the plants in the territory equipped to make the required parts. Upon order from Washington, the patterns will be shipped to the designated foundries, and, beginning with the third day, castings should be received at the rate of one casting a day per pattern. It will probably require about three weeks to manufacture the various working parts of the machine, but within thirty days at the outside completed machines will be ready to run in the ammunitions plants. The number of machines added to the equipment daily will be the same as the number of patterns from which castings are made. This record can be bettered by stocking in the warehouse the various machine parts, aside from the large bed castings, sufficient to make up machines of a desired daily output during the period found necessary. If this is done, completed machines can be delivered to the munition plants within a week of authorization by the government. The total cost to the government for the patterns, jigs and equipment necessary for such a plan of preparedness will be approximately but \$1,000,000.

Retrospection on the days of 1915, when manufacturers were begging for standard machine tools with which to make shells and were given deliveries of eight to eighteen months, shows the necessity for an entirely different provision of emergency machines. To depend at all on current stocks or to hope to utilize to any extent the working equipment of existing shops is equally ill-advised. To cut from new cloth in such an emergency as wartime conditions is the only method that promises success, and there is promise of nothing but disappointment in the attempt to adapt existing shops and machinery.

Change of Conductivity of Minerals By Illumination

BESIDES selenium, stibnite, and cuprous oxide, certain other substances show an instantaneous response to varying illumination. Over 150 crystalline minerals were examined by exposing them to intermittent illumination from an arc lamp while in circuit with 110 volts and a three-step audion amplifier. The effect was judged by the loudness of the musical note corresponding to the frequency of interruption. The new light-sensitive substances thus discovered are: Iodynite—AgI—, silver oxide—Ag₂O—, the simple sulfides of Bi, Mo, Ag, and Pb, and certain compounds of either Pb or Ag with sulphur and either Sb or As, known as pearceite, miargyrite, jamesonite, boulangerite, bournonite, pyrrargyrite, proustite, stephannite, and polybasite. Bismuthinite—Bi₂S₃—is classed as "very good," though its resistance is over a megohm in a mm.-cube.—Note in *Science Abstracts* on a paper by T. W. CASE in *Phys. Rev.*

Under-Sea Instinct of the Sea Lion

WE cannot remember a winter for many years when persistent cold over such lengthy periods froze our ponds and pools to such a depth as in 1916. On larger bodies of water it was impossible to keep open a greater area than mere airholes. This has been the condition of the big sea-lion pool and incidentally has worried many visitors who have thought the animals would drown. To those uninitiated into the ways of these creatures, it is disconcerting to see the big Stellar sea-lion plunge into an opening of the ice about four feet in diameter, note the agitation of the small area of water absolutely cease, then look over the large surface of solidly-frozen pool. Visitors reason that the animal can never find its way back to the opening, but after several minutes of painful suspense, the object of apprehension pokes out his head, barks vigorously for his associates to join him, then dives again.—*New York Zoological Society Bulletin*.