



Underwater Television Equipment

The Deep Sea Underwater Television Camera

In the development of underwater television, the Research Laboratories of Pye Ltd., Cambridge, are taking a leading part. Equipment designed and built at Cambridge was successfully used to identify the wreckage of the Comet airliner on the sea-bed off the Island of Elba.

The increasing use of underwater television will, in the future, undoubtedly have great effect on certain diving and salvage methods, in oceanography, and on survey and repair operations carried out under water.

Operation of the Camera

The Deep Sea camera apparatus can be operated at depths down to 3,000 feet below the surface, the image which it produces being displayed on the picture tube of a monitor located on the salvage ship. Alternatively, or additionally, the picture waveforms may be transmitted by normal means for reproduction at a point remote from that of investigation.

Instead of having to rely on a diver's report, a number of expert observers may view the underwater scene displayed on the monitor, the number of monitors used being increased as required. Conversely, a diver may be shown the monitor picture and instructed what to do before descending to his work under water. A record of the pictures reproduced on the monitor screen is easily made by photographic means, which obviates the difficulties of taking photographs under water.

The camera may be trawled for search purposes, or may be employed for detailed examinations of specific objects located by Asdic or other echo-sounding apparatus. In a salvage application concerning the recovery of submerged wreckage, objects are first located by means of Asdic and are then examined visually by means of the camera. Owing to the impossibility of stopping a moving ship immediately an object is located by Asdic, subsequent search of the same area is made by trawling the deep sea camera at slow speed until the previously located object comes into view on the monitor. This operation can be carried out with considerable accuracy.



The 'Deep Sea' underwater camera, which can operate at depths down to 3,000 feet.

Pye underwater television equipment will find many applications in salvage operations, submarine engineering, marine biology and oceanography, especially at depths to which it may be dangerous or impossible for a diver to descend. In the survey of dock-gates or wharves, or of the hulls of ships, especially ships which may have been damaged in collision, Pye underwater television camera equipment is an invaluable and economic aid. Experts may themselves observe the extent of damage as revealed on the monitor, instead of relying on second-hand

information from a diver, and so decide if repairs can be made *in situ*, or if it is necessary to incur the expense of putting a ship into dry-dock.

The camera provides a means of seeing under water and, like the diver, is dependent on light conditions for its range of vision. The underwater television camera employs an Image Orthicon pick-up tube of the same type as that used for normal television purposes. This tube can operate at lower light levels than the human eye, which means that the range of the camera is a little greater than the diver's under similar underwater conditions. For example, it was found during a naval exercise in Tobermory Bay that a diver could be directed, from the surface, to an object which was out of the diver's range of vision, though both he and the object were visible on the monitor screen to observers at the surface.

When a diver is working in adverse conditions, or is fatigued, or is under stress, the camera has a greater advantage since the performance of the camera is not affected by conditions or depth and can remain submerged indefinitely while still operating at full efficiency. The camera is not affected by the speed at which it is lowered or raised, no matter what the depth may be.

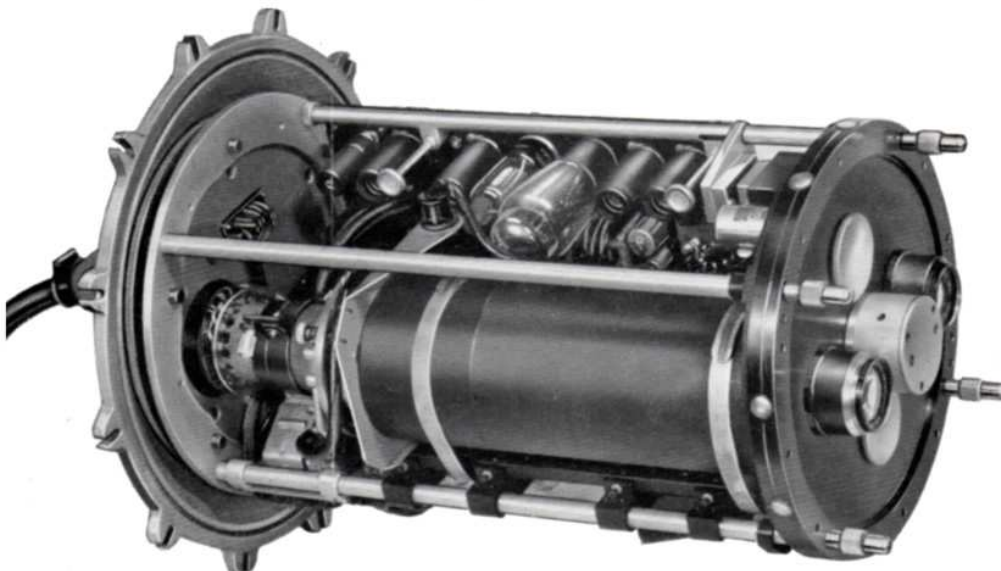
It is not intended to convey, nor should it be understood, that television can ever completely replace the diver. Rather should it be looked upon as a valuable aid. By being able to operate in conditions and for periods of time impossible for divers, television makes possible underwater operations which could not previously be carried out. It also enables experts to observe and direct the work of a submerged diver.

Brief description of the Equipment

The camera is contained in a protective cylinder which is constructed with an ample safety margin to resist the pressure encountered at the maximum operational depth. This cylinder is fitted with large fins so that it will take up the desired attitude when being towed. The container and fins are made of Duralinox alloy, which is resistant to the action of sea water. All bolts, nuts, washers and pins are made from stainless steel. The head, or end plate carrying the camera, is fitted to the casing by twelve screws, the joint being made waterproof by means of an annular seal. Special measures are taken to make the glass window, at the other end of the cylinder, waterproof, and also to make the cable entry watertight. The ingress of water, due to accident, or to possible failure thoroughly to tighten the head nuts, is immediately indicated at the control point by means of a buzzer and a warning light.

From the control unit all operational adjustments are made to the camera by remote control, for focus, iris setting and lens changing. The rotary lens turret is equipped with two lenses with focal lengths of 35 mm and 50 mm, giving horizontal viewing angles of 58° and 35° respectively. An additional lens of 39 mm focal length and 45° horizontal angle of view can be supplied if required. The selection of lenses permits a wide or narrow angle of view to be obtained as may be required by circumstances.

Meters can be provided on the control equipment as optional extra items by means of which the depth of operation and the angle at which the camera is tilted can be continuously indicated.



Removal of the headplate from the outer casing removes the camera assembly complete. The illustration shows the hand-held camera assembly, but construction is similar for the 'Deep Sea' camera.

The stirrup from which the camera is suspended is attached on either side of the camera, the point of attachment being adjustable to give several pre-set angles of tilt. The stirrup is terminated at the top by means of a cleat through which the special camera cable passes and to which it is attached. The cable also forms the rope from which the complete assembly is suspended, so that only one rope or cable has to be dealt with in lowering or raising the camera.

A probe, 12 feet long, projecting in front of the camera, is attached to the container. This device gives indication of distance from an object, since both the

lamp may be focussed from the control unit so as to give either a spot or a diffused effect.

The camera container is 23 in. long and has an average diameter of 13 in., the combined area of the fins being 4 sq. ft. The camera and container combined weighs 200 lbs. in air and 100 lbs. when submerged. The combined rope and camera cable is supplied in either 1,200 ft. or 3,000 ft. lengths, as required.

The Hand-held Underwater Camera

Pye Ltd. also produce a hand-held underwater television camera which is similar to the Deep Sea type,



The hand-held underwater television camera

object and the end of the probe are visible on the monitor screen. The probe also serves as a visual indication that the camera is operating correctly, if no other object is within range of the camera.

The apparatus for controlling the camera and supplying power for its operation is contained in a box 14 in. high, 14½ in. wide and 21 in. deep. The total power consumption is approximately 400 watts.

The monitor for viewing the picture, which is the third item in the complete camera chain, is housed in a container the same size as the control unit. The compact form of the shipboard equipment therefore makes little demand on the accommodation provided by even a small vessel. The equipment can provide a signal for the operation of as many additional monitors as may be required.

Some form of artificial lighting is necessary when operating in deep water, and this is provided by one 250 watt spot lamp fitted to the fin attachment. The

except that since it is not required to operate beyond the depth to which a diver can venture, the case is correspondingly lighter and less bulky. Handles are fitted to the container on both sides, and since it is just buoyant in water, the container is convenient and easy to handle. As with the Deep Sea camera, all operational adjustments are made from the surface, the diver acting only as a means of propulsion. The maximum depth of operation for which this camera is designed is 250 feet. It is supplied with 300 feet of cable.

Users of Pye Underwater Camera Equipment

Pye underwater camera equipment is used by H.M. Navy, the Royal Canadian Navy, the United States Navy and by salvage companies.

The Underwater Television Division, Pye Ltd., Cambridge, England, will be glad to supply further information and to advise on projected applications of the equipment.



Underwater Television Division

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