Uniclamp, a Load-bearing Termination for Oil-well, Logging-type Cables[1]

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ABSTRACT

Uniclamp, a simple, durable, and easily installed device used currently for oceanographic work permits mechanical loads to be attached to an oil-well, logging-type cable containing coaxial electrical leads, and it has the desirable feature of bearing loads up to the ultimate strength of the armored cable. This clamp secures the armor between a slightly tapered hollow spindle within the cable and a similarly tapered external block. This device is easy to dismantle and to reuse.

Oceanographers are often confronted with the requirement of towing or lowering to great depths at the end of a cable a heavy instrument-package requiring electrical power and telemetering. Sometimes the requirement is fulfilled by using separate cables – one for the mechanical functions and another for electrical functions; this complicates and necessarily retards operations at sea. By using an armored steel cable with electrical wires mounted coaxially within the stress members, operations at sea are simplified; with such cables, however, many of the clamps used for attaching mechanical load to the stress members of the cable produce a nonuniform distribution of the load among individual wires of the armored cable; consequently such cables fail to develop the full strength of the cable. A well-designed clamp should permit repeated mechanical loading of the cable up to its breaking point without any interference with the cable's electrical functions.

Uniclamp, so named because it is a universal type, is simple, durable, and easily installed, and meets the requirement of realizing the full strength of the cable without limiting its electrical functions. It was developed at this laboratory specifically for a deep-towed oceanographic device.

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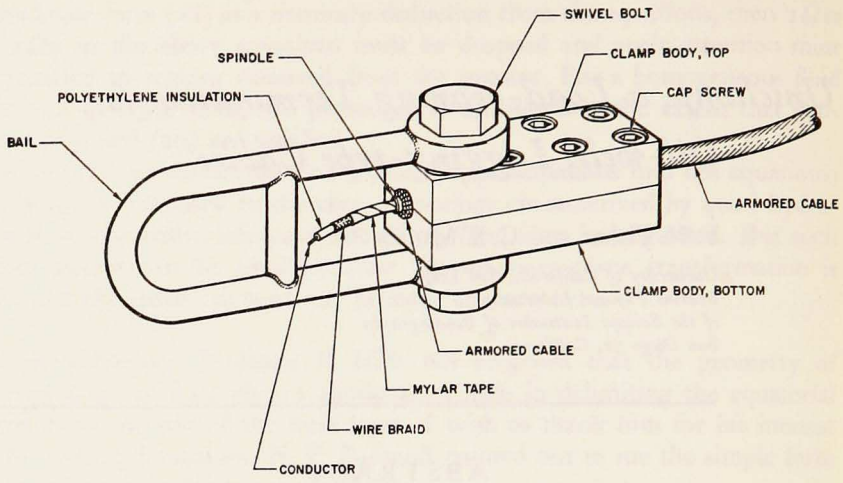

Figure 1.

Uniclamp, shown in Figs. 1 and 2, consists of (1) two halves of a clamping body or block and (2) a hollow spindle between which strain members of the cable are wedged. The clamping block has a hole, centered between the two halves, that has been drilled longitudinally through it. The diameter of two-thirds of the length of the hole is slightly less than the outside diameter of the cable; the diameter of the remaining third, which is nearest the load, tapers to a size slightly larger than the outside diameter of the cable. Two-thirds of the hollow spindle has an outside diameter equal to the inside diameter of the armor, while the remaining third increases to a slightly larger diameter that matches the taper of the clamping block. The difference between the radii on the outside of the spindle and on the inside of the clamping block equals the sum: diameter of wires from the inside lay and the diameter of wires from the outside lay minus 0.010 inch; that is, to insure a tight initial fit, the clearance between the spindle and the clamping block is 0.010 inch less than the thickness of the armor. Upon application of the load to the clamp, the clamping block will be wedged against the wire over the tapered section of the spindle.

The two halves of the clamping block are held together by eight cap screws. The mechanical load is supported by a bail that is attached to the clamping body by two special swivel bolts.

The cable used with this clamp is a double-lay armored cable with co-axially mounted electrical wires. For cable with an outside diameter of 3/8 inch,

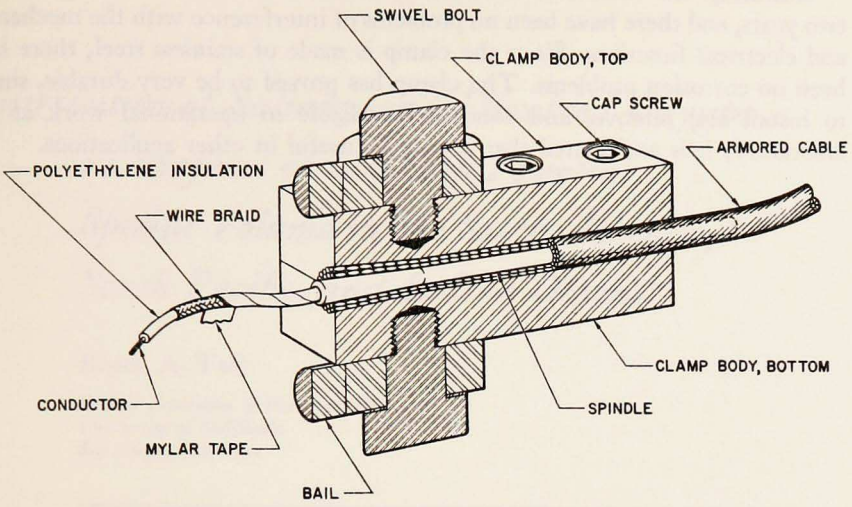

Figure 2.

Uniclamp has a length of $4\frac{1}{2}$ inches and a width of $1\frac{7}{8}$ inches. It is prepared for use with the clamp essentially as follows:

1. The armor or the strain members of the cable are cut and removed so that the length of the exposed electrical wires is adequate to reach the equipment involved.

2. The remaining armor is unlayed far enough so that, when the insulation is removed, the hollow spindle can be pushed over the electrical wires until the spindle is just covered by the armor. The inside diameter of the spindle can be enlarged if it is necessary to use, for example, a pressure-sensitive mylar tape to insure electrical insulation and water-tight integrity.

3. The clamping block is secured over the spindle and armor after the strain members of the armored cable have been relayed as closely as possible to their original configuration.

The gradual taper of both spindle and clamping-body block insures not only a minimum alteration in the lay of the strain members of the cable but a uniform stress distribution among them. As the load increases, the wedging effect increases; because of uniform stress distribution, failure does not occur until maximum strength of the cable is reached. The clamp was tested to the ultimate strength of the cable (10,000-lb load) several times at the U.S. Navy Electronics Laboratory with the kind cooperation of Mr. J. C. Thompson, head of the Materials Testing Section.

Uniclamp has been used successfully at sea several times during the past two years, and there have been no problems of interference with the mechanical and electrical functions. Since the clamp is made of stainless steel, there have been no corrosion problems. The clamp has proved to be very durable, simple to install and remove, and completely reliable in operational work at this laboratory; it is anticipated that it may be useful in other applications.