

QUICK RELEASE BRANCHLINE CLIP DEVELOPED FOR LONGLINING

Michael G. Corbett

The longline auto-clip, an improved clip, has been developed for the automatic or manual attachment and detachment of longline branchlines and buoylines. Its use will improve safety, speed, and efficiency through better use of manpower.

A satisfactory clip must be easy to attach and detach, permit mainline to rotate freely, must not slide along mainline, and still be readily adaptable to mechanical attachment and detachment. Clips that fulfill some of these requirements have been developed.

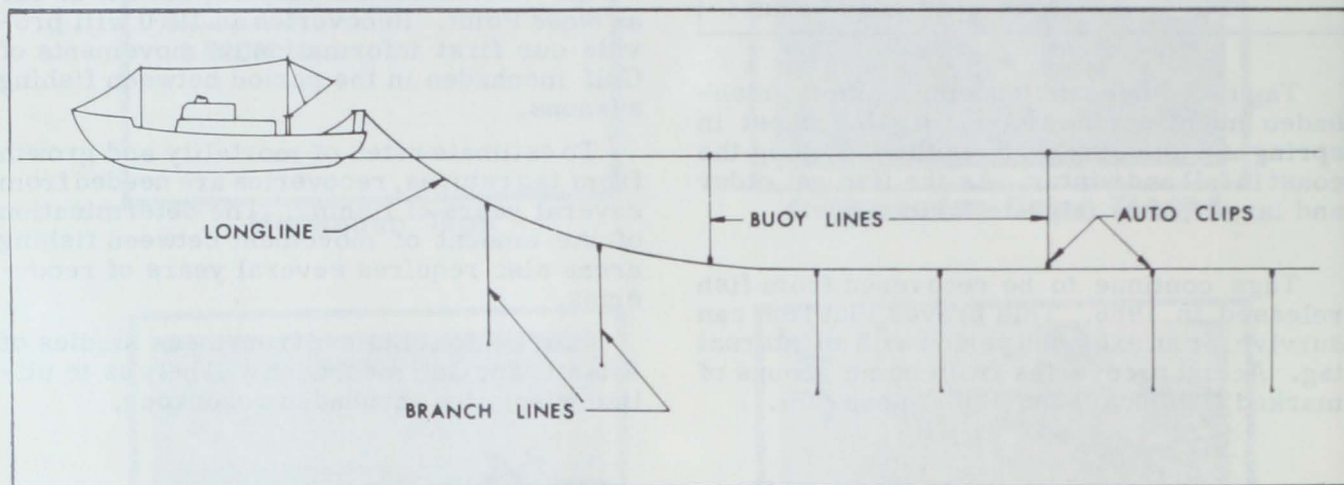


Fig. 1 - Typical longline operation.

Longlining is a method used extensively in commercial fishing for tuna, swordfish, and halibut (Fig. 1). It may be used for any fish that will strike a baited hook. A fishing boat pays out a main or longline, to which are attached branchlines and buoyines at spaced intervals. Each branchline has one or more baited hooks; each buoyine has a float. In tuna fishing, the longline may be 10 to 12 miles long and carry 1,000 branchlines and buoyines.

Early systems for handling longline gear used knots for attaching branchlines and buoyines to the longline. Fishing-gear technologists have emphasized frequently the advantages of a readily detachable clip to secure these lines to the longline. Such a system enables baiting of hooks prior to shooting (paying out) the longline, speeds both shooting and hauling (line retrieval) processes, and decreases labor requirement.

Generally, these clips are heavy wire bent in shape to allow them to be snapped onto longline. In use, however, these clips often slip along longline or, occasionally, deform under tension of pull from a large fish and sometimes unsnap from longline when they strike the boat during haulback. Known designs of such clips cannot readily be adapted to a mechanical attaching and detaching operation.

The BCF Exploratory Fishing and Gear Research Base, Gloucester, Mass., developed the longline auto-clip. It has these features: 1) mechanical attachment and detachment from moving mainline, 2) capacity for simple alternate manual operation when necessary, 3) nonslippage of branchline along mainline, 4) a design suitable for further development of a fully automated longline fishing operation, 5) strength equal to or greater than other longline components, 6) positive holding of branchline(s) with fish to mainline, and 7) simple fabrication by conventional techniques.

Mr. Corbett is Mechanical Engineer, BCF Exploratory Fishing and Gear Research Base, Gloucester, Mass. 01930.

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DESCRIPTION

Figure 2 shows configuration of longline auto-clip. The clip includes an upper and a lower body plate (A). These body plates are identical and are formed by die stamping from corrosion resistant 6061 T6 aluminum alloy strapping. Three spring guide projections (1) and a jaw stop projection (2) extend inwardly

on each body plate. These projections are formed during the die stamping operation. On the midline at the front end of each body plate is a slot or throat (3) that tapers and terminates in a radius of curvature equal to or very slightly smaller than the radius of the longline. On either side of the throat are ears (4); each ear has a hole. A third hole is located on the midline near the back end of each body plate. The two body plates are held apart by bushings (B) mounted on rivets (C). The bushings are of a nylon and formaldehyde resin, "Delrin,"¹ having a relatively high strength and a low coefficient friction.

Pivotal movement of the jaws is limited by contact of jaw points with jaw stop. Pivotaly mounted on the bushings between the body plates are the jaws (D). The jaws are of identical shape and are assembled in a mirror-image relation. The jaws have rounded lips (5), which extend beyond body plates. The jaw teeth (6), in closed position, extend across throat of body plate, terminate in jaw points (7), and form an enclosure with the throat within which is secured the longline. Pivotal movement of the jaws is limited by contact of jaw points with jaw stop.

The jaws are held normally in a closed position by pressure exerted by ends of the spring (E). Force exerted by a rope or line within the enclosure formed by the jaw teeth and throat tends to act with the spring pressure, causing the jaws to close tightly. The spring is a flat strip of corrosion resistant 304 stainless steel bent to be held in position by spring guide projections. The ends of spring are curved to provide a sliding contact with outside edge of jaw points. The swivel (F) pivots freely around bushing and rivet at back end of clip. The clip is finished in a flat black hardcoat anodizing to reduce its attractiveness to fish and prevent longline damage caused by fish striking it.

Other important features of the clip are weight, tensile strength, shape, and size. Weight is minimal ($3\frac{1}{2}$ ounces) through use of aluminum in its construction. Tensile strength has been tested to exceed 1,000 pounds, which equals or exceeds strength of any other branchline components. Shape and size (Fig. 3) have been designed to: 1) fit the hand for manual operation, 2) adapt to mechanical indexing and orientation, and 3) adapt to mass production manufacturing processes.

The mechanical principles are not new; the application of these principles, through concept and design of the auto-clip, is new to

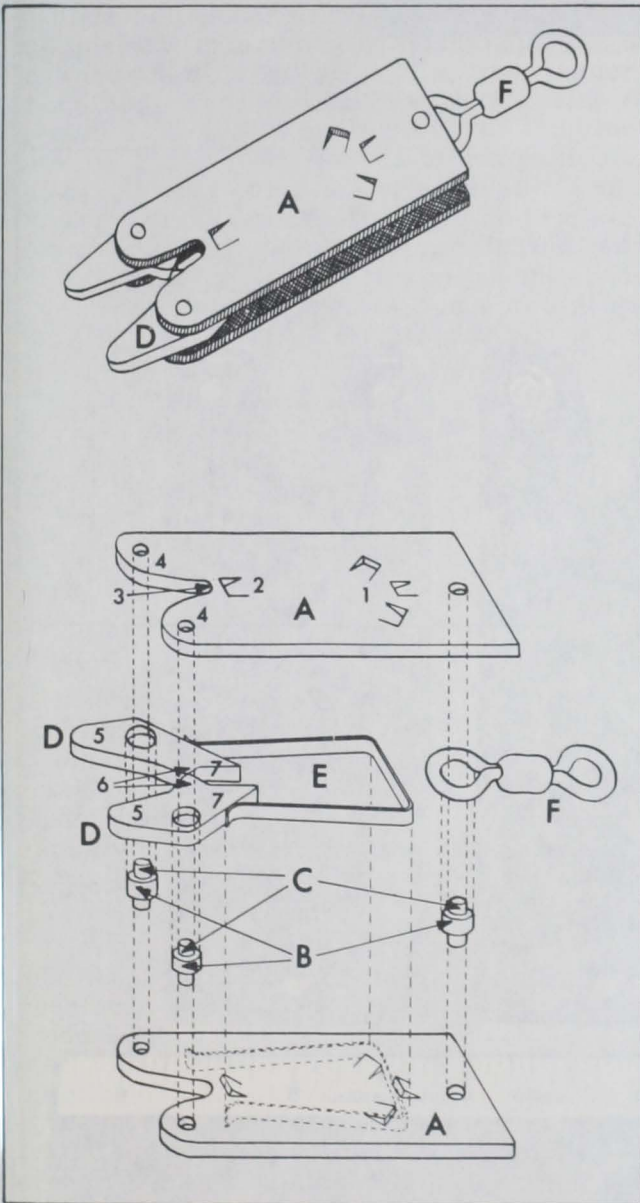


Fig. 2 - Auto-clip (exploded view).

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|----------------|-----------------------------|
| A. Body plates | 1. Spring guide projections |
| B. Bushings | 2. Jaw stop projection |
| C. Rivets | 3. Slot or throat |
| D. Jaws | 4. Ears |
| E. Spring | 5. Jaw lips |
| F. Swivel | 6. Jaw teeth |
| | 7. Jaw points |

¹ Trade names do not imply endorsement of commercial products.

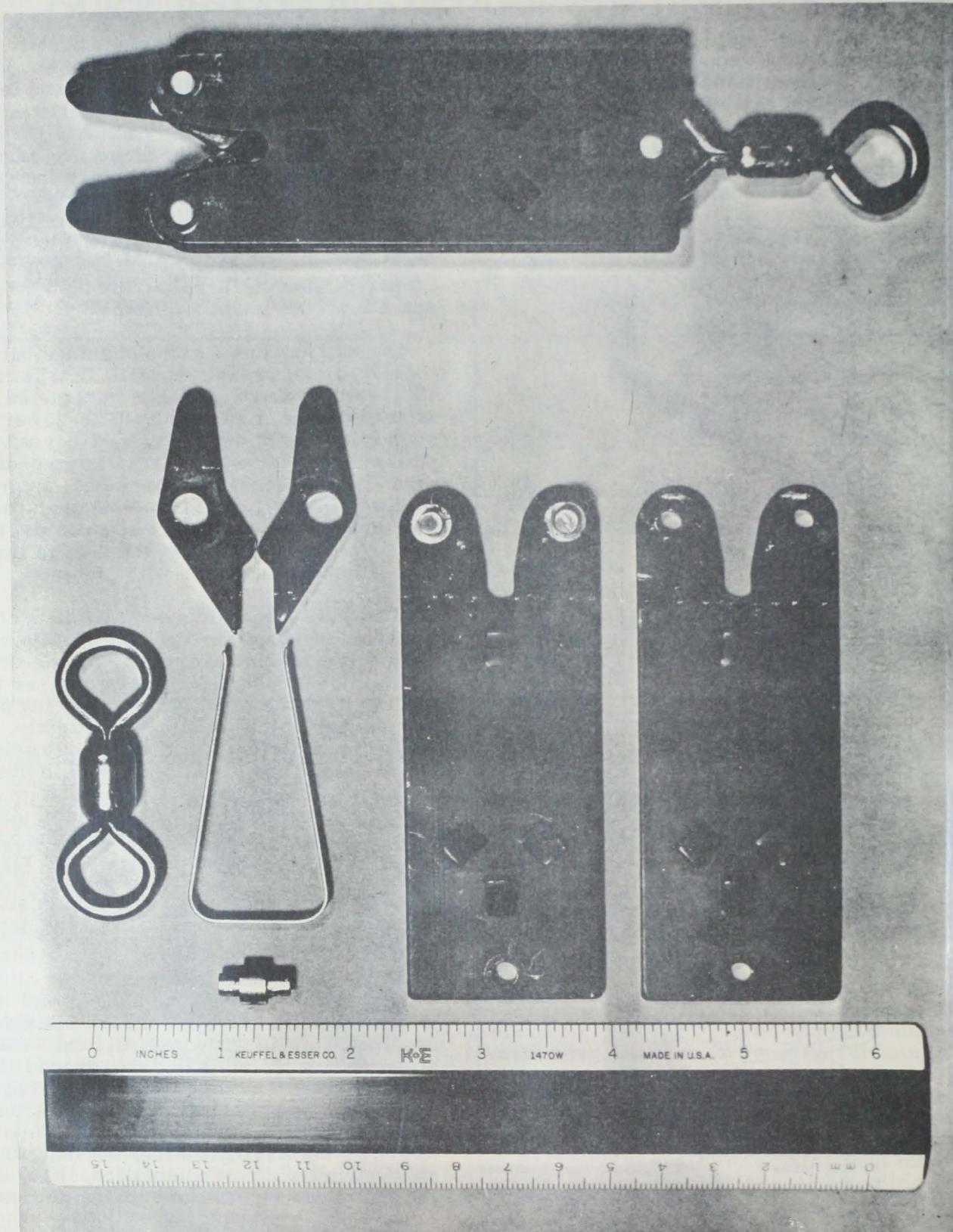


Fig. 3 - Photograph of auto-clip showing size of components.

fisheries. Other applications of this attachment principle are the semitrailer truck tractor-to-trailer hitching device and German Rolleiflex strap-to-camera hitch. Although these devices operate similarly to the longline auto-clip, their application and design are different.

THEORY OF OPERATION

The longline auto-clip is an integral part of longline fishing gear: It is one component of the branchline consisting of clip, line, leader, and hook. The clip is connecting link of branchline for its attachment to longline. Buoylines are also attached by auto-clips to the longline at intervals of several branchlines, and are connected to buoys on sea surface above--thereby suspending fishing gear below sea surface. The line component of the branchline, or buoyline, is connected to the barrel swivel, which permits rotation of the line.

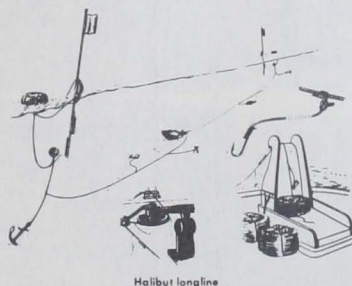
During setout of the fishing gear, the longline is payed out behind the moving vessel. Baited branchlines are attached either mechanically or manually to longline by pushing clip onto moving longline. As longline is inserted between jaws of clip, the jaw teeth are forced apart against spring tension. This allows longline to slip past jaw teeth and into throat of the clip. Once longline is in throat of clip, the jaw teeth snap shut under pressure of the spring.

The branchline attached by auto-clip cannot slide horizontally along the longline unless the auto-clip is precisely perpendicular to the longline. At any other angle to the longline, the clip "grabs" the longline to prevent slippage. This feature permits longline construc-

tion without knots or hardware to hold branchlines at their spaced positions--and it also permits flexibility of longline gear change by enabling metered branchline and buoyline attachment to the longline. This flexibility is virtually impossible with other clips or methods that require a pre-knotted longline for positioning and holding of branchlines and buoylines. The "grabbing" action of the auto-clip does not cut or fray the longline under normal (fish) pressures because of the rounded edges of the clip components.

When longline gear is retrieved, the clip-attached branchlines and buoylines approach from various angles and under varying tensions--depending on catch, weather, sea, and vessel maneuvering. Regardless of approach angle or tension, clip-attached branchlines and buoylines may be readily released from the longline either mechanically or manually. If operation is mechanical, the longline is directed through a fairlead sheave designed to orient, detach, and catch the clips with their attached lines. If detaching operation is manual, or if branchline is snarled about the longline preventing mechanical detachment, the fisherman removes the clip by grasping it with one hand and closing the protruding jaw lips. The thumb and forefinger of either hand, whether gloved or not, can readily close the jaw lips at a grab. This act releases the clip and, simultaneously, deflects it away from mainline. The fisherman does not have to take hold of the clip to release it.

Use of the longline auto-clip reduces and possibly eliminates manual handling of longline gear. The result is to improve safety aboard vessels, reduce labor requirements, and increase speed and efficiency of the fishing operation.



Halibut longline