CHAPTER 7

TRU-LOC CABLE END-FITTING SWAGING MACHINE

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LIST OF ILLUSTRATIONS

General

1. A hand operated swaging machine is used for fixing outer sleeves or hollow shanks to certain special types of control cables, by the application of an external squeezing action. The pressure is applied by a combined lever and cam acting through the medium of a pair of suitably shaped dies, the action being repeated at close intervals along the length of the cable end-fitting.

2. The machine can be used to swage the following types of end-fittings to control cables:—

(i) Threaded shank-type terminals
(ii) Eye-end shank-type terminals
(iii) Fork-end shank-type terminals
(iv) Rotatable shank-type terminals
(v) Ball-ends.

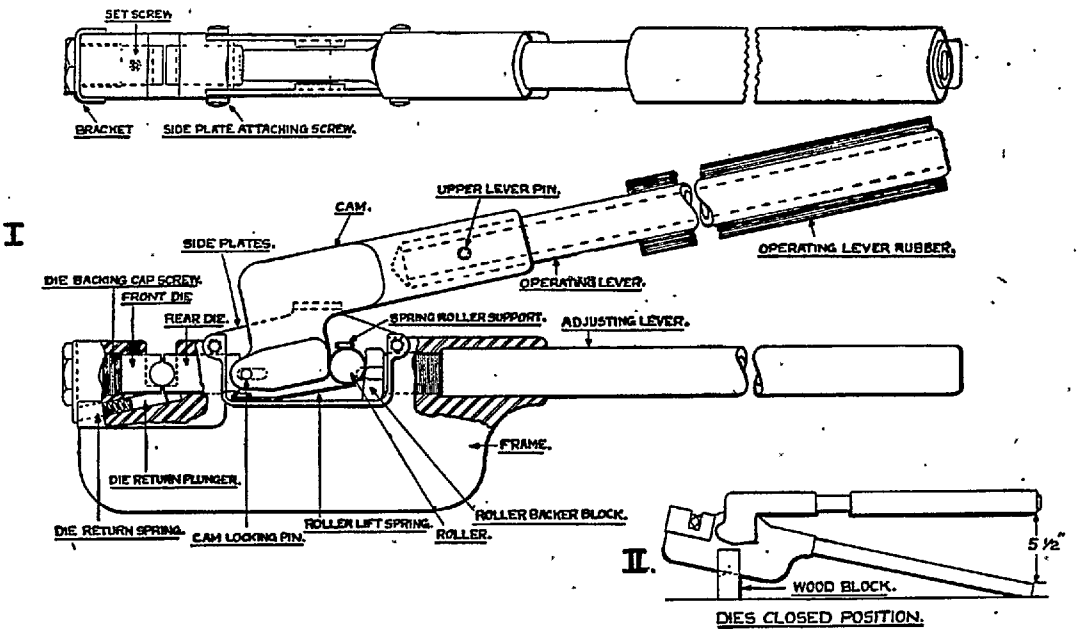


Fig. 1—Tru-loc cable end-fitting swaging machine

3. The machine can be used either on the bench or, if more convenient, on the aircraft with the cable *in situ*, and is particularly intended for use on the special control cables of certain aircraft where swaging is preferable to splicing. Some instances are detailed in the following list:—

(i) Gill controls
(ii) Throttle controls
(iii) Mixture controls
(iv) Airscrew pitch controls
(v) Carburettor heat controls
(vi) Aileron, elevator and rudder controls.

DESCRIPTION

Layout of machine

4. A sectional view of the swaging machine is shown in fig. 1. The steel frame has in its upper surface a recess, guarded by side plates, in which a cam can be rocked by means of its operating lever. The forward end of the cam is cylindrically shaped to engage a concave recess in the rear die against which it exerts a horizontal, forward thrust when the operating lever is pressed. The reaction to this thrust is taken by a roller which is held against the rear face of the cam by a flat spring, a roller backing-block, and a rotatable adjusting lever. The front die, held in position by a die backing cap screw and prevented from rotating by a setscrew, meets the swaging face of the rear die in a recess in the frame through which the work can be introduced. A die return plunger, spring-loaded, in an inclined cylindrical bore at the forward end of the frame, presses against the rear die and ensures that it returns with the cam after the working stroke is completed.

Interchangeable dies

5. A set of front and rear dies to suit cables of the following diameters is provided with each swaging machine:—

Dia. of cable	Die number	Cable strength
$\frac{1}{16}$ in.	24–M/25–M	5 cwt.
$\frac{3}{32}$ in.	26–M/27–M	10 cwt.
$\frac{1}{8}$ in.	28–M/29–M	15 cwt.
$\frac{5}{32}$ in.	30–M/31–M	20 cwt.
$\frac{3}{16}$ in.	32–M/33–M	25 cwt.

Gauges

6. To guard against excessive squeezing of the cable and end fitting, a pair of plate gauges is supplied for each size of die. These gauges are marked "GO" and "NOT GO", and should invariably be used during the operation of the machine.

OPERATION

Setting up

7. The swaging machine when required in operation should be placed on a bench about 20 in. to 24 in. above floor level to enable the operator to apply the weight of his body on the lever to full advantage. The operating lever should be parallel with the edge of the bench, the frame with the dies being at the operator's left hand. This will bring the dies into the correct position for introducing and feeding the fitting to be swaged. A great increase in the speed of operation can be obtained if two operators are engaged, one to feed and rotate the fitting between the dies, the other to operate the handle.

8. The amount of squeeze transmitted to the dies is important. An adjustment which contributes to uniformity of results is provided in the form of the lower rotatable lever. Clockwise rotation of the adjusting lever forces the roller against the cam, lifting the operating lever and causing the dies to be brought together earlier in the downward, operating stroke. Anti-clockwise rotation of the adjusting lever allows the cam to settle lower, and the dies to meet later in the operating stroke. The correct adjustment is obtained when, with the dies together, a gap of $5\frac{1}{2}$ in. is measured between the ends of the operating lever and the adjusting lever (see fig. 1, Sketch II).

9. A wooden block is provided to support the frame of the machine. The block and the end of the adjusting lever are the only parts in contact with the bench during operation (see fig. 1, Sketch II).

Cutting the cable

10. During the swaging operation an elongation of the cable end fitting occurs. This should be taken into account when cutting the cable for existing conditions. The following allowances in length should be made for end fittings on cable assemblies, noting that two end fittings would double the amount to be deducted:—

For each end-fitting on	$\frac{1}{16}$ in.	cable, deduct	$\frac{1}{8}$ in.
,, ,, ,, ,,	$\frac{3}{32}$ in.	,, ,,	$\frac{1}{8}$ in.
,, ,, ,, ,,	$\frac{1}{8}$ in.	,, ,,	$\frac{9}{16}$ in.
,, ,, ,, ,,	$\frac{5}{32}$ in.	,, ,,	$\frac{7}{32}$ in.
,, ,, ,, ,,	$\frac{3}{16}$ in.	,, ,,	$\frac{1}{4}$ in.

Blind hole fittings

11. In fig. 2, Sketch I, the fittings marked Class A, B and D, have the cable hole drilled for a limited distance into the shank. It is important that the cable touches the bottom of the drill hole at the time of the first swaging operation. To ensure this the cable should be marked in accordance with the lengths given in the following table:—

Cable diameter	Depth of hole
$\frac{1}{16}$ in.	$1\frac{3}{64}$ in.
$\frac{3}{32}$ in.	$1\frac{17}{64}$ in.
$\frac{1}{8}$ in.	$1\frac{33}{64}$ in.
$\frac{5}{32}$ in.	$1\frac{49}{64}$ in.
$\frac{3}{16}$ in.	$2\frac{1}{64}$ in.

Note.—If the cable does not enter the hole to the point marked, the fitting should be examined to ensure that no foreign matter is present. If cleaning of the fitting fails to admit the cable to the full extent, the fitting should be rejected.

Clear hole fittings

12. The fitting marked Class C (see fig. 2, Sketch I) has the cable hole drilled right through the shank. The cable for this type of fitting should pass through the hole in the shank and extend beyond it by an amount equal to the diameter of the cable.

Inserting dies

13. The following sequence of operations should be applied when inserting dies in the machine:—

(i) Remove die-backing cap-screw and bracket from front end of machine frame (see fig. 1.)

(ii) Apply heavy coating of extreme pressure grease (Stores Ref. 34A/54 or /72) to the outer surface and cam-end of rear die.

(iii) Insert the rear (long) die into the hole vacated by the die-backing cap-screw, making sure that the flat is on the underside.

(iv) Insert the front (short) die with the setscrew, the flat face being uppermost and the plunger groove downwards.

(v) Align the setscrew and the flat on the front die, and tighten setscrew.

(vi) Ensure that the die-return plunger and spring are in the inclined hole under the front die, then replace the bracket on the front end of the swaging machine.

(vii) Screw in and tighten the die-backing cap-screw in front of the machine.

(viii) Rotate the adjusting lever until the operating and the adjusting levers are $5\frac{1}{2}$ in. apart at their extreme ends (see fig. 1, Sketch II).

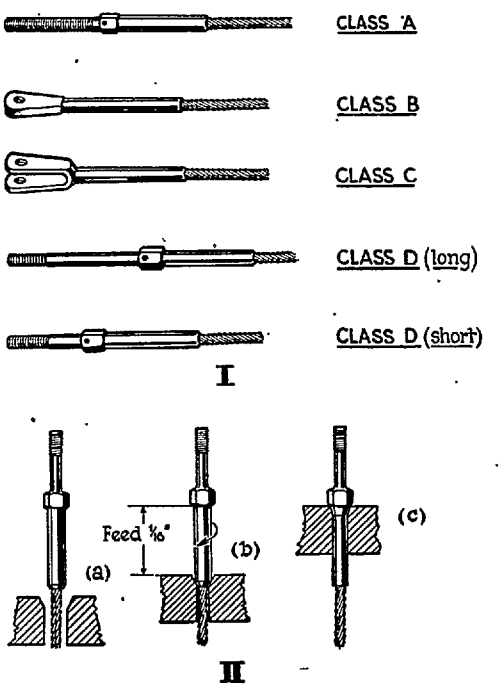


Fig. 2—Tru-loc swaged type terminals

Examination of parts before swaging

14. The cable and end-fitting should be examined before swaging as follows:—

(i) Ascertain whether, if required, preliminary stretching of a flexible cable has been effected.

(ii) Measure the external diameter of the terminal shank, its length, the depth of hole and ensure that each connection is correctly mated to its particular cable.

(iii) See that the ends of the cable have been squarely cut and that the correct allowances has been made for stretching the fitting during swaging, as indicated in para. 10.

Swaging

15. With the swaging machine set up and the dies in position proceed as follows:—

(i) Insert the cable into the end-fitting.

(ii) Apply a few drops of oil to the cable and to the fitting to be swaged.

(iii) Open the dies by raising the operating lever.

(iv) Place the fitting and cable in the front die recess so that the end of the fitting is centred in the die. (See fig. 2, Sketch II (a).)

Note.—Always insert the end-fitting into the bell-mouthed side of the dies.

(v) Squeeze the end-fitting by pushing down the operating lever until the dies are completely closed.

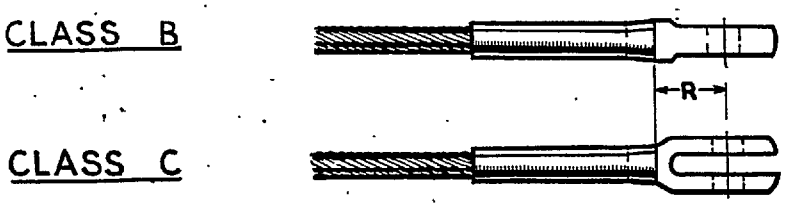
(vi) Open the dies by raising the operating lever sufficiently to rotate the end-fitting one quarter of a revolution and feed it $\frac{1}{16}$ in. into the dies. (See fig. 2, Sketch II (b).)

Note.—Where possible, rotate the end-fitting the opposite way to the lay of the cable. Otherwise, rotate the fitting one quarter of a revolution, in alternate directions, to each $\frac{1}{16}$ in. feed. Do not overfeed the end-fitting into the dies. To do so will call for a pressure in excess of the power range of the cam and lever.

(vii) Repeat operations (v) and (vi) until the correct length of shank has been swaged. Fittings marked Class A and D (see fig. 2) are swaged as far as the shoulder. The swaging lengths for Class B and C fittings are tabulated in fig. 3.

(viii) To finish the swaged tapered portion of the fitting, rotate and swage several time without feeding movement. (See fig. 2, Sketch II (c).)

(ix) When the swaging operation is completed, gauge the diameter of the cable end-fitting with the "GO" and "NOT GO" gauges supplied.



Cable dia.	Dimension R	
	Class B	Class C
$\frac{1}{16}$ in.	$\frac{21}{32}$ in.	$\frac{5}{8}$ in.
$\frac{3}{32}$ in.	$\frac{7}{8}$ in.	$\frac{3}{4}$ in.
$\frac{1}{8}$ in.	$\frac{29}{32}$ in.	$\frac{29}{32}$ in.
$\frac{5}{32}$ in.	1 in.	$\frac{31}{32}$ in.
$\frac{3}{16}$ in.	$1\frac{3}{32}$ in.	$1\frac{1}{8}$ in.

Fig. 3—Swaging lengths for Class B and Class C end fittings

Examination of parts after swaging

16. The cable and end-fitting should be examined after swaging, as follows:—

(i) If the shank of the fitting fails to enter the "GO" gauge, the amount of swaging is insufficient and further application of the swager should be made.

(ii) If the "NOT GO" gauge slips easily over the shank, it indicates over-swaging and consequent crushing or fracturing of the cable. In severe cases of over-swaging, both the cable and end-fitting should be rejected.

(iii) The increase in length of the fitting should be measured. This dimension will give an additional indication of the amount of swaging that has been applied. An insufficient increase in length suggests incomplete swaging, and undue increase in length suggests excessive swaging.

(iv) It should be ensured that the length of the cable in engagement with the shank is as originally intended. For blind-hole fittings the locating mark on the cable is used for this purpose.

(v) Notice that the lay of the cable is correct, and that the angle of the lay has not slipped during the swaging operation.

(vi) Measure the overall length of the cable assembly when tensioned by a load of 1 cwt. This should be to the length required in the installation.

(vii) Where possible subject the complete cable and end-fitting to a proof loading of 50 per cent of the ultimate strength of the cable.

Removal of dies

17. In order to remove the dies, turn the adjusting lever in an anti-clockwise direction until the operating lever and the adjusting lever come together, then remove the die backing nut and bracket from the front of the machine; loosen the setscrew above the front die and push both dies out of the machine with the die push-out rod provided.

SERVICING

General

18. The dies are the parts principally subjected to wear. A periodic examination should be made for scoring, pitting or corrosion of the working surface. The use of the plate gauges will show up any appreciable change that may take place in the profile of the dies.

Lubrication

19. It is important to keep the working surfaces of the rear die heavily coated with lubricant (Stores Ref. 34A/54 or /72).

20. The rear surface of the cam which contacts the roller should also be greased periodically and it should be ensured that all working parts are kept clean and free in operation.

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