Throttle linkages

The throttle linkage associated with a petrol, or glow, engine transfers the intended servo response to the carburettor. The design challenge is that the rotational axis of the carburettor throttle arm is sometimes not in a simple orientation with respect to the axis of the servo arm. There are many tried and tested ways of achieving a practical linkage, but it may be useful to describe the most commonly used approaches. However, there are so many variations of linkage arrangements based on very specific circumstances that the examples given here are really only meant as a rough guide to the general principles. Commercial kits are available for the bell-crank type linkage and most work well without modification, but a builder should be prepared to spend time optimising their operation.

Cables

Cables – usually comprising a flexible, stranded-wire, inner core and a less flexible (or rigid) outer housing – have been used for many years in all sorts of applications – for racing boats in particular the rotary motion of the throttle and/or mixture control servo(s) needs to be transmitted to a distant point where that motion is converted to a rotation of the throttle, in situations where there are obstructions to a straight path.

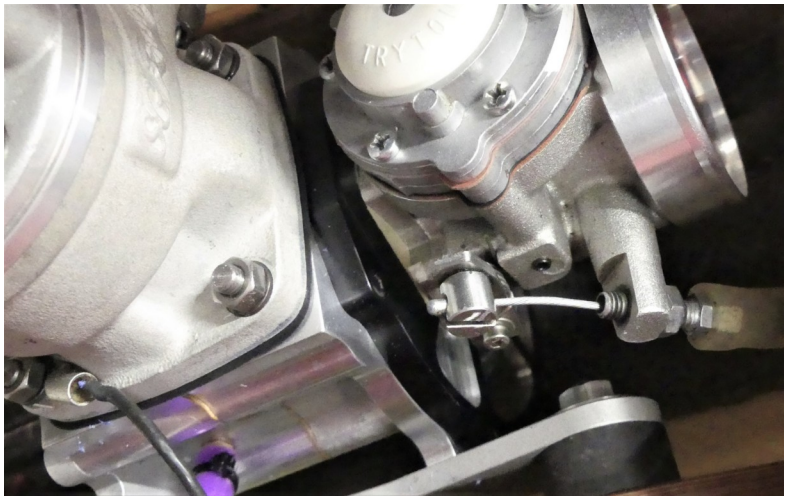

Fig.1 A cable set up is about the only option to reach the carburettor of this bespoke rear induction SG35 special.

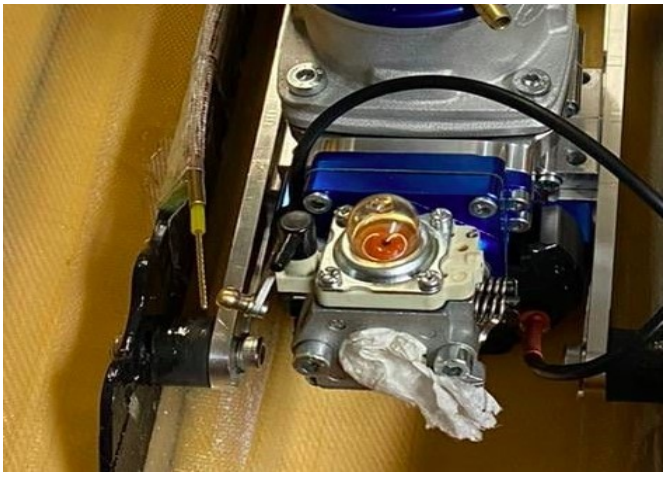

Fig.2 An SG27 motor with a cable and ball-joint connection to the throttle.

A steel wire cable is usually the central core of the linkage, a plain copper tube is used as the outer casing which is often built into the hull and the Bowden cable often has a low friction coating. It is important to ensure that the cable is sufficiently well supported by the outer casing so that there is no tendency for the cable to buckle when under compression. Alternatively, an un-coated Bowden cable can be used with a housing which has a low-friction inner surface. Properly installed and with relatively wide bends it is remarkable how effective this arrangement can be. Moreover, very little vibration is transmitted to the servo so that this system improves servo life. Ideally the Bowden cable should be terminated with a connector that can rotate in the throttle arm, see fig.3.

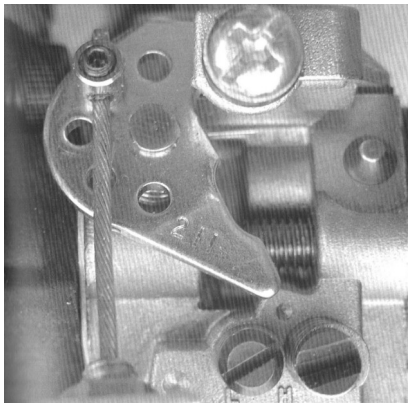

Fig.3 Bowden cable terminating with a swivel connection.

Most throttles have a simple arm to actuate them, but sometimes a disc fixed to the shaft carrying the butterfly can be used. This arrangement maximises the straight pull and push of the cable exiting the casing and provides a more accurate control to the throttle.

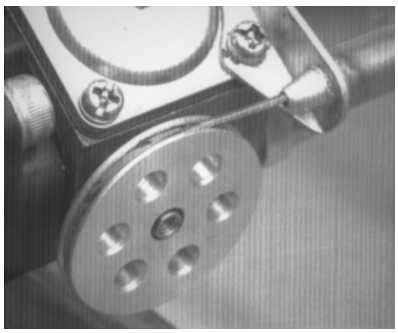

Fig.4 A disc can be used to ensure a uniform throttle action – such an arrangement requires a spring to ensure that the cable does not jump out of the groove in the disc.

Push-pull arrangements are rarely, if ever, required for throttle applications. But such a system is very effective for specialised rudder arrangements, such as in scale catamarans.

Push rods

If the shaft carrying the throttle butterfly valve in the carburettor is in a vertical position on the engine, then it is relatively easy to use a straight rod from the servo to the throttle arm. This arrangement has the advantage of a very direct connection between servo arm and throttle arm, the disadvantage is that engine vibrations act directly on the throttle shaft with the potential for wear.

For the Walbro family of carburettors an adapter plate is required to rotate the carburettor so that the throttle shaft is vertical. Without such an adapter a direct arrangement is still possible, but there will

be significant movement in the joint between the throttle arm and the bearing fixed to the throttle linkage.

The use of a bell-crank arrangement has become popular as an element in a throttle linkage. Despite these kits being available commercially they need to be carefully set up so that the response to the linear motion of the throttle control rod is uniform through the travel of the throttle arm. In some cases, the pivot point of the bell crank attached to the engine might need to be moved away from the engine very slightly for optimum performance.

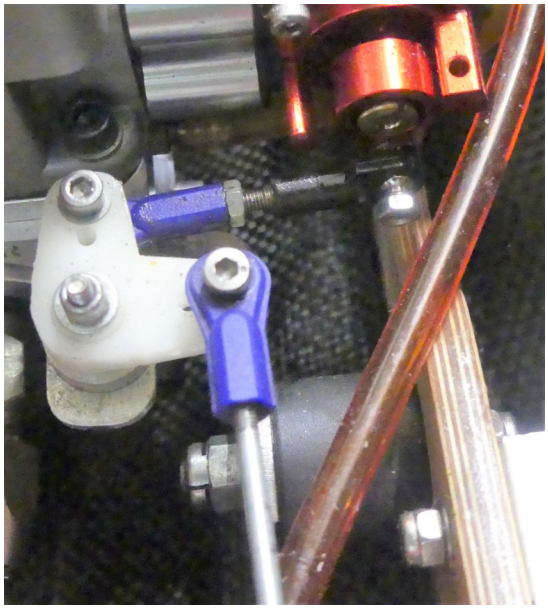

Fig.4 A bespoke bell-crank with a DM barrel carburettor.

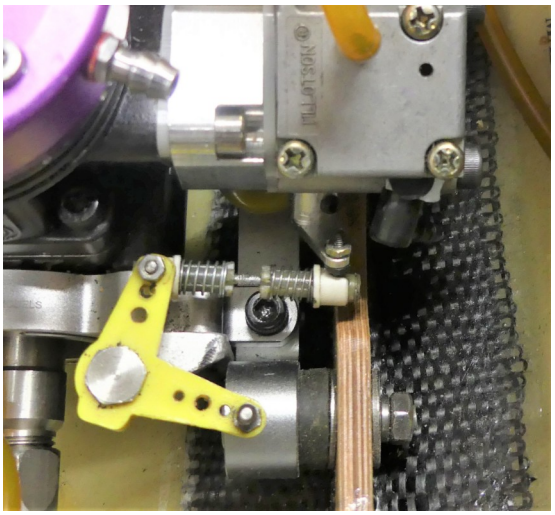

Fig.5 A modified TK bell-crank with a Tillotson carburettor.

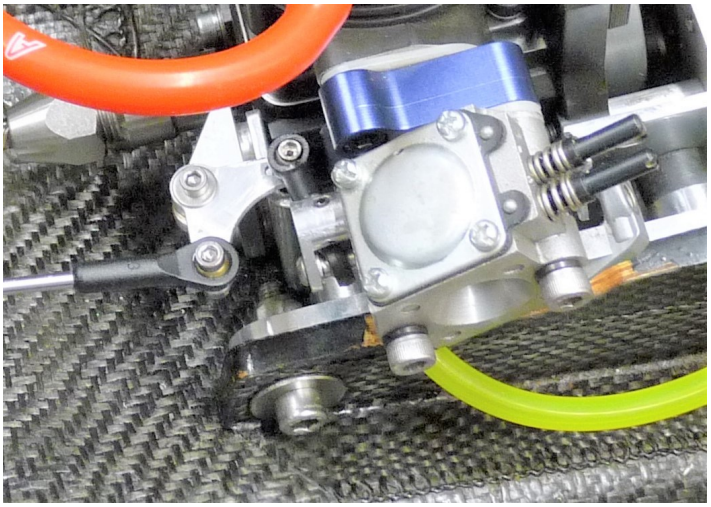

Fig.6 A Walbro carburettor with a slightly tortuous Route for the throttle link

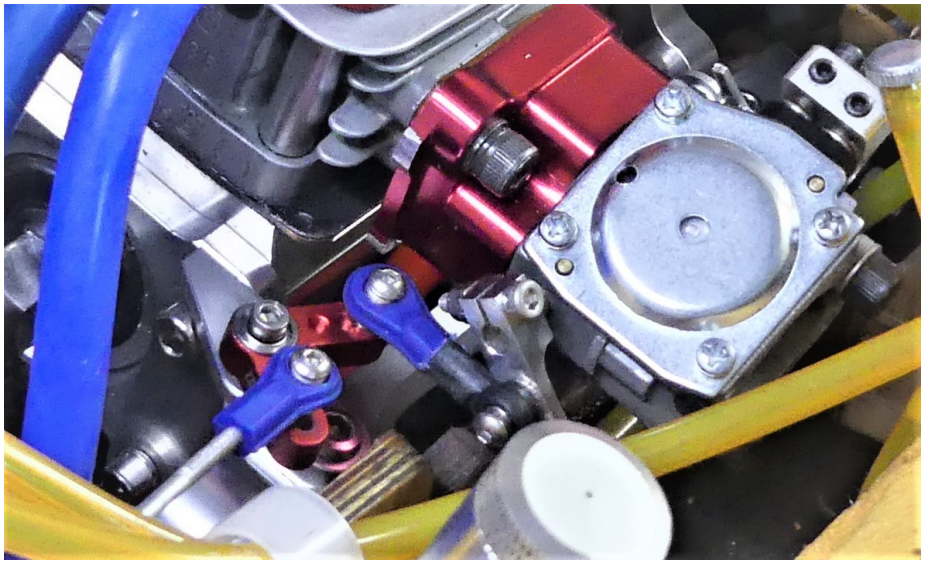

Fig.7 Zen 35 with a Tillotson carburettor.

Some while ago an alternative arrangement of throttle linkage was popular. This used an arm attached to the throttle fitted with a rotating sleeve. A bell-crank was mounted near the throttle arm and imparted a rotation to the throttle, see fig.8. When correctly adjusted they work well. However, any flexing in the set up can lead to poor throttle response and sometimes the bell-crank can disengage with the throttle linkage, especially if a nylon bell-crank is used.

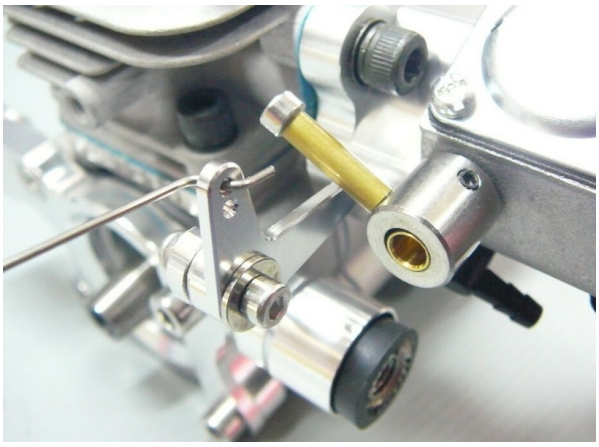

Fig.8 An alternative throttle linkage.

Semi-direct drive

With the increasing availability of water-proof servos, there are applications where a very short mechanical linkage from the servo to the throttle arm may have advantages, for example in larger boats where there is a significant distance from the radio box to the throttle. Care needs to be taken to route the servo cables away from sources of electrical noise. In addition, the effects of vibration on the servo transmitted through the throttle linkage needs to be minimised.