BASICALLY A BANDSAW is a flexible saw blade arranged to move downwards in a vertical plane. This is restrained by side and rear thrust devices and held in tension by an adjustable tension wheel. It is essential that the blade runs true and does not wander when the work is applied. This is accomplished by an angular setting device incorporated on the shaft of the free running wheel.

For economy and space considerations the machine was built to operate on the bed of an M.L.7 lathe and was also provided with a choice of speeds. It is worthwhile to slip two pieces of cardboard between the base of the bandsaw and the lathe shears; this will prevent any damage to their surface.

The frame

It is sound engineering practice to make all frames as heavy as possible, so that all or most vibration is absorbed. The frame was made of 3/8 in. thick mild steel plate cut to shape as in Fig. 1. It was made in two pieces for convenience of working. The bearing points were stiffened up each side by welding 1/2 in. thick mild steel discs or bosses. The two members are held together by a 1/4 in. thick plate at each side and bolted through. The top member is extended at the front by welding a bracket on the front edge to take the saw guide assembly.

Two pieces of 1-1/2 in. x 2 in. angle were welded to the lower frame member to form a clamping bracket to fit on the lathe shears. After cutting to shape, all rough edges should be cleaned up and the holes drilled as required. It is best to drill in the lathe with the frame bolted to an angle plate on the cross-slide, thus ensuring that all holes are square to the frame face. Before drilling the rivet holes in the angles at the base and the locating cross member, make sure the frame is at right angles to the lathe bed.

Main shafts and bearing bush

Having completed the frame, the shafts are the next logical step. Fig. 2 shows all details. The
FIG. 1A. OF FRAME
BMS

15"

Brass washer adjusting screw
3/4 x 1/4" D silver FREE RUNNING BAND steel bar WHEEL SHAFT BMS

Turn lubrication groove

DRIVE BEARING BRASS

SHAFT ADJUSTING SCREW BMS

FIG. 2

FIG. 5

Slots milled to suit silver steel bar

Retaining plates securing to frame by 2 BA screws

UPPER WHEEL ANGULAR ADJUSTMENT

FIG. 3

MODEL ENGINEER 6 September 1968
DETAILS OF THE BANDSAW
main shaft consists of a shouldered length of mild steel with a hole drilled on the diameter at the large end for a split pin to secure the bandsaw wheel. This should be drilled after marking off through the wheel boss to ensure sufficient end play for free rotation. The main drive bearing is turned from phosphor-bronze, the outside being a press fit into the hole on the frame. The bore should be reamed 7/16 in. dia. to fit the drive shaft. It is likely that the hole will close up after the bush is pressed into the frame; this can easily be corrected by reaming again.

The upper or free running shaft is also detailed in Fig. 2 and should present no difficulty. The exploded view Fig. 3 shows the purpose of the adjustment. This provides angular movement of the top band wheel in relation to the vertical plane of the blade. This ensures that the blade will run on the top of the curved surface of the wheel and remain there. The shaft is supported by the support bar which is a length of silver steel; it is held in milled recesses and kept in position by retaining plates and screws.

The band wheels, Fig. 4, are made up by gluing thicknesses of plywood together, making up a total thickness of 1 in., and turning to 7-1/2 in. dia. The centre is drilled to take the bushes which are made of mild steel for the drive wheel, and phosphor-bronze for the free running wheel at the top. The details of the bushes are clearly indicated in the drawing and an oil hole should be drilled at an angle from the outside face; when completed an oil groove should be scored across the inside of the bore. The bushes are held in position by three nuts and bolts spaced at 120 deg.; note that the clamping shoulders are dimensioned so that the plates make contact with the bushes before the wood in order to prevent movement. The mild steel bush for the driving wheel is extended, thus allowing for a split pin to secure the wheel to the shaft.

The edges of the band wheels are completed with plastic trim, this is of curved section one side and flat the other and is sold for table edging. This is a "must," the machine will not work with flat edges nor will it work if the wood edges are turned to a curved shape due to lack of resilience. The plastic trim should be cut at an angle where the overlap occurs and stuck down without overlap with Evostik.

Blade tensioning device
This is a free-running tyred wheel made from plywood or fibre with a tyre of plastic trim. The wheel is fitted on an adjustable bracket tensioned by a screw as detailed in Fig. 5. Since this wheel revolves at high speed, it is fitted with a brass bush press fitted into the bore.

Main drive assembly
The details are given in Fig. 6; the drive is taken from the lathe chuck via a length of mild steel to one side of a flexible coupling. If a coupling is not available a piece of heavy duty hose-pipe about 2 in. long can be used. This is attached to the stub shaft that fits in the chuck and held with a Jubilee clip.

The other end is attached to the conduit and again held by a Jubilee clip. The purpose of the flexible coupling is to relieve the lathe chuck of any axial or radial thrusts which may be imposed if the shaft centres are not in dead alignment.
The various parts are machined as in Fig. 6; the main drive shaft should either be screw cut or tapped using the die in the tailstock holder. Similarly the hole in the frame should be threaded by using the tap in the chuck. This ensures that the shaft, when screwed up tight, will be square with the face of the frame.

The bushed pulley fits on the shaft and is secured by the 2 BA bolt and brass washer. The conduit fitting (this was only used because it was available and saved machining from stock) was then bolted to the pulley with two 1/4 in. bolts. The pulley boss should be turned off and the face cleaned up to receive the dome cover which was also machined. It may be necessary to put spacer washers on the bolts between the pulley and the dome cover to give a little extra play. Before pressing the bush into the pulley, two flats should be filed or milled to give clearance for the fixing bolts.

A conduit nipple is screwed into the dome cover and locked with a nut, the short length of conduit is then screwed on and tightened. Next the shaft is turned to a tight fit into the conduit and fixed with a split pin. The other end of this shaft carries the flexible coupling or hose-pipe.

In order to keep the belt tight, which is of circular leather with a "U" fastener, a bushed jockey pulley of any convenient size is fitted to a bracket which is bolted to the frame. This is tightened up at a suitable angle so that the pressure is applied to the belt and keeps it taut.

### Upper blade guide

Guides are required above and below the saw table to offset the back and side thrusts produced when work is fed into the saw. This is shown as an exploded view in Fig. 7. The main support is turned from 3/4 in. square steel bar to 1/2 in. dia. as shown; this fits into the holder welded to the frame. It is made adjustable to allow for height variations over the work being sawn. A piece of 7/8 in. x 1/8 in. b.m.s. is bent as shown and fixed to the main support by two lengths of 1/4 in. BSF studding to allow alignment with the blade in the vertical plane.

Take care when drilling the fixing holes for the brass guide bars, these should be clamped up on the bench with a short length of blade in position, together with a piece of 1/32 in. shim. The holes can then be drilled in this position; when the shim is removed the correct gap between the guides is obtained. The back thrust is taken by a brass roller carried on a shaft fitted on the lower extension which is twisted at right angles to the bent flat steel holder. The shaft is threaded at each end and held in position by shake-proof nuts.

### Table support and lower blade guides

The table support serves two purposes, to support the table and also to hold the lower blade guides. Fig. 8 gives full details. The vertical member is welded to a length of angle; this angle is drilled to receive the table. Below this is a steel rod shouldered at one end which carries a small length of angle mounted in a position behind the saw blade. This is located and fixed and the holes for the side thrust roller shafts are marked off with the saw blade in position. The saw blade should be tensioned so that the band wheels grip the blade. Insert the piece of shim alongside the saw blade and place the rollers in position, either get someone to hold them or clamp up with a hand vice. Now turn up a piece of steel so that it just fits the roller bore, turn the end to a point and use as a centre punch to mark the hole centres for the roller shafts. The holes can now be drilled, the shafts made and fitted in position. Note that the thickness of the rollers are less than the width of the saw, and when in position the rollers are clear of the saw teeth. Since it is difficult at such a small diameter to drill oil holes in the shafts, an oil groove is made inside the roller bore to retain and distribute the oil.

The back roller is mounted on a shaft with a larger end than the roller bore, and bolted up to a shoulder which allows free rotation and a little end play. A lubrication hole is drilled through at an angle. This is bolted to a threaded bar, allowing movement to line up with the rear of the saw blade. It should be fitted so that the roller just touches the blade when the upper roller also touches: the working thrust is then shared between both thrust rollers and gives the necessary support at the working position of the blade.

It should be noted that the fixing holes on the vertical member for fixing to the main frame are elongated on one hole. This is to allow for any discrepancy in the centre markings for the band wheels, and will also enable the table to be corrected if necessary to ensure vertical cuts.

### Table and guard

The table is simply a piece of 1/8 in. thick steel plate 8 in. square with a slot cut in the centre to receive the saw blade. This slot is connected to the side edge by a saw cut cleaned up with a warding file, alternatively cut with two hacksaw blades, it will give the necessary width to allow the band saw blade to be "threaded." The table is fixed to the angle support by means of two countersunk 1/4 in. dia. Whitworth nuts and bolts.

The guard is a piece of plywood fitted with bolts tapped into the machine. This could, however, be

Continued on page 852
Boiler on each side of the tug.

Boilers and tubes were of iron and generally lasted as long as the tug; the vessel might get a secondhand pair, but never a new set. Coal consumption was heavy and owners often remarked that "all the profits go up the funnel."

Boiler pressures varied between 5 and 25 p.s.i. The simple lever and weight safety-valve could easily be tampered with and this was quite frequent for short periods. When a little more steam was required a shackle (always handy) was placed on the lever.

The old boilers rarely exploded but "blows" were frequent in shell and tubes. Temporary patches were often applied to tide things over; these were known as "one-eyed patches" consisting of a nut, bolt and washer, liberally smeared with red lead and tar.

I remember the case of an old tug steaming to the breaker's yard with two dozen "one-eyed patches" on each boiler.

The wooden paddle tugs were essentially the same, closely resembling each other; they varied in size only. The largest were the "Seekers" but even the small ones also went over the bar to look for a sailing ship when they had nothing else to do.

Clipper stems, with or without bowsprits, were common to the very oldest tugs, then a very inclined straight stem superseded them. Gradually the inclination became less and less but they never became vertical.

Tugs were steered by tiller at first, but later a steering wheel was placed forward of the engine house on deck; this alternative was generally used for long straight runs. In confined waters such as docks, the tiller was more convenient, but it was a very dangerous method though quick acting. The tow rope was a menace; many skippers were knocked overboard or suffered broken legs. Finally, the steering position was taken to the centre of the bridge plank over the casings; this was inconvenient when the very high spring tides prevented the tug from passing under the Swing Bridge at Newcastle. The funnels were cut for lowering but the primitive bridge screens to shelter the skipper were above the cut in the funnel; this meant waiting for the tide to fall.

The first wooden tugs combined towing sailing ships with ferrying, but the latter stopped in 1862 when the regular ferry service was started by the Tyne General Ferry Co. By this time industry was in full swing and all its raw materials, coal and coke were carried by wooden wherries; they also carried the finished products to the regular weekly boats established at the Newcastle Quay.

There was abundant work until the First World War after which this heavy traffic went on to the roads; tugs and wherries gradually died out.

One thing about paddle tugs eludes me: I cannot state positively why they were so popular on the Tyne; they existed in large numbers when all other rivers had discarded paddle tugs. No doubt the private owners of the single-engined, wooden paddle tugs lacked capital and the discards from other rivers were to be had at reasonable prices, but that did not apply to the company boats; these were iron tugs with twin, disconnecting side-lever engines. The fleets of these large vessels were predominantly paddle tugs.

Screw tugs trickled here very slowly and most of them were secondhand; I cannot account for this very slow change over and probably never shall be able to do so.

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**BANDSAW**

from page 861

elaborated by making a hinged guard of plywood to open as and when required.

**Putting to work**

First of all, fit the blade over the wheels and line up between the guides. Next adjust the tension wheel until the driving wheel will turn the blade without slipping. Make sure the machine is lubricated, and with the lathe in back gear do a test run. Carefully watch the blade to see if it tracks correctly, if it runs to one side of the upper or lower wheel, correct by making a small adjustment to the upper shaft. Having corrected the tracking, the blade should run smoothly and without side movement on the wheels. Now put the lathe on higher speed and make a test cut on 1/2 in. thick wood. If the blade tends to sag, increase the tension; if thicker wood, say up to 2 in. thick is to be cut, the tension may require to be increased more, but this thickness should not be difficult to cut. It should, of course, be appreciated that sharp curves cannot be cut in "one go" as they tend to twist the blade, but toy wheels 2 or 3 in. dia. should present no difficulty.

**Materials**

All materials used are easily obtainable. The saw blade was obtained already as a loop 5ft 3-3/4 in. long, in. wide and with seven teeth per inch, but lengths can be obtained brazed up to suit individual requirements. The blade used was obtained from Burgess Products.