OVERHAULING THE LATHE

by B. J. Whitehead

MANY READERS must be in possession of lathes and other machinery that have slide wear concentrated in sections of most use. 1 expect that some have heard of, if not come in contact with, the old craftsman held in awe because his machine is in such a bad condition that he is the only one able to produce good work from it. How much better he could perform on a good machine where full concentration could be given to the workpiece rather than the eccentricities and shortcomings of his machine tool.

An accurate machine is a joy to use. but wear creeps in insidiously, one day it is found impossible to adjust the gibs to give full travel and yet be tight enough for accurate work in the section of most use. When this situation arises it does not necessarily mean an expensive regrind for your lathe bed for example, my aim is to show how small machine tool slides may be restored by the amateur with a minimum of equipment. In this age of enormous labour costs few reasonably priced machines have hand-finished slides, so owners of new machines may profit from a little of the work I shall attempt to describe.

Rather than describe the overhaul of a particular make and type of machine 1 shall give a procedure for a 3-1/2 in. lathe, I am sure readers will be able to apply the principles and methods involved to their own make and size of lathe, also millers, shapers etc.

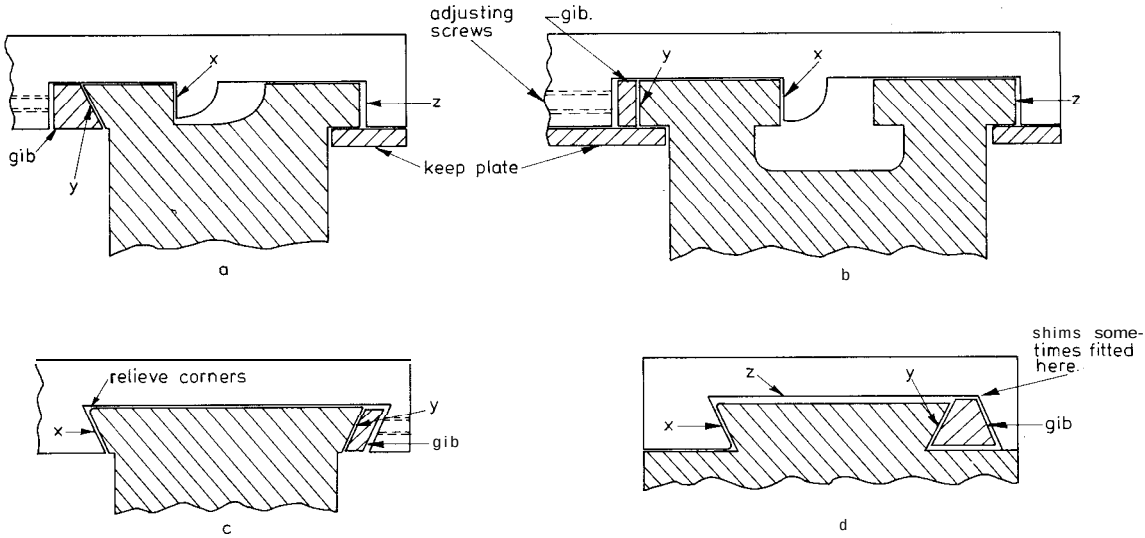
Some of the methods I use may not be theoretically correct and there may be better ways given sophisticated equipment but if they are employed intelligently and dextrously they work; l don't want to be jumped by the "Talk in half thou's, work in half yards" brigade.

Before stripping, overhaul the headstock mandrel and bearings. I do not intend to enlarge on this, volumes have been written on the subject, adjustment is usually built in anyway. Good bearings are essential for letting up the slides later and the lathe is still intact if new bearings have to be machined.

Strip the lathe right down to the bed, now check the mounting onto bench or stand that the bed is not twisted by the holding down bolts, this can be checked with a sensitive spirit level across headstock seating and unworn sections of bed, readings should be exactly the same, if not shim or adjust the jacking bolts to correct. Much more care must be taken with a bed mounted on feet at each end than the cantilever type.

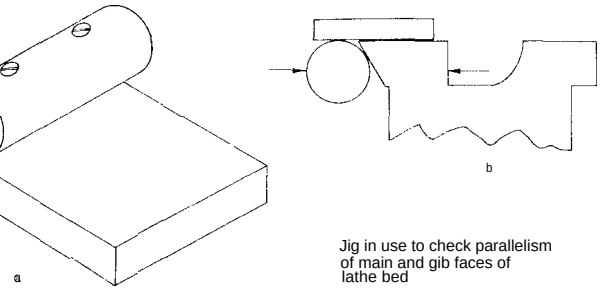
Clean the bed thoroughly with carbon tet. or similar solvent and take a good look at it in conjunction with the saddle, headstock, tailstock and sketches Fig. 1, identify the main guide faces, these will always be opposite the gib faces.

Now to check the wear present, I doubt if many readers have a fishback surface plate as



Some examples of machine slide and gib design x denotes main guide face y-gib face and z-clearance

Fig. 1.



Jig for measurement accross vee slides

Jig in use to check parallelism of main and gib faces of lathe bed

Fig 2

long as the bed, but a 24 in. straight-edge can, with care, be used equally well. The thick type of straight-edge as used in combination sets is certainly the best and easiest to use. These straight-edges can be obtained plain without graduations at a considerable saving In cost.

Try along the top flats of the bed with the straight-edge, if the headstock seating is on the same level as the bed, bridge the gap from unworn seating to bed as far back as possible and try to insert a .0015 in. feeler gauge in worn section; unless wear is excessive you will probably find that It won't go. Wear will have to be detected by holding the straight-edge firmly down on the bed carefully keeping it vertical and flexing it sideways, a little practice and you will be able to feel where the bed is hollow or worn. Check the bed all over including guide edges in this manner, you will probably be comforted to find that very little wear is causing all that trouble. A check on the actual amount of wear present can be taken by using micrometers, vernier or ordinary calipers over and between all bed surfaces. To measure over vee slides a jig or jigs must be made as shown in Fig. 2. Screw a 1-1/2in. length of ground stock to a piece of 1-1/2 in. x 1/4 in. flat with one face trued flat.

Before scraping the bed a good surface plate at least 6 in. x 6 in. will be necessary and also an off standard one about 2 in. x 1 in. x 8 in. with one edge machined and scraped flat at about 45 degrees. a piece of old cast iron strip from a large machine is excellent, see Fig. 3.

Cast iron tends to form a thin but very hard skin, so a few words on scrapers and the method of attacking the surface are in order. I have not yet found a commercial scraper that is hard enough for use on machine slides, 1 have found the best is a good quality parallel flat file thinned by grinding see Fig. 3 and the end hardened right out by quenching in water; for the work in hand 3/4 in. wide is about right.

Two different methods of sharpening are used, one for roughing and one finishing. The roughing scraper is flat and straight ended, not curved, as the book says and the finishing scraper is

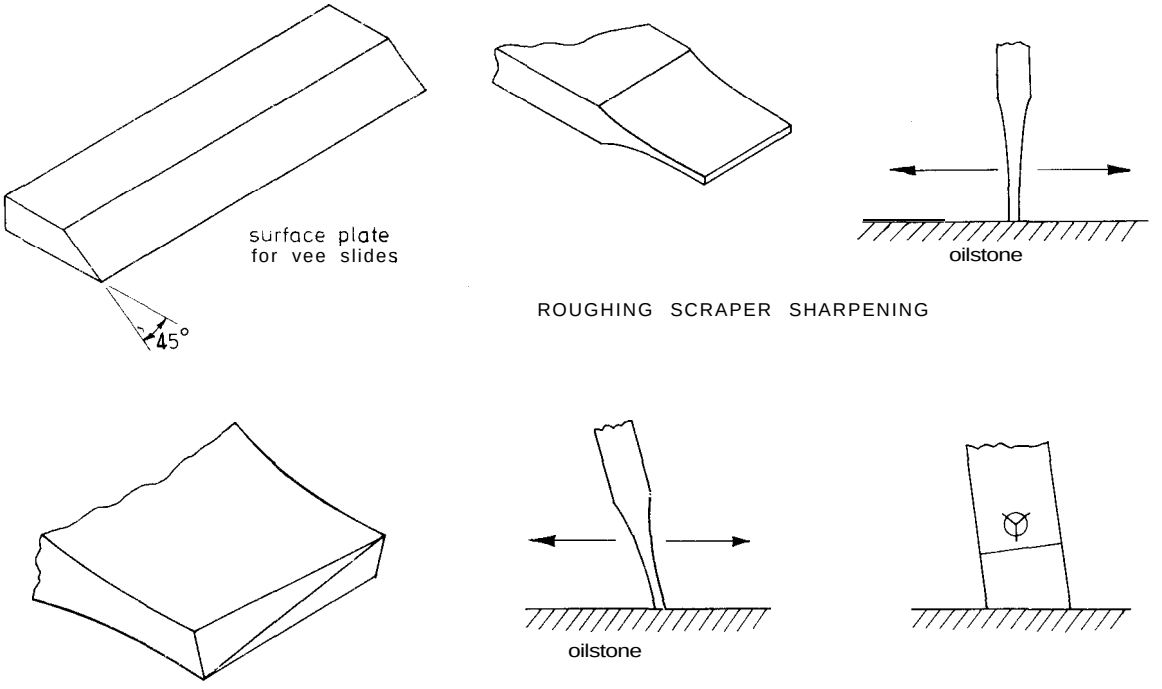


Fig. 3

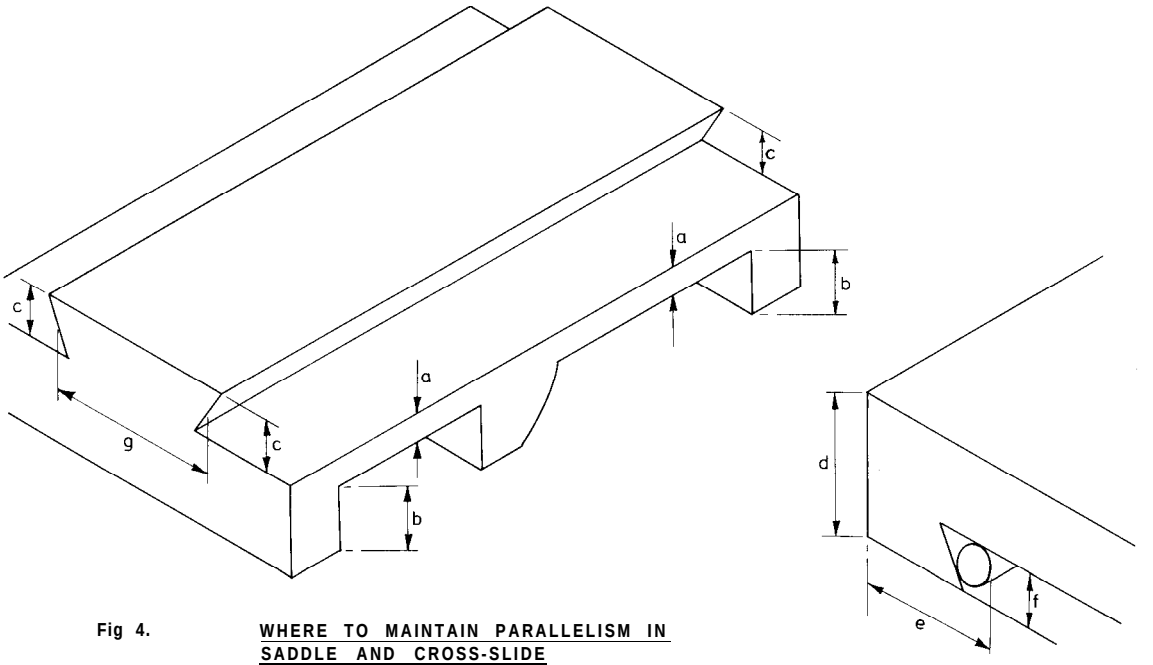


Fig 4. **WHERE TO MAINTAIN PARALLELISM IN SADDLE AND CROSS-SLIDE**

sharpened as Fig. 3. This scraper is used to remove the high spots and is worked with a sort of forward-sideways-rocking motion, like digging the high spot out. I am sorry, but this is the best description I am able to give, those that are able to mottle will understand what I mean and also the difficulty of describing it, however do not despair if you are not able to mottle, a very attractive frosted effect may be obtained quite easily.

Start scraping down the top of the bed with the roughing scraper. Work at about 45 degrees across the bed, use long even strokes and put some pressure on, try to remove metal evenly. If difficulty is encountered breaking the skin use a fine 6 in. flat file pressed firmly, again at about 45 degrees across the bed and worked slowly and evenly. This will score the surface to give the scraper a bite. With the skin removed use level, straight-edge and feelers to take the high areas down evenly to the lowest point of wear. The scraper should be sharpened frequently on a medium India stone, do not use anything coarser as it will cause the scraper to score the bed. Each pass along the bed should be at 90 degrees to the previous one.

When you are satisfied the bed is dead flat to the straight-edge smear the large surface plate with engineers' marking blue and slide it up and down the bed a few times, the high spots revealed will probably be few and far between, but if the preceding work has been correctly carried out no perceptible rock should be felt in the plate. Still using the roughing scraper, take the high spots off and repeat a few times until a reasonable contact is shown all over the bed. By now smal! bright spots surrounded by blue should begin to appear, using the finishing scraper take these off. A word of caution. large areas of heavy blue do not mean a good bearing, it means too much blue on the plate, 1 repeat, the very high spots will show bright surrounded by blue. If you pick the high spots off with a short forward and sideways motion working at 45 degrees across the bed and the next time the plate is used, at 45 degrees the other way the high spots will appear in more dense clusters and a very nice frosted effect will take form on the bed. It is now up to the individual how much time, patience and dexterity he puts in to obtain a bearing surface, the more and closer the high spots, the greater bearing and flatter surface, but whenever the work is stopped the bearing should be even all over the bed. All the low areas surrounded the high spots are "oil wells" which will help to retain lubrication on the surface.

Locate the main guide face and carry out the same procedure on it, if this face serves as the headstock location work on this as well to obtain a straight flat face right through. The tailstock is probably guided by the same face as the saddle but if not, this is the next for attention, measurements must be taken from the completed face to ensure parallelism. The secondary or gib

faces for the saddle and tailstock are worked on next, not only maintaining straightness and flatness but parallelism is of paramount importance. Working clearances are so small that half a thou makes the difference between binding and slack in the assembled machine, so if you can measure a difference, scrape it out. The top and vertical faces complete, the bed can be removed from its stand and turned over for work on the underside of the shears, make sure these faces are kept dead parallel with the top of the bed.

It may be advantageous to remove some vee type beds from the stand at an earlier stage than this but every effort should be made to get the main guide faces completed while firmly held to prevent twist.

The completed bed can be refitted to its stand, take great care to avoid distortion.

Before commencing work on the saddle you should look at the consequences of your actions. Removing metal from the bed means that the saddle will lie in a different plane from the original, lower and to one side, this will be magnified by the time the saddle is trued up, there will be misalignment between leadscrew bearings and the split nut. Since the intention is to deal with a few thou of wear and not a really "clapped out" machine, there will also be wear in the nut and bearings and it is doubtful that the slight misalignment will have any adverse effects.

When wear is excessive and the bed has to be machined or ground the usual procedure is to machine out the saddle and tailstock and screw on plates to come back to standard, other methods can be used depending on the design of the machine, bearings can be repositioned, apron modified etc.

Every individual must use a fair amount of initiative to apply these principles to his own machine, so a warning to use forethought and envisage the consequences of metal removal and the possible action necessary to correct, look even further, the consequence of this action. Be sure that curing one problem does not create a bigger one. Clean the saddle off with solvent and check for wear on the bearing surfaces by means of straight edge and feelers, the surface plates can also be of use here, in addition take measurements as Fig. 4. It is essential to scrape the bearing faces so that when complete the cross-slide or boring table top face will be dead parallel with the bed. Lathes used for normal work almost always suffer most wear on the saddle main guide face, a straight edge will probably show this face to be bowed, when trued it must be square with the cross-slide.

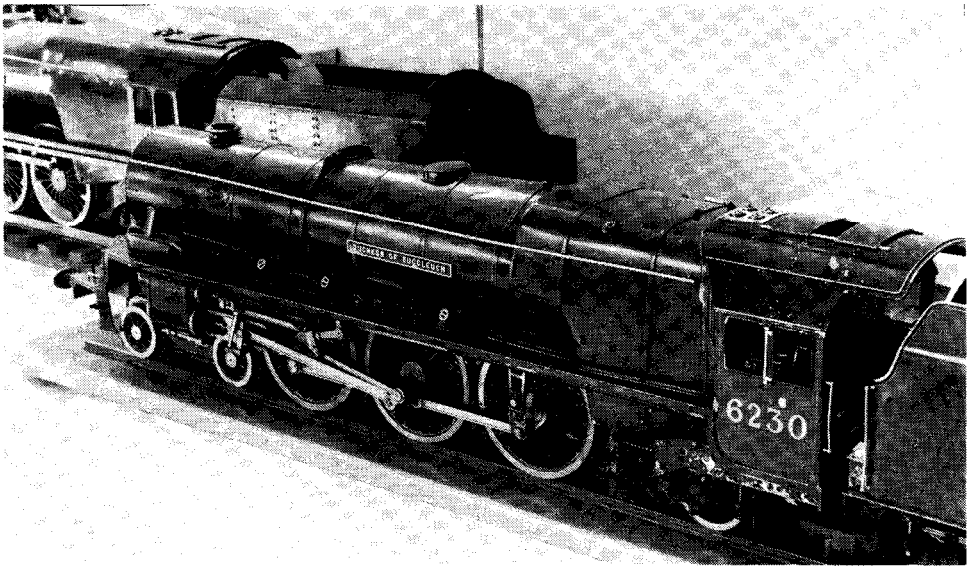
Many small lathes have a boring table with vee slides longer than the mating ones on the saddle, it is better to work on this first leaving the saddle until afterwards. The boring table slides will probably resemble those in Fig. 1d, except that the gib is more likely to be as Fig. lc. Scrape the under bearing faces true and flat to the large surface plate, taking care to keep measurements to the top face exactly the same all round. Scrape the main guide face true to the vee surface plate and dead parallel to the front edge of the table, use a piece of ground stock to take measurements, see Fig. 4. Blue the boring table slides and use as a reference to scrape the flats and main guide face of the saddle cross slide surfaces, take the points of the vees off with a file to give clearance in the corners if necessary. Using the vee surface plate and pieces of ground stock for measurement scrape the gib face parallel with the main guide. If the gib is of the type shown in Fig. lc, it is only necessary to scrape the bearing face flat to the surface plate and the cross-slide can be cleaned, oiled and assembled. Test by pushing back and fore by hand, it will be heavy to start but should then move with an even drag without tight or slack spots.

It is likely that the gib strip is steel, if so, use a spot of soluble cutting oil on the scraper, this will prevent pick up and give a bright clean cut, the scraper will work much more cleanly and smoothly.

Some machines may have a different type of gib strip. there are many different designs in use, a few are shown at Fig. I. The gib at Fig. Id is retained by screws up through it or down through the slide, it is a dead fit and to take up slack it must be carefully filed on the top face to let it in. Sornetimes peeler shims are fitted to help, a good bearing must be obtained on both taper and top face and retaining screws kept dead tight. This type needs a lot of time, patience and skill to fit well. The gib at Fig. la may be a dead fit and have to be treated as Id but it is more likely that there are adjusting screws behind it and the retaining bolts pass through clearance holes in the gib to allow for adjustment. It is unlikely that a taper key will be met with in small machines but if so it is fitted to a good bearing throughout its length on both faces.

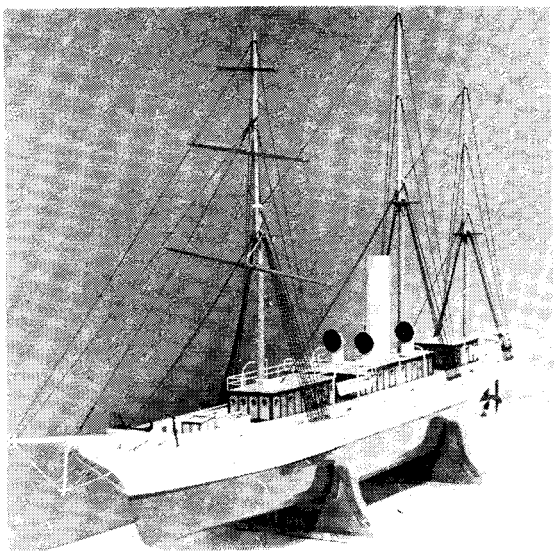
To true the saddle main guide face square with the cross-slide put the saddle with boring table fitted upright on the surface plate supported on the front edge of the table, this is parallel with its slides, use a square between plate and guide face, file out bow true with the square.

To be continued



A 3½ in. gauge L.M.S "Duchess" built by T. A. Bott and loaned by J. E. Langrishe. t'hotographs: Keith Lauderdale.

Right: Model steam yacht "Alva" by Ian Sharp of the Burrow Ship Model Society.



Z-gauge one from the Manchester M.R.S. occupying only 6 ft. x 3 ft.

The Barrow Ship Model Society again put on a show of ship models, both sail and power. Perhaps the most outstanding ship model was the steam yacht by Ian Sharp, powered by a Stuart 10V engine and a spirit fired boiler.

Among the locomotives was the very fine 3½ in. gauge Vale of Rheidol engine by Alan Green of Urmston. A. Walshaw of Kendal showed his model beam engine, a Silver Medal winner at the M. E. Exhibition, and there were several horse-drawn vehicles, such as a model tip cart by Bill Whidborne, and an Oxfordshire hoop-raved wagon and a gypsy straight-sided wagon.

In the School yard, the F.M.R.C.'s 5 in. gauge portable track was kept busy, the Club's ***Simplex*** giving a good account of itself.

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Part II

From page 803

FILE AND SCRAPE out any measurable difference in under-saddle to cross-slide thickness. blue the bed and bed in the saddle flats and main guide face to it; it is an advantage to lighten the bearing in the centre of the guide face keeping a really good bearing at both ends. True up the gib, clean and oil saddle and bed, fit and adjust the gib and push the saddle from end to end of the bed, any tight spots will be felt, an even drag will reward accurate work. Remove the gib and fit the keep plates. this is best done by measurement, stepping will probably be necessary. Fit them one at a time using blue under the bed shears to obtain a good bearing. they should be just making contact with the retaining bolts hardened up ¦ again feel the drag.

Assemble saddle. apron. leadscrew. cross-slide and screw and check that everything is working smoothly and correctly. Refit the headstock and chuck a piece of I in. 1-1/2 in. dia. ground stock about 7 in. 8 in. long, set it to run perfectly true through-out its length. fix a dial test indicator on the cross-slide. a magnetic stand is excellent

for this if you have one, so that it may be traversed over the ground bar by means of the cross-slide ; take the highest readings at the chuck and unsupported ends of the bar, any discrepancy between these readings indicates the amount the headstock mandrel is out of parallel with the bed. Scrape the underside of the headstock. maintaining a good bearing to correct. With the headstock refitted and the test bar still chucked and now dead parallel vertically with the bed set the D.T.I. against the side of the bar at centre height ; traverse it by means of the saddle along the length of the bar. The difference in reading end to end must be corrected by scraping the headstock locating face or using any adjustment incorporated in the machine.

When you are satisfied that the headstock is dead true with the bed, make the acid test on cross-slide squareness. Attach the "clock" to the faceplate so that by swinging it, it makes contact with each end of the true front face of the boring table or alternatively each end of a length of straight ground stock laid in the front vee of the cross slide with the table removed. It is usual to set the cross-slide not absolutely dead square but so that it will face .001 in. - .002 in. concave in the diameter of the faceplate, this ensures that faced components will mate together without rock. You will probably find that it will be necessary to again strip the saddle etc. and scrape the main guide face to obtain this setting for the cross-slide.

The next problem is the tailstock. Blue the bed and scrape the tailstock to a good bearing with it. Extend the barrel fully and lock, set the D.T.I. on the faceplate so that it can be swung around the barrel, lock the tailstock on the bed with the D.T.I. at the front end of the extended barrel, take readings around the barrel and move the set-over device to centralise the barrel with the headstock; note any discrepancy in height, Now move the tailstock bodily up the bed and again lock so that readings can be taken as near to the casting as possible. If the barrel at this point is out of centre and a different height the tailstock flats and main guide face will have to be scraped to correct. The barrel should now be parallel to the bed but it is probably low in relation to the headstock, the cures for this are either file and scrape the underside of the headstock to bring it down in line or machine out and fit plates where tailstock is split for set over to bring it up. A quick way out is to use shims instead of machining out and fitting plates. If the barrel is badly worn, some may consider fitting the tailstock in front of the saddle, just take up the lock to bear and bore out using the saddle to push it along, it is then bound to be in line, either bush or fit an over size barrel.

The top-slide is dealt with in the same way as the cross-slide, anyone that has gone this far will not find it any problem.

I hope these notes will be of some use to readers who are prepared to use time, patience and elbow grease to improve their machines, but are not quite sure how to go about it, I can assure them that their efforts will be amply rewarded, I will bet they will think twice about using emery without precautions on the lathe afterwards.

AROUND THE TRADE

New "Braze-Welder"

Kellers Welding Centre of 32133 Cattle Market Street, Norwich: are manufacturing a new style of welding equipment designed for brazing as well as welding. Known as the Kel-Arc Braze-Welder, this works from the domestic 230-250 volt electricity supply and comprises a fan-cooled transformer, a "Chem-Arc" torch with pencils, a set of welding leads and electrode holder and earth clip. and an industrial head mask. A supply of 16 gauge electrodes and flux-coated brazing rods are also included.

The Braze-Welder is designed to braze or weld metals from thin steel sheet of 24 s.w.g. up to 1/8 in. plate.

Drawings of farm carts

We have received samples of the "Mode1 Wheelwright" plans produced by John Thompson of 15 Darset Avenue, Fleet, Aldershot, Hants.

The drawings include a sketch of the item to show the general appearance, information on the present location of the item, its origin and history etc., and the correct names of the various parts. The drawings are to scale, key dimensions only being given. They are all of items accessible at the public museums, etc.

Two instruction charts are available, covering tools, materials and methods of construction.

The supplier's list draws attention to the Model Horse Drawn Vehicles Club-Mr. J. B. Pearce, 4 Heron Drive, Westgate, Morecambe, Lanes.

16,000 Official Drawings now available to model engineers

Many readers of the Model Engineer have already availed themselves of the opportunity to secure copies of the authentic works drawines. which have bekn collected, filmed, and marketed by British Rail/ Oxford Publishing Co. over the past 18 months. However, as the total number of plans located has now reached the staeeerine figure of 16.000. and there are perhaps seevra1 model engineers who have yet to realise just what a chance is here I have begged space from the Editor to try and indicate the progress of this collection, and to give some idea of its coverage.

Briefly-its origin came about through the co-operation of an enthusiastic Public Relations Office