OPERATING INSTRUCTIONS

FOR THE

UNIMAT

UNIVERSAL MACHINE TOOL

3rd EDITON

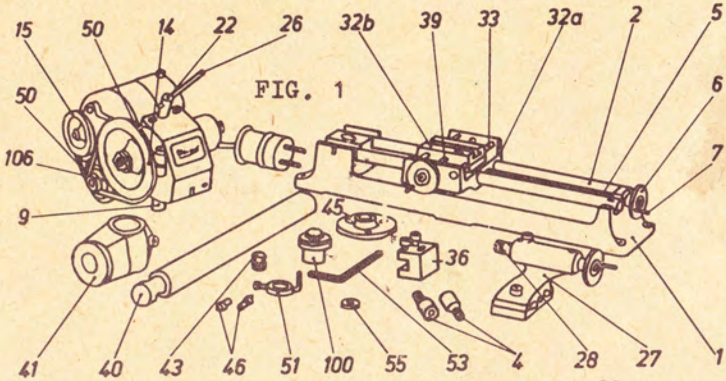

FIG. 1

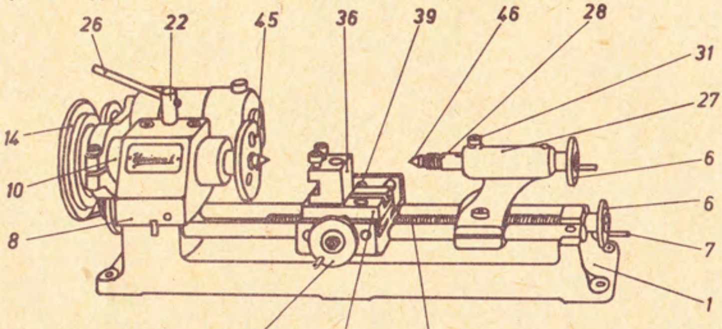

FIG. 2

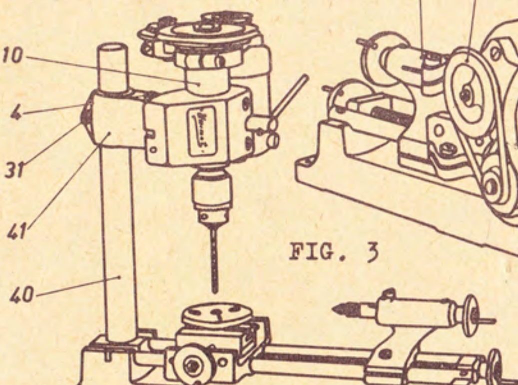

FIG. 3

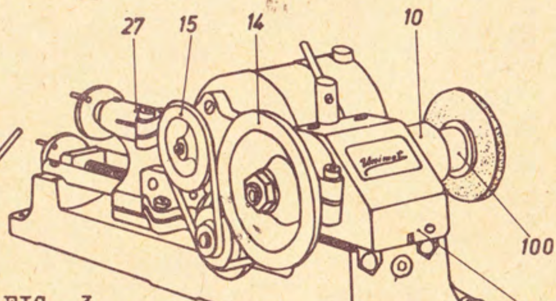

FIG. 4

OPERATING INSTRUCTIONS

FOR THE

U N I M A T

UNIVERSAL MACHINE TOOL

Key to parts illustrated in Figs. 1-4

LATHE BED

No. 1 Bed
No. 2 Bed slide bars
No. 4 Cone screw
No. 5 Lead screw
No. 6 Hand wheel
No. 7 Hand-wheel grip

HEADSTOCK

No. 8 Headstock housing
No. 9 Clamp pin.
No. 10 Headstock spindle
No. 14 Headstock pulley
No. 15 Motor pulley
No. 22 Feed pinion
No. 26 Feed pinion lever

TAILSTOCK

No. 27 Tailstock
No. 28 Tailstock spindle
No. 31 Socket head cap screw

SLIDE REST

No. 32 Slide rest
No. 33 Cross traverse slide bars
No. 36 Toolholder
No. 39 Cross feed screw

VERTICAL ASSEMBLY

No. 40 Vertical column
No. 41 Vertical column bracket
No. 43 Slotted stud.

ACCESSORIES

No. 45 Face plate
No. 46 Centre
No. 50 Driving belt
No. 51 Lathe dog
No. 53 Hexagonal wrench
No. 55 Setting piece
No. 100 Grinding wheel arbor
No. 106 Intermediate drive pull

Please quote name and number of part when ordering:

TECHNICAL SPECIFICATION

LATHE:	Centre height. . . . . .1.41" Distance between centres . . . . .6.69"
GRINDING WHEELS:	Maximum diameter . . . . .2.36"
DRILLING MACHINE:	Max.distance chuck to base . . . .4.72" Spindle travel when fixed to column. . . . . .0.9"
MILLING MACHINE:	Distance spindle to column . . . .4.72"
BED:	Dimensions . . . . 14.17 x 3.34"
MOTOR:	65 Watt - 110, 220 and 250 volt (AC/DC)
R.p.m. MOTOR:	Running on load: 4.000 r.p.m.

EMCO-UNIMAT

A really versatile electric tool
offering unlimited possibilities

The Unimat is a most ingenious machine of Austrian origin and has already been patented and introduced into the leading countries of the world. As the Unimat is a combination of about a dozen different machines in one, it is not only an indispensable aid for the ambitious handyman, home mechanic, model-builder and do-it-yourselfer around the home, but also - on account of its sturdy construction and the great precision characterizing its design and operation - a most welcome piece of equipment for craftsmen of all trades, such as jewellers, opticians, engravers, radio and typewriter mechanics, watch- and instrument-makers, etc. Even some of the largest European mechanical engineering workshops and construction undertakings have one or two Unimat machines installed for the machining of small parts, especially in cases where the production of the latter would be uneconomical on larger machines. For the home handyman, who prefers to carry out the majority of repairs himself, the Unimat is the ideal equipment allowing him to effect repairs to all kinds of household appliances, such as vacuum cleaners, radio and television sets, broken toys, etc., quickly, inexpensively and efficiently.

A complete home workshop, eliminating the need for many other appliances, can be built up simply by acquiring the various accessories designed for use in conjunction with this machine. The great versatility of the Unimat is probably best demonstrated by the fact that it can even be used to polish the family car. All that is necessary is to fit a buffing disc to the electric hand drill, and the job is completed very quickly.

At technical training colleges and schools, the instructors will find it far simpler to explain the principles of machining metals when he has a Unimat available for demonstration purposes, for this offers numerous advantages compared with the difficulties involved when standard size machines are used, or when the students are compelled to work solely from blueprints. Not only that, but instruction is rendered much more interesting and lifelike when the various operations can actually be demonstrated on the Unimat.

For the technically-minded boy, too, the Unimat is not only a perfect technical toy, but - as it encourages him to make all kinds of things himself - it also helps to develop his technical knowledge, something from which he will undoubtedly benefit later in life. The unlimited possibilities offered by this machine encourage and develop the inherent technical initiative of the teenager with playful ease.

The Unimat is a product of one of the leading Austrian manufacturers of precision machinery and tools and is both strongly built and attractively designed. Official reports from various European laboratories, where the Unimat has undergone gruelling tests, show that a tolerance of even less than 0.0004" can be obtained when turning metals, providing, of course, that the facilities offered by the machine are utilized to their full advantage. This tolerance is something which it is extremely difficult to achieve even on large, standard lathes !

Craftsmanship handed down from generation to generation, coupled with unhurried European manufacturing methods, is the secret of the very high quality built into every Unimat.

<u>WORKING WITH THE UNIMAT</u>

It stands to reason that one must be thoroughly conversant with the operation of the Unimat, as is the case incidentally with all machinery, if one is to derive the maximum benefit from all its many features.

A small, but nevertheless precision-built machine like the Unimat has to be handled efficiently in order to make the most of its many and versatile

possibilities. Just as a motorist gradually becomes familiar with the car he drives, the Unimat-owner too, must gradually familiarize himself with his machine and, as he gets to know the feel of it, he will discover countless new uses and possibilities.

This booklet, therefore, is confined to the more general operating instructions, together with various notes on the maintenance and upkeep of the machine. Just to give you some idea of the wide range of articles which can be produced on the Unimat, we would mention: chessmen, wheels for model trains and cars, gears and cams, parts for model aircraft, small parts for cars, bicycles, sewing machines, vacuum cleaners, furniture, and so on, but the list is, in fact, almost endless. The Unimat is also eminently suited for grinding tools and, when a sufficient degree of proficiency has been acquired, even the most complex machines and apparatus may be produced. When the jig-saw is fitted, all kinds of intricate patterns (e.g. those met with in jig-saw puzzles) can be executed, not only in wood, but in metals, including steel, as well.

TECHNICAL TERMS, AN INDISPENSABLE NECESSITY

Before going into details of the various possibilities offered by the Unimat, it is essential to acquire a working knowledge of the technical terms, especially those in current use relating to the work done on larger machines. We would suggest therefore that you study the illustrations on the inside cover, together with the names of the various parts given on page 1. comparing them with the corresponding parts of the actual machine.

When you remove the Unimat from its case and place it on your work-bench, you will find - after inserting the feed pinion lever (No.22) in the hole provided for it at the top of the headstock - that it corresponds exactly with Fig.2. The same numbering is adopted throughout for all the illustrations.

The dismantling of the Unimat into its various individual component parts is explained by degrees further on in this booklet, in the various sections dealing with the different uses to which the machine may be put.

PRINCIPAL MACHINING OPERATIONS WHEN THE UNIMAT IS USED AS A LATHE

After the machine has been assembled (the feed pinion lever (No.22) must be fitted as described in the foregoing) a start can be made with a description of the principal machining operations. These are, straight, or plain turning, and facing (axial and radial turning).

Straight or plain turning implies machining the work to a predetermined diameter. Facing, as its name suggests, means the operation of machining the ends of a piece of work so that they have truly flat surfaces square to their axis. In both these cases, the work rotates, driven by the motor through the belt pulleys (No's 14-15 and 106) which are connected with one another by driving belts. The tool, which we will discuss in more detail later on, is placed in the toolholder (No.36) and should face the work for straight turning and facing.

This may seem fairly complicated at first, but we shall explain this in greater detail later on.

One thing is certain: the work must be connected up with the drive in such a way as to ensure that the work turns as soon as the motor is switched on.

MOUNTING THE WORK

This can be done in various ways. The work (e.g.a piece of bar stock) can be clamped between the centres (No.46) of the tailstock (No.27) and the headstock (No.8) and rotated by the lathe dog (No.51) via the face plate (No.45).

Using this mounting method, the ends of the stock must be provided with centre

holes into which the lathe centres must fit in order to hold the work firmly. In cases where the work is suitably shaped (i.e. it has a flange) it can be clamped directly to the face-plate (See fig.5). If clamps are employed, inserted through the slots of the face plate and bolted in position, the work will form one rigid whole with the face plate (No.45). The motor should be switched on for a moment to ensure that the work rotates properly, i.e. does not slip and runs true.

Suitable adjustments must be made if the work does not run true, or, in cases where the incorrect alignment is only slight, a few slight taps will centre it properly. All this must be done, however, with the work stationary.

When clamped to the face plate, the work can be both straight turned and faced (See fig.5).

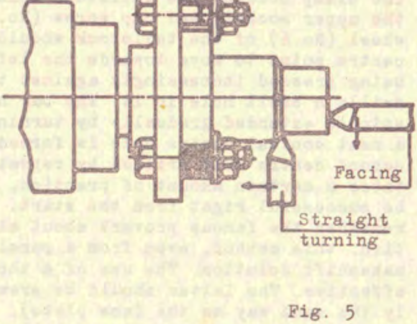

Fig. 5

While we are still on the subject of mounting the work, mention must also be made of the self-centring three-jaw universal chuck (See fig.6), which is supplied as an extra.

When the latter is fitted, centring is effected automatically, as is the case with a normal drill chuck. Instructions for mounting the three-jaw chuck will be found on page 13.

AND NOW ..... TO WORK

As straight turning is the simplest operation, we shall start off by attempting to machine a piece of work to a given diameter. Take a piece of aluminium or brass bar (softer materials are more suitable in the initial stages than iron or steel) approximately 0.4" in diameter and cut off a piece about 1.96" long with a hacksaw. Try to saw at right-angles as accurately as possible (finish off with a file if necessary). This facilitates working in the lathe later on.

CENTRING THE WORK

The bar must run smoothly between the centres of the headstock and the tailstock, so that conical holes must be countersunk in the centre of both ends of the bar to take the lathe centres. Before a hole can be drilled in the work, however, it is essential to make a centerpunch hole at the correct point first, as otherwise the drill may slip and the drilled hole not be perfectly central. The bar should be clamped in a vise and an indentation made with a centre punch in the dead centre at each end of the bar.

A suitable centre punch can be obtained at any tool shop for about 1/6.

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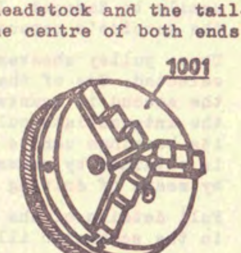


Fig. 6

DRILLING CENTRE HOLES
(See also page 5)

The centre holes can be drilled in the lathe. The centre drill should be inserted in the drill chuck, which should then be tightened with the key. The next step is to fit the drill chuck to the main spindle and a centre in the hollow spindle of the tailstock, the clamping screw of the tailstock

should be loosened and the latter moved by hand towards the headstock until the centre drill comes into contact with the bar in which the centre hole is to be drilled. When the socket head cap screw in the tailstock base is tightened again, the latter is firmly secured in position on the bed slide bars of the lathe. (A second drilling at the rear of the tailstock base has only been provided for manufacturing purposes. Disregard it altogether).

The clamp holding the tailstock spindle should now be loosened by turning the upper socket head cap screw (No.31) clockwise slightly. The handwheel (No.6) of the tailstock should be rotated anti clockwise causing the centre point to move towards the left. This, in turn, results in the bar being pressed increasingly against the rotating drill, so that the latter drills a small hole in it. The bar held with the left hand and the tailstock spindle extended gradually by turning the wheel with the right hand, until a neat conical centre hole is formed. The bar should then be reversed and a second centre hole drilled by repeating the operation. This method necessitates a certain amount of practice, so that the uninitiated may not always be successful right from the start. Do not be discouraged, however, and remember the famous proverb about all beginnings being difficult. In addition, this method, even from a purely technical point of views, is only a makeshift solution. The use of a three-jaw chuck (See fig.6) is much more effective. The latter should be srewed on to the headstock spindle (in exactly the same way as the face plate). When this method is adopted, the drill chuck should be fitted to the tailstock spindle, instead of the lathe centre. The drill, therefore, remains stationary and the work rotates, this being the method most commonly used on lathes of all sizes. The feed is effected by rotating the feed pinion (No.26,), after the two upper locknuts of the headstock have been loosened. The most favourable speed for centering is 1.600 r.p.m.

TIGHTENING BOLTS, ETC.

Loosening and tightening of all bolts is effected with the aid of a hexagon wrench (No.53), which fits into the socket head cap screw.

CUTTING SPEEDS

The cutting speed is an extremely important factor in operating the Emco-Unimat, just as it is the case of every other machine tool. If the cutting speed is too high, the tools (lathe tool, drill, milling cutter, etc.) can easily be damaged. If the cutting speed is too low, one works too slowly and the machine's capacity is not utilized to the full.

Three pulley sheaves enable the desired speed of the main spindle to be selected. One of these sheaves forms a single unit with the shaft of the motor, the second is mounted on the main spindle of the machine, while the third, the intermediate pulley, is an idler. The intermediate pulley together with its bearings can be removed by loosening the clamp bolt. The desired speed is obtained by connecting up the different pulleys in various arrangements by means of driving belts.

Full details of the correct positioning of the belts and pulleys are given in the schematic illustrations on page (3) of the cover.

As will be seen from these illustrations, the speeds from 1 to 6 are obtained by placing two driving belts around all three of the pulley sheaves. It should be remembered that the speeds indicated in the illustrations apply to the machine when running under load.

To obtain speeds 10 and 11, the pulley sheave of the motor should be connected up directly to that of the machine. This necessitates the removal of the intermediate pulley together with its bearings. The longest belt should be fitted.

To obtain speeds 7,8 and 9,the intermediate pulley must also be removed and the pulley sheave of the motor shaft taken off and reversed. After loosening the centre screw, the pulley sheave can usually be slid off by hand. If this proves impossible, the sheave can be prized off quite simply by inserting two screwdrivers, which act as levers, between the pulley sheave and the motor bracket. The sheave should then be reversed, replaced on the shaft and the screw tightened again.

You may feel that this alteration does not appear to result in higher speed, compared with positions 3 and 4. In actual fact, 10 and 11 are higher than those of 3 and 4, however, as they are obtained by employing only two pulley sheaves and a single driving belt. This means, of course, that there is less loss of motor power in consequence of lower belt and bearing frictional losses. The choice of the most suitable speed may appear to be a very complicated affair (but this is a matter of importance, even where large lathes are concerned) and it is essential therefore to familiarize oneself fully with this aspect from the very beginning.

The best way is to start off by setting the machine to operate at the various available speeds between 1 and 9, without actually turning a piece of work.

SELECTING THE APPROPRIATE CUTTING SPEED

Which cutting speed should be selected for turning a given piece of work ?

The general rule applicable in most cases involving stock removal operations, such as turning, drilling and milling, is, the softer the material the higher the cutting speed.

Apart from this general rule, however, it should be remembered that the cutting speed is also governed by the diameter of the work. As the diameter increases, the speed should be correspondingly lower.

When drilling and milling, i.e. when the work remains stationary and the tool (the drill or milling cutter) rotates, the dimensions of the stationary work exercise no influence whatsoever on the speed. In this case, the guiding rule is the greater the diameter of the drill or the milling cutter employed, the lower the speed. Summing up, it is correct to say that the greater the diameter of the rotating part (work or tool), the lower the speed one must employ.

As the cutting speed is governed by several factors, (material, diameter of work, rate of feed, tools employed, etc.), it would take us too long to go into details other than the general guiding principles outlined in the foregoing. When turning, therefore, this guiding principle should be borne in mind wherever possible.

The design of the Unimat is such, however, that due, to the belt slip that occurs, no damage will be caused to the machine, even if speeds are used, which are actually too high for the work on hand.

A broken drill or a damaged cutter is the inevitable toll which everyone must pay in learning to operate a machine tool. In the majority of cases, however, the damaged cutter can generally be repaired on the Unimat grinding machine. These notes on selecting the speeds are an indispensable preliminary to the description of the first actual machining operations.

In order to facilitate your work, reference should be made to the following speed tables. It should be borne in mind, however, that these are not absolute values, but are intended for your guidance:

For all machining operations involving wood (Turning, Drilling, Milling and Sawing):

n = 1600 r.p.m., Belt position No.8

Turning steel:

Up to 5/16"	in diam.	n = 1100 r.p.m.	Belt pos. 10
3/8" to 3/4"	in diam.	n = 850 r.p.m.	Belt pos. 7
3/4" to 1"	in diam.	n = 685 r.p.m.	Belt pos. 2
Over 1"	in diam.	n = 365 r.p.m.	Belt pos. 1

In the case of work exceeding 1 1/2" in diamenter it is expedient to use the double intermediate drive gear. (See page 22).

n = 155 r.p.m., Belt position 12.

Turning non-ferrous metals (Aluminium, Brass, Bronze and Copper);

The speeds indicated in the table "Turning steel" should be approximately doubled.

Thread-cutting:

Ascertain the speed in accordance with the foregoing data for the material and diameter in question, dividing the resulting figure by two. The figure obtained in this way indicates the approximate speed for thread-cutting.

Milling:

End-milling cutter up to 3/16" in diameter:

n = 1100 r.p.m., Belt position 10

Milling cutter up to 3/8" in diameter:

n = 850 r.p.m., Belt position 7

Milling cutters 3/8" to 3/4" in diameter:

n = 685 r.p.m., Belt position 2

Larger milling cutters 1 1/2" in diameter and above:

n = 365 r.p.m., Belt position 1

Drilling in steel:

Up to 1/8"	dril diameter	n = 1600 r.p.m.	Belt position 8
1/8" - 5/32"	" "	n = 1100 r.p.m.	" " 10
5/32" - 3/16"	" "	n = 850 r.p.m.	" " 7
3/16" - 1/4"	" "	n = 365 r.p.m.	" " 1

Drilling in non-ferrous metals:

The speed should be approximately double that indicated in the table "Drlling in steel".

Jig saws:

Working in steel:	n = 365 r.p.m.,	Belt position 1
Working in non-ferrous metals:	n = 850 r.p.m.,	" " 7

Grinding:

Grinding wheel 2 1/2" in diameter for tool grinding:

Coarse grinding:	n = 2000 r.p.m.,	Belt position		11
Fine grinding:	n = 2600 r.p.m.,	"	"	9
Cup grinding wheel:	n = 2600 r.p.m.,	"	"	9

Mounted grinding points 3/8" in diamter:

n = 3750 r.p.m., " " 5

Smaller grinding points:

n = 6000 r.p.m., " " 6

Lapping (emery grinding):

Steel and non-ferrous metals:

n = 850 r.p.m., Belt position 7

When working synthetic materials (e.g.bakelite, ebonite, ceramics, etc.): The speeds applicable to non-ferrous metals should be used. The speeds indicated in the foregoing are applicable when working with tools (lathe tools, drills, circular saw blades, etc.) of high-speed steel similar to those supplied with the Unimat. If tools of carbon steel are employed, then the cutting speeds must be reduced by approximately 50 %.

You are strongly recommended to consult these tables when carrying out any of the machining operations with the Unimat described in the following. They will prove particularly useful, especially in the initial stages, until such time as you have familiarized yourself thoroughly with the machine.

STRAIGHT OR PLAIN TURNING

The face plate and the lathe centre should be mounted. The lathe dog (No.51) clamped to the work by tightening the screw. The work, together with the lathe dog, should now be mounted between the centres (See fig.2), in such a way that the tail-end of the lathe dog fits into the slot of the face plate (the lathe dog has been omitted from the illustration in fig.2 in order to simplify the lay-out.)

Attention should be paid to ensure that the work is not clamped too tightly between the centres; there must, of course, be no play. It will be noticed that the headstock centre rotates along with the work, whereas the other centre remains stationary. A few drops of oil should be applied between the latter centre and the work. The actual clamping of the work between the two centres is effected by extending the tailstock spindle (No.28) by rotating the hand wheel. To do this, the socket head cap screw (No.31) must first be loosened.

After the work has been positioned correctly, this screw should be tightened again. Before commencing the actual turning operation, however, check to see that the two bolts in the headstock, which lock the spindle, have been tightened sufficiently.

The drill chuck can also be used for clamping the bar instead of the face plate.

SETTING-UP THE TOOL HOLDER

The tee nut of the tool holder (No.36) should be inserted into the keyway of the slide rest and clamped in position.

The tool should be secured in the holder, ensuring that the point of the tool is level with the spindle centre line. If necessary a few small pieces of sheet steel should be placed under the tool as packing pieces. The correct position of the tool is also shown in fig.5.

THE FIRST CUT

Metals are generally turned at low cutting speeds. After having selected the correct speed, switch the motor on, but before doing so, ensure that the tool is not in contact with the work. The threaded spindle (lead screw No.5) should then be rotated - by means of the hand wheel on the lathe bed - in such a way that the tool is moved to the right until it is completely clear of the work. The tool is now located between the end of the bar and the tailstock centre. The depth of cut should now be adjusted by turning the hand wheel on the slide rest.

The actual work commences by turning the lead screw anti clockwise, as a result

of which the slide rest holding the tool starts moving towards the headstock. This results in the first cut being taken.

You should not increase the depth of cut until you have first taken several light cuts in this way.

Before operating a lathe for the first time, it is advisalbe to ascertain how the longitudinal and cross feed mechanism operates, with the motor switched off, as well as the direction in which the hand wheels must be turned in order to move the slide rest from the tailstock end towards the headstock. In addition, you must also familiarize yourself with the way in which the cross feed screw (No.39) functions, with which the tool is fed towards the work. As you gain experience, you will become more familiar with all these operations.

GRADUATED TURNING

The next exercise consists of the graduated turning of various diameters. Approximately one-third of the total length of the work should be turned to a smaller diamter (start by the tailstock).

The slide should then be brought back to the tailstock, the tool set a little closer to the centre line, and another cut taken. If one wishes to achieve a large difference in the diameters of two sections, the above procedure should be repeated several times.

If one wishes to machine bars not exceeding 1/4" in diameter, these bars can be inserted in the bore of the hollow headstock spindle and clamped in position by means of the selfcentering three-jaw chuck.

FACING

A lathe does not only permit one to machine the external diameter of a piece of work, but also the ends as well. This operation is known as "facing". For facing, the work should be clamped against the face plate (See fig.5) or in the three-jaw chuck. The tool must be secured in the tool holder in such a way that it forms an angle of 75° with the surface to be faced. The tool is brought up against the end of the work by turning the lead screw. The end is then faced with the aid of the cross feed screw.

WARNING:

Ensure that the capscrews in the top of the headstock are firmly secured.

Using the lathe tools.

The accessories supplied in the toolbox include 2 lathe tools: a finishing tool and a roughing tool. The finishing tool is used for normal straight turning and facing, while the roughing tool, as its name implies, is chiefly used for preliminary machining operations, i.e. for taking heavier cuts, before the work is finally machined accurately to its appropriate dimensions with the aid of the finishing tool.

The roughing tool can also be used for facing purposes. In this case, however, the tool should be set at right angles to the surface in question.

Other lathe tools, such as parting-off tools, inside boring tools, etc. can be supplied. Novices are strongly advised not to grind the tools supplied with the machine into any other shapes.

Woodworking

Wood is simpler to machine in many respects than metal. Higher speeds can be used while the rate of feed too, can be correspondingly increased. The tool holder must first be removed for the production of complicated patterns, such as pillars, chessmen, etc. A support for the hand chisel is then placed on the slide rest in the same way as the tool holder and the wooden work secured

in the three-jaw chuck or clamped between the centres with the aid of the driver or face plate.

If no good clamping devices are available, an ordinary wood screw can be screwed into a surface of the wooden work. The head of the screw should be sawn off and the shank of the screw clamped in the drill chuck; pressure is provided by the tailstock spindle.

TAPER TURNING

For taper turning (the production of a conical-shaped work). The headstock, after loosening the tension screw (No.4) (located in the bed of the machine under the headstock pulley, No.14), should be inclined to the requisite angle and locked in position again. When this has been done, the process is identical with normal straight turning, i.e. the tool should be set up in the tool holder and traversed with the aid of the lead screw.

To re-align the headstock on completion of taper turning, the tailstock should be slid as far as possible to the left by hand, the tailstock centre fits exactly into the bore of the headstock, after the centre fitted to the latter has been removed. This accurately re-aligns the headstock, after which it may be clamped securely in position again. In order to facilitate the alignment of the swinging headstock in its zero position (i.e. the "normal" position for cylindrical turning), two corresponding grooves have been milled in the bed and the headstock housing. If, with the tension screw (No.4,Fig.1) slackened, you insert the accompanying setting piece (No.55) (disc washer 0.748" in diameter) in this milled groove and tighten the tension screw again, the headstock and tailstock will be lined up, i.e. the machine is re-aligned, and cylindrical turning can be recommenced. The seting piece may be removed again after the headstock has been clamped in position.

This method of alignment, employing the setting piece, is of course much simpler, although it is not as accurate as the other method of lining up described in the foregoing. It may be used, for example, when working with the scroll saw (see subsequent section), grinding, etc. For accurate centre turning, however the first of these two alignment methods should be used.

THE UNIMAT AS A BENCH GRINDER

When a grinding wheel is fitted to the arbor, included in the equipment supplied with the machine, and this is screwed on to the headstock spindle, your Unimat has been converted into an excellent grinding machine.

The tailstock (No.27) and the slide rest (No.32) should be placed as far as possible to the right. All grinding processes normally used in a workshop can now be carried out. Fig.4 shows the Unimat assembled as a bench grinder. When grinding, always remember to use the highest possible speed. Lathe tools and drills can also be sharpened in this way.

Greater efficiency can be obtained by rotating the headstock 90°, so that the grinding wheel is more accessible, coupled with the added advantage that the grinding dust will not be projected directly on to the slides along which the slide rest travels.

When grinding, all machine parts not in use should be covered with a cloth.

When sharpening tools, special care must be taken to ensure that no alterations are made in the cutting angles. In other words, newly-ground surfaces must be absolutely parallel with their original counterparts. If these steel tools are ground efficiently, the tool point will be sharpened and one is in possession of a sharp tool with the same cutting angles as the original tool.

These remarks are equally applicable to the grinding of twist drills and wood chisels.

These concise operating instructions make no claim to completeness. The novice

can do not better than arrange for his tools to be sharpened by an experienced hand, as this is an operation which necessitates a certain degree of skill and proficiency.

SURFACE GRINDING

Surface grinding can also be carried out with the aid of a cup grinding wheel, which is supplied in the toolbox. For this purpose, the work should be secured by means of clamps in the slide rest or tool holder.

Positioning is effected with the lead screw, although the actual process is carried out with the aid of the cross feed screw. Important: When grinding the headstock spindle must be firmly secured.

THE UNIMAT AS A DRILLING MACHINE

After loosening and completely removing the cone screw (No.4) under the headstock pulley (No.14) attached to the machine bed, the entire headstock together with the motor can be removed. This enables one to set up either a hand or bench drill. In order to set up the hand drill, all one needs to do is to screw the drill chuck, in the same way as was described in the section devoted to drilling on the lathe, on to the headstock spindle which should be firmly secured, clamping the vertical column bracket (No.41, fig.1) on to the headstock to facilitate its handling.

The clamping pin (No.9) and the vertical column bracket (No.41) cannot be mounted until the cone screw (No.4, fig.3) has been removed. When fitting both parts together, care should be taken to ensure that the end of the clamping pin, where the bore of the tapered hole is largest, faces the side at which the tension screw is inserted.

To set up a bench drill, use the vertical column, which should be attached to the lathe bed instead of the headstock and locked in position by means of the cone screw (see fig.3).

Assembly is then identical with the procedure adopted in the case of the hand drill and may be described briefly as follows: Set up the vertical column (when assembling pay special attention to ensure that the largest aperture in the column is located at the left-hand end of the lathe bed). Replace the cone screw and secure the vertical column in position 1. The vertical column bracket should be fitted with the largest aperture on top. Insert the headstock (ensuring that the largest aperture is on top) and secure.

VERTICAL ALIGNMENT OF THE SPINDLE

The face plate should be fitted to the headstock spindle instead of the drill chuck.

The slide rest should be moved until it rests under the face plate, the socket head cap screw (No.31) should be loosened and the whole of the headstock allowed to sink until the face plate bears on the slide rest. The cone screw on the drilling head should now be tightened. Finally, the headstock should be slid upwards along the drill column, the socket head cap screw (No.31) tightened again and the face plate exchanged for the drill chuck.

The height of the headstock should be adjusted on the column to suit the height of the work. Attach the face plate to the slide rest by means of the slotted stud (No.43). The work to be drilled may now be placed on the face plate, which does duty as a drilling table in this set-up. High work may be placed directly on top of the slide rest.

It should be remembered that if the headstock is allowed any play, the result will be incorrectly aligned holes. The drill may be fed by means of the feed pinion lever (No.26), after the two clamping screws of the headstock have been loosened. These clamping screws should only be loosened to such an extent, however, that the spindle is just prevented from slipping downwards under its own weight.

If desired, oblique holes can be drilled by aligning the headstock accordingly.

The Unimat, set up as a vertical machine, can also be used as a grinder (fit the cup grinding wheel) for surface finishing and tool grinding.

THE UNIMAT AS A MILLING MACHINE

For milling, the Unimat should be assembled in its vertical position (Fig.3), i.e. when set up as a drilling machine. The milling cutter should be fitted either in the drill chuck screwed on to the headstock spindle, or, where more accurate centring is desired, clamped in the collet chuck (see page 23). Depending on its shape, the work should either be clamped in the lathe chuck (cylindrical material), fastened in the cross slide by means of the slotted stud (see Fig.1, No.43), in the machine vise with a jaw capacity of up to approximately 1.063", or on the milling table (larger and unwieldy pieces). Medium-sized clamping screws for work up to approximately 1.181" are included as part of the standard equipment supplied with the milling table.

For further detailed information regarding the lathe chuck, the machine vise and the milling table, see pages 16 and 17 respectively.

The circular table (accessory supplied with the dividing head), see page 18 can - as explained on that page - also be used as a milling table when attached to the lathe side bracket with the aid of the slotted stud. The work should be secured to the circular table with the aid of clamps in a similar manner as is the case when the milling table is used (Page 17).

The milling cutter can then be set to the correct height with the aid of the rack and pinion gear of the headstock spindle. (Loosen the setscrews on the headstock and then tighten again).

The work being fed by means of the cross slide or lead screw hand wheels.

The milling cutters (woodruff and end mill cutter,) included in the tool kit are universal tools, with which all normal milling work can be carried out (conventional milling, facing, slotting, etc.). Providing the cut taken is not too deep (0.04", depending on the material being machined), even novices will experience no difficulty in milling smooth surfaces.

For the appropriate speeds, consult the table on page 7.

ACCESSORIES

The Unimat basic machine comprises all the elements necessary to assemble a lathe, milling machine, grinding machine, and a bench or hand drill. It also includes a motor, intermediate driving gear, face plate, 2 lathe centres, one lathe dog, one grinding wheel arbor and one hexagonal wrench.

This is considerably more than is supplied as standard equipment with even the largest lathes.

The various other accessories for use in conjunction with this machine should be acquired, depending on the uses to which the Unimat is to be put.

We would specially recommend the purchase of the tool set which is essential even for the first machining operations.

THE UNIVERSAL, SELF-CENTRING THREE-JAW CHUCK AND ITS MOUNTING (No.1001)

The carton contains the three-jaw chuck, 3 screws, 2 Tommy bars and 1 back plate (No. 1002). Before starting to mount the three-jaw chuck, one should ensure that the two lathe centres (the headstock and tailstock centres) are accurately aligned.

If this is not the case, the centres should be re-aligned.

A start can then be made to fit the three-jaw chuck, proceeding in the order indicated overleaf.

1) After the thread of the headstock spindle and the back plate have been thoroughly cleaned, the back plate should be screwed on to the spindle (see fig.8). Ensure that the bearing surface of the back plate lies perfectly flat and that there is no play whatsoever.

2) Clamp a lathe tool in the holder (see fig.8) and turn the smallest diameter very carefully until the bore of the chuck (0.66") fits over the turned part of the rear plate. No force should be required, nor must there be any play, i.e. a sliding fit is required.

   Attention ! Take the greatest care to ensure that the back plate diameter is not turned too small !

3) The back plate should be cleaned thoroughly and greased with machine oil when turning is completed.

   The three-jaw chuck should also be cleaned, slid on to the back plate and secured in position by means of the three screws.

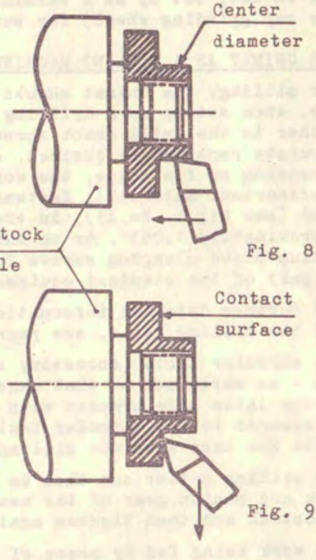


Fig. 8

Fig. 9

If the back plate has been machined too small, this will be immediately obvious as the three-jaw chuck will rotate excentrically. In this event, it is absolutely essential to turn a new back plate. This can be obtained from your dealer.

Fitting the three-jaw chuck to the back plate is a task which we must unfortunately leave to you entirely. The concentricity can only be guaranteed when the back plate is turned on the same machine as that on which the three-jaw chuck will be mounted.

The jaws of the three-jaw chuck supplied by us are fitted in such a way that smaller work (i.e. up to approximately 0.78") can be chucked from outside.

Circular or hollow work will be gripped by the jaws when the work is placed over them. This is carried out as follows: The jaws should be screwed off completely and cleaned. The knurled tension ring should then be rotated until the beginning of the thread lies close to slot No.1. Jaw No.3 should be reversed and inserted and the tension ring tightened sufficiently until the jaw is held securely.

Jaw No.2 should then be inserted in slot No.2 and finally Jaw No.1 in slot No.3

The jaws should always be turned inwards to such an extent that they do not come into contact with the slides of the lathe bed.
If one wishes to replace the jaws in their original position, it is only necessary to reverse the procedure outlined in the foregoing.

This time, however, jaws No.'s 1, 2 and 3 should be placed in the slots bearing the corresponding numbers. Two Tommy bars are supplied with the three-jaw chuck to facilitate clamping the work firmly.

N O T E

If you receive the chuck from us with the back plate already fitted, the procedure outlined in the foregoing paragraphs has already been carried out. In this case, the above instructions do not apply.

The three-jaw drill chuck (Jacobs system)

This is used for holding twist drills, centring drills, countersink and end milling cutters and mounted grinding wheels. It permits a certain degree of accurate centre chucking; for the particularly accurate centring of tools (milling cutters, mounted grinding points, etc.), the collet chuck should be used (see page 24).

In order to ensure that work is held and clamped firmly in position when grinding, milling and drilling, use should be made of the following piece of auxiliary equipment, which can be supplied on request.

MACHINE VISE (FIG. 10)

The machine vise, as its name implies, is used for clamping work which one wishes to grind, mill, or drill in position. This vise can be supplied on request as an additional accessory.

The machine vise is secured to the slide rest, care being taken to ensure that the two tee nuts fit into the grooves. When work is clamped in this way, the machining operations are identical with those described in the sections on grinding, drilling and milling, where use is made of the face plate to secure the work to the slide rest.

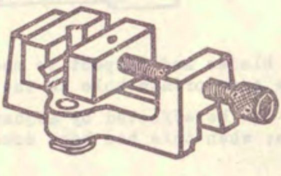


Fig.10

THE JIG SAW

A particularly attractive piece of equipment which can be mounted on the Unimat is that known as a jig saw.

This enables you to perform all the operations, normally possible with a fretsaw, but using materials such as sheet steel, wood, bakelite and plastics. Packed in the carton you will find:

1) The saw holder complete together with the driving mechanism and clamping plate (120-2), as well as the driving eccentric (120-11), which is fitted separately.
2) The saw table (120-3).
3) The saw frame (120-4).
4) A dozen saw blades, i.e.
   6 metal saws (fine teeth)
   3 wood saws (coarse teeth), and
   3 spiral type saws for wood and plastics.

As it is necessary to forward the saw dismantled, you are kindly requested to follow the instructions carefully when assembling the jig saw:

a) Remove the two separate socket head cap screws inserted at the top of the pillar, place the saw table in position and tighten screws again.

b) Place the saw frame so that it rests under the saw table and secure in position by means of the two socket head cap screws in the saw frame. These screws should only be tightened moderately for the time being.

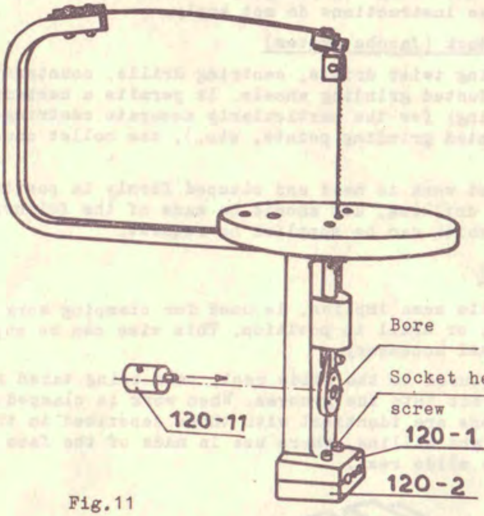


Fig.11

c) Insert any one of the saw blades and inspect to see whether this is accurately centered in the appropriate hole in the table.

d) Any necessary corrections can be effected by adjusting the screws securing the saw frame to the table; when this has been done. the screws can be tightened securely.

Fitting the jig saw to the Unimat will now be explained with reference to Fig.11. The driving eccentric, which is packed separately from the remainder of the saw in the carton (No.120-11 in Fig.11), should first be screwed on to the threaded part of the lathe spindle.
The up and down movement of the saw blade is effected by the activating column.

To secure the work firmly in position, use should be made of the toggle clamp supplied with the equipment, which should be inserted for this purpose in the relevant hole, which is shaded at Fig.11, Part 120-11.

In order to attach the saw to the activating columns (2), the clamp plate, 120-2 should be loosened from the saw holder 120-1, slid under the activating columns, the saw fitted to the activating columns (the saw frame lies over headstock of the machine) and secured to them by means of the two socket head cap screws, inserted from on top through the base-plate of the saw holder into the clamp plate (120-2).

The eccentric pin of the driving eccentric should then be inserted, as shown at Fig.11, into the ball bearing race, which should be slid in turn over the headstock spindle.

Before starting up the saw, the headstock spindle should be secured by tightening the two socket head cap screws on the headstock.

See page 7 for the appropriate cutting speeds.

To dismantle the saw, proceed as follows: Slacken the headstock spindle clamping screws and slide back the headstock spindle. Loosen the socket head cap screws at the foot of the saw, remove the saw and unscrew the driving eccentric from the headstock spindle.

If this driving eccentric cannot be unscrewed by hand, this can be achieved with the aid of the accompanying tommy bar which should be inserted in the hole of the driving eccentric held tight and the driving eccentric loosened by turning the pulley sheave.

MILLING TABLE

The milling table is designed especially for clamping larger and unwieldy work. The use of this piece of equipment enables the Unimat to be used as a milling machine even more effectively.

The milling table is provided with four different attachment holes, in which two socket head cap screws can be inserted, together with the tee nuts. The tee nuts should be inserted in the T-groove of the transverse slide rest and the table secured by tightening the socket head cap screws. This enables the milling table to be positioned either in the direction of the bed of the machine, at right angles to the bed, or at an angle of 45° to the latter. The actual position is determined by various factors, including the shape of the work in question, the type of milling to be carried out, etc., so that it is impossible to lay down any definite rules with regard to this point in these operating instructions. The work should be secured in position by means of the tee bolts and clamps included in the set, which should be inserted in the appropriate slots in the milling table. The work should be secured in such a way that its maximum level surface is in contact with the milling table.

The milling table can also be used to support larger work when drilling, in which case it takes the place of the table clamped to the cross slide (see page 12), especially when the work has to be clamped down tightly (e.g.during boring mill work). The distance between the various individual drillings can be selected as desired by means of the longitudinal and cross slides.

LIVE CENTRE

The use of the live centre is particularly advantageous, especially when work has to be machined at a high speed. While stationary centres easily tend to break up and become useless, in spite of good lubrication, when revolving at high speeds, coupled with the temperature rise of the tool when cutting, this can be obviated by employing a live centre, as it incorporates built-in pressure and friction bearings. When turning, it will be found to be particularly effective, as the live centre can be pressed firmly against the work, without it biting its way into the latter, as invariably happens when a stationary centre is employed.

The live centre can easily be removed and replaced by the insertion of a punch in the centre boring of the attachment. High melting point grease should be injected into this boring occaisionally for lubrication purposes.

Please do not allow yourself to be misled by the play in the live centre when it is under no-load conditions. When work is clamped in position, i.e. as soon as the centre is loaded, the ball-bearings of the built-in bearings automatically assume their correct position in the spherical guideway, so that all play is eliminated and the live centre runs concentrically.

THE CIRCULAR SAW ATTACHMENT (See Fig. 12)

The circular saw attachment offers numerous possibilities for carrying out all kinds of cutting and finishing work. Depending on the type of saw blade in use, steel and other metals, as well as wood and plastics, can be machined.

1) Fitting the saw blade:

The thread and contact face of the headstock spindle should be thoroughly cleaned. After cleaning, the circular saw arbor should be screwed on to the headstock spindle, using the tommy bar supplied with the saw (160-1) tighten

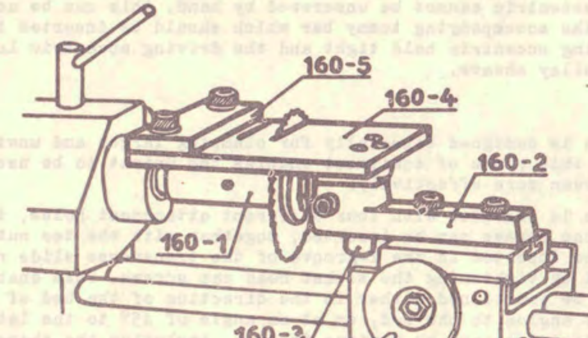


Fig.12

securely. You will then discover that the circular saw blade does not fit the arbor. In order to ensure that the circular motion is true and that there is no lateral wobbling, it should be fitted to the machine as follows:

Set the headstock to its normal position, i.e. for cylindrical turning (see page 8). The cutting speed should be approximately 800 r.p.m. Use the finishing tool. Take a fine cut of approximately 0.5 mm (0.002") from the spigot of the circular saw arbor and continue turning until the saw blade with its 16 mm (0.62") bore can be pressed on to this spigot without any play being apparent. A cut of approximately 0.2 mm (0.008") should be taken from the face of the circular saw arbor with the longitudinal slide rest locked in position. Pay special attention to ensure that the corner between the previously turned spigot and the face is sharp.

The saw blade (for wood or metal) can now be fitted, care being taken to ensure that the teeth are facing in the correct direction.

2) Assembling the saw table:

Remove the table from the bearing-block (160-2). Insert the bearing-block with the tee-nuts in the tee slot in the upper part of the slide rest and tighten. Place the table shank in the block, and secure it in such a way, that the saw blade can rotate in one of the two slots without fouling in any way. The two slide rests should then be locked in position with the aid of the appropriate clamping screws. The fence can then be mounted on the saw table parallel with the saw blade (this is important to ensure that sawing can be carried out without jamming).

3) When sawing, attention must be paid to ensure that when fed by hand the work is pressed at one and the same time on the table and against the fence (160-5).

A cutting speed should be selected as high as possible, providing of course that the speed of the motor is not reduced excessively. Recommended cutting speeds:

wood	1600 r.p.m.
plastics	850 "
non-ferrous metals	685 "
steel	365 "

Compared with the jig saw, the circular saw possesses the advantage of being able to make exact, straight cuts and cut thin strips (i.e. those used in model aircraft construction). Furthermore, straight sections can be prepared, for example, those used for drawers or picture frames. The coarse blade is used for wood, whereas the finer toothed blade is for metalworking. If an angle-plate is attached to the table, chamfered edges can be cut. An angle-plate can be made from a piece of flat steel, bent to the appropriate angle, this being attached to the table by means of clamping screws.

Saw blades, up to a diameter of 2.755", can be used in conjunction with this circular saw.

When cutting bar stock, a box clamp should be attached to the cross slide, instead of the saw table and bearing-block, the bar stock clamped in the prism, and the length to be cut being determined with the aid of the longitudinal slide. The feed is governed by the transverse slide rest.

FLEXIBLE SHAFT (See Fig.13)

This piece of additional equipment facilitates drilling, grinding, buffing and engraving work, etc., on larger or irregular-shaped work, which cannot be worked on the machine. In this case, the machine only serves as a source of power. The hand piece (130-1) is provided with an identical spindle end to that of the headstock spindle of the machine; this means therefore that all the standard equipment pertaining to the machine, e.g. drilling head, lathe chuck, grinding arbor can be used in conjunction with the flexible shaft.

FITTING THE FLEXIBLE SHAFT:

The driver (130-6) with female thread should be screwed on to the spindle end of the Unimat. (To do this, insert the accompanying pin in the radial hole of the driver, holding the pulley sheave of the machine to prevent it slipping). Slide the housing (130-5) over the headstock spindle and secure in position by means of the clamp screw. Insert the flexible shaft in the square opening of the driver - screw the adapter of the cable on to the threaded section of the housing, so that the flexible shaft is attached securely to the source of power. When working with the flexible shaft, particular attention

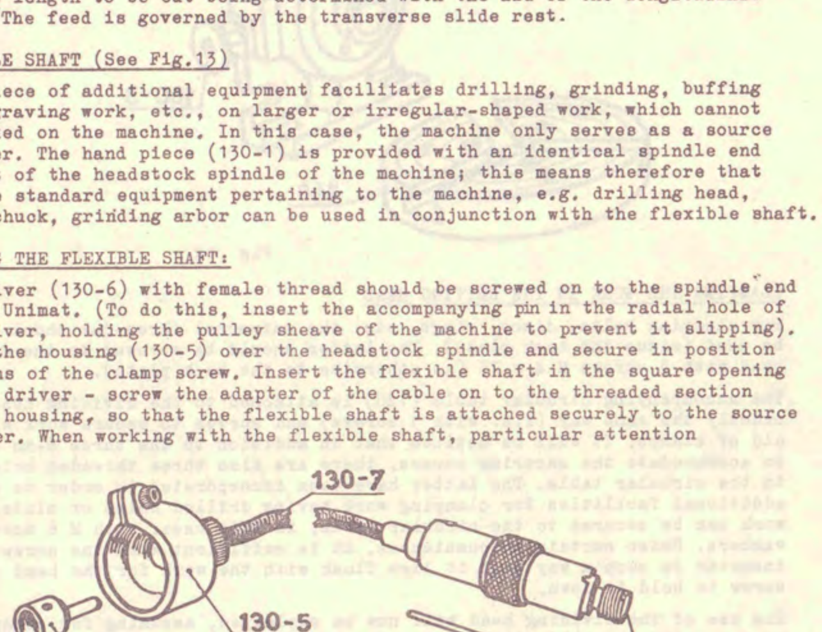


Fig.13

should be paid to ensure that the latter does not become unduly twisted and, above all, that it is not overloaded, as otherwise there is a danger of breaking the shaft (130-7). (Do not carry out any rough work, nor use drills larger than 0.157" in diameter. The maximum permissible speed 3750 r.p.m.).

THE DIVIDING HEAD (See Fig.14)

This attachment should be secured to the transverse slide with the aid of the two tee nuts and the socket head cap screws.

(Use the shorter hexagon wrench)
The dividing head can be set up either horizontally or vertically on the machine.

When the axis of the work is horizontal, as shown at Fig.14, the dividing head can be used for milling slots or recesses in the outer surface of cylindrical work.

When the axis of the work is vertical, radial grooves can be milled, perforated discs drilled, etc. The divisibility amounts to a maximum of 24, so that ratios of 2, 3, 4, 6, 8, 12 and 24 are correspondingly possible.

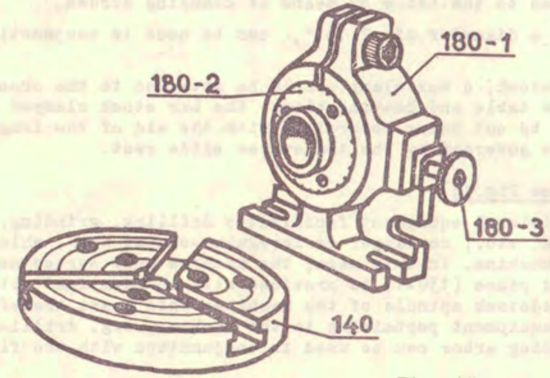


Fig 14

CLAMPING THE WORK IN THE DRIVING HEAD

For clamping bolts, discs, rings, etc. the universal three-jaw chuck should be used (minus the back plate). The latter should be screwed to the dividing head with 3 screws M 4 x 25 (as otherwise to the back plate).

The accompanying circular table (140) is attached to the dividing head in exactly the same way (i.e. with 3 screws) and serves to secure work with the aid of clamps. It will be noticed that in addition to the three 6-mm holes to accommodate the securing screws, there are also three threaded holes M 6 in the circular table. The latter have been incorporated in order to provide additional facilities for clamping work having drilled holes or slits. The work can be secured to the circular table, in this case, with M 6 screws and washers. Under certain circumstances, it is sufficient when the screw is inserted in such a way that it lies flush with the work for the head of the screw to hold it down.

The use of the dividing head will now be explained, assuming for example that we are going to mill radial slots. The Unimat should be set up as a vertical machine (see Fig.3).

Mount the dividing head on the slide rest with the tee-nuts and socket-head screws, with its axis vertical. The indexing pin (180-3) towards the tail-stock.

Secure the work on the circular table, or in the three-jaw chuck. Using the lead-screw traverse, position the work under the end-mill held in the drill chuck on the headstock spindle. Ensure that the work can be traversed by the cross traverse, sufficiently to allow the slot to be milled without an alteration to any other movement. Mill this slot to the required depth with all but the cross traverse locked whilst cutting. The headstock spindle will have to be released to allow the depth of cut to be increased.

Should three especially spaced slots be required, pull out the indexing pin against its spring, and turn the work, counting eight indentations at the indexing plate. Allow the pin to locate the plate and tighten the clamping bolt on the lugs at the back of the casting.

To ascertain the number of indentations to count, to equally devide a circle. Divide the number of positions (slots, holes, etc) required into 24 (the number of indentations on the plate) the result being the number of indentations to count with the pin disengaged, e.g. 6 holes equally spaced. 24 : 6 = 4 therefore a hole is drilled after four indents have passed the pin.

The dividing head can also be used horizontally.

A T T E N T I O N !

The number of divisions on the graduated scale can be read through the clamp slit.

Other types of work can also be carried out with the work and the milling cutter in the position described in the foregoing (horizontal to the axis of work), e.g. the milling of spanner flats of nuts (hexagon and square faces on the heads of bolts, radial grooves in discs (washers), and so on.

Please remember that the circular milling table can also be used in conjunction with the back plate of the lathe chuck as a face plate, attached to the headstock spindle during turning. In order to facilitate centering the work the centering rings may be employed.

After removing the circlip, the graduated disc can be withdrawn.

THREAD-CUTTING ATTACHMENT (See Fig.15)

An additional piece of auxiliary equipment, to be used in conjunction with the Unimat, is the thread-cutting attachment, with the aid of which male and femalc threads can be cut. The attachment is supplied with a master and follower for 16 T.P.I. Masters and followers for other thread pitches can be supplied.

When cutting metric threads, a tool with a tip angle of 60° should be used, this to be 55° in the case of Whitworth thread. Tools for male and female threads can be obtained from us. If one desires to cut other thread forms (e.g. trapezoidal, square and rounded threads), tools ground to the appropriate angles must be used. The thread-cutting attachment consists of the following parts:

2 brackets for guide rod	No. 170-1
Guide rod	No. 170-2
Tool holder assembly	No. 170-3
Return spring.	No. 170-6
Follower arm	No. 170-7
Master	No. 170-8
Follower	No. 170-9
Internal thread tool holder	No. 170-10
Collar	No. 170-16

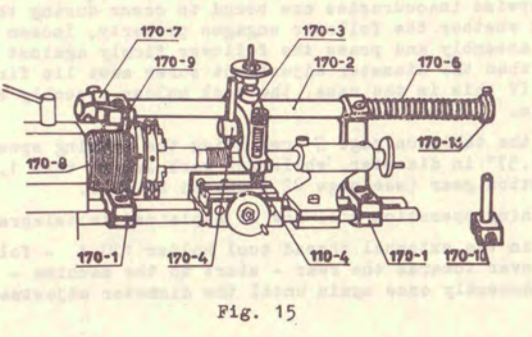


Fig. 15

In addition, the universal three-jaw chuck, together with the back plate, is used to hold the work in position.

The thread-cutting attachment is assembled as follows, reference being made to Fig. 15:

1) Fit the two brackets to the slides of the bed of the machine, In case of long work, where it is necessary to slide the tailstock as far to the right as possible, the right-hand bracket can be attached on the inside (left) of the tailstock to the slide.

2) The universal three-jaw chuck should be removed from the back plate and only the back plate screwed on to the headstock spindle. The master should be inserted in the back plate in such a way that the cup-shaped master fits over the extended headstock spindle. (The headstock spindle should be fully extended). The headstock spindle should be secured in position with the aid of the two tension screws, the universal three-jaw chuck placed on the spigot of the back plate protruding through the master, after which the chuck, together with the master, should be secured to the back plate with the aid of the three countersunk screws M 4 x 25. (Note: The left-hand bracket should not rub against the knurled ring of the lathe chuck). Guide rod, Fig.170-2, should be passed through the right-hand bracket from the tailstock side until it is on a level with the slide rest - the complete tool holder assembly No.170-3 should be placed on the guide rod - slide the guide rod through the left-hand bracket and fit follower arm No. 170-7 to the left end of the guide rod, after which it should be secured with a clamping screw. The upper clamping screw on both brackets No. 170-1 should be tightened sufficiently, so that the guide rod can be slid easily along, although there must be no play.

Please remember the following important points:

As the tool holder assembly and follower arm move to the left during thread-cutting, the diameter adjustment screw on the tool holder assembly 110-4 (the foremost) should lie at the right end of the slide rest prior to work commencing. The slide rest should therefore be adjusted accordingly!

The diameter adjustment screw on the tool holder assembly is used, as its name implies, to correct the tool holder assembly, depending on the diameter of the work being machined. When the screw is tightened (turned to the right) - the clamp should be loosened beforehand and then tightened again - the cutting arm is raised, so that work of a greater diameter can be machined. Slackening this screw exercises the reverse effect. When the setting of the diameter adjustment screw is altered, the tool in the external thread tool holder No. 170-4 should be adjusted so that its point is on a level with the centre line of the work.

Further attention should also be paid to the following:

The follower must engage with the master in such a way that there is absolutely no play, as otherwise inaccuracies are bound to occur during the thread-cutting process. To test whether the follower engages properly, loosen the clamp of the tool holder assembly and press the follower firmly against the master (with the left hand), when the diameter adjustment screw must lie firmly against the slide rest. If this is the case, the tool holder assembly can be clamped in position again.

Please refer to the table on page 7 regarding the cutting speeds to be used for work up to 1.57" in diameter, while for work larger than 1.57" in diameter, the double reduction gear (see page 22) should be used.

The actual machining operation will now be explained in telegram style.

Insert the tool in the external thread tool holder 170-4 - fold the tool holder assembly over towards the rear - start up the machine - swing over the tool holder assembly once again until the diameter adjustment screw lies

flush with the slide rest (the follower now engages with the leader and carries the tool holder assembly to the left) - press the head of the diameter adjustment screw by hand, so that the latter does not rise from the slide rest, but slides over it. After the thread has been cut, raise the tool holder assembly - the spring draws the assembly to the right once again - increase cut each time after the process has been repeated thrice - adjust to a cutting depth of approximately 0,005" by means of the handwheel - repeat the process until the desired thread depth is obtained - check with a thread gauge (the screw can also be screwed into a female thread by way of a test).

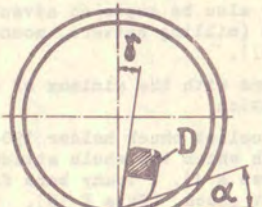
When cutting external threads between the two centres (i.e.when the work is not clamped in the three-jaw chuck), the procedure to be adopted is as follows:

The jaws of the chuck should be removed - insert a centre in the headstock spindle - the driving dog attached to the work will be engaged in one of the jaw grooves.

CUTTING INTERNAL THREADS:

Work (tubular section, ring, etc.) should be clamped in the universal three-jaw chuck - replace the external thread tool attached to the tool holder assembly by, an inside-thread tool holder No. 170-10 - fit an inside-thread tool into this holder so that it faces downwards - adjust the height of the inside-thread tool so that it corresponds roughly with the horizontal diameter of the work, this is done by sliding the inside-thread tool holder in the external-thread tool holder - the cutting tool should be clamped so that there is as little overhang as possible (the tool holder assembly should be slid as close as possible to the headstock and clamped securely to the guide rod). The inside-thread tool should be set up as shown at Fig.16.

Turn sketch 1/4 turn anti clockwise.



α side rake approx. 5° for steel, and approx. 20° for light metals
γ clearance angle approx. 5 - 7°
D cutting tool

Fig.16

Adjust the depth of cut by means of the handwheel on the tool holder assembly - cutting can then be commenced in a manner similar to that explained under the section dealing with external-thread cutting. When raising the tool holder assembly after a cut has been taken, however, care should be taken to ensure that the inside-thread tool does not come into contact with the opposing inner wall of the tube, as it may damage the tool or thread.

THE DOUBLE REDUCTION GEAR:

(For correct positioning of the belts, see Fig.7, No.'s 12 and 13). The double reduction gear enables the lowest speed available with three pulley sheaves (365 r.p.m.) to be further reduced to a minimum of 130 r.p.m. The double reduction gear should be fitted as follows:

After loosening the screws M 4, remove the motor belt pulley - unsrew the 2 motor attachment screws on the motor end plate - remove the motor - withdraw the intermediate gear (pulley sheave together with its bearings) by loosening the clamp screw - loosen the headstock securing screws - unscrew the setscrew on the headstock with a screwdriver - withdraw the headstock spindle - loosen

the clamps of the motor support plate and remove the latter - assemble, in its place, the motor support plate for the double reduction gear, proceeding as follows:

Slide the headstock spindle together with the spindle pulley into the motor support plate for the double reduction gear (the smooth side should face the pulley sheave) - insert the spindle in the headstock - tighten setscrew, but then loosen it again half a turn - insert the feed pinion together with the feed pinion lever - secure the motor to the motor support plate in the normal way (the rating plate facing outwards, cable below) - fit the motor pulley sheave in such a way that the largest step faces the motor - the new intermediate gear has already been assembled correctly on the support - insert the old intermediate gear in the free opening - align the pulley sheaves from the motor pulley. The motor support plate should be slid on to the spindle until this has been completed, i.e. until the sheaves are aligned and the centres of the machine and motor driving pulleys lie in one line - secure the motor support plate to the spindle - secure the intermediate gear bearings in the motor support plate - place the belts in position as shown at Fig. 7, No.'s 12 or 13.

The following illustrates yet another advantage attached to the use of the double reduction gear:

The majoritiy of other speeds frequently used, i.e. those shown at Fig.7 No.'s 7, 8 and 9, can now be selected without it being necessary to reverse the motor pulley sheaves (as is the case when working with the standard equipment - see pages 6 and 7). It is now only necessary to reposition the driving belts.

THE COLLET CHUCK ATTACHMENT (See Fig.17)

This attachment is used for holding bar stock with a smooth, cylindrical surface of between 1/16" and 5/16" in diameter, in conjunction with the collet chucks of the appropriate diameter, it may also be employed advantageously for the accurate chucking of shanked tools (milling cutters, mounted grinding points, drills, counterbores, reamers, etc.).

It enables these tools to be held firmly and with the minimum of overhang, in addition to ensuring more accurate rotation.

The collet chuck attachment comprises the collet chuck holder 190-1, the adjusting nut 190-2, the flange 190-3, with which the whole attachment is secured to the machine (3 countersunk screws M 4), 2 tommy bars for tightening the attachment, and a double-conical collet chuck, (Type E 16).

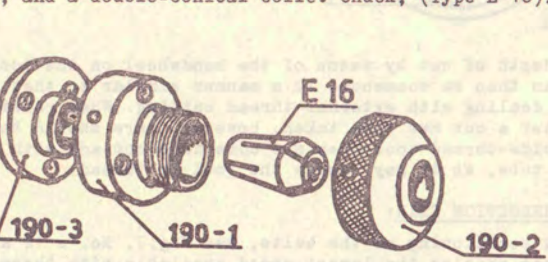


Fig 17

The collet chuck should be mounted extremely carefully, in exactly the same way as the three-jaw chuck (see page 13). Very special care should be taken, as otherwise the great accuracy - the very reason why this chuck is fitted - will be seriously impaired.

THE TRUING DIAMOND

This is used, as its name implies, to true grinding wheels and mounted grinding points in order to achieve a perfectly regular surface.

TRUING A GRINDING DISC:

The truing diamond should be clamped in the tool holder - a very fine cut should be taken from the grinding disc at approximately 2600 r.p.m., this being continued until the disc is perfectly circular.

HIGHLY-FINISHED SURFACES can be obtained, either when turning longitudinally or facing, with the aid of the truing diamond, which should be secured in exactly the same way as a cutting tool. The speed used should be at least double that used when machining steel !

ATTENTION !

It should only be engaged with the work in motion - a very fine cut should be taken at the lowest possible rate of feed !

The truing diamond can also be used succesfully for turning plastic materials, such as bakelite, ebonite, or vitreous substances, materials with which it is difficult to obtain a smooth surface when normal cutting tools are employed.

DENTISTS OR TAPERED BUFFING SPINDLE

The Conical Buffing Spindle, is most useful when using wire brushes, with wooden or lead core, and all polishing bobs of felt or cloth.
All types and sizes of bobs may be used, up to a diameter of 2 3/4" when the Unimat is normally mounted. If the headstock of the Unimat is swung out by 90 degrees (see toolgrinding machine) these bobs may be used up to approx. 4" in diameter.

INSTRUCTIONS FOR MOUNTING:

The spindle has the same back plate as the Unimat lathe chuck, with the same diameter, which must be turned to measure in the same way as described in the Operating Instructions booklet page 13 Fig. 8 and 9 (Mounting of the lathe chuck on to the back plate).

After finishing this procedure, fix the spindle itself (by means of the three screws) on the back plate.

For dismounting the Conical Threaded Spindle from the Unimat, unscrew the back plate together with the conical threaded spindle from the spindle nose by means of a tommy bar.

The Tapered Buffing Spindle will find its application for laboratory work by dentists, as well as by goldsmiths and mechanics, for polishing and grinding, which work requires a frequent exchange of bobs etc.

THE FIXED STEADY REST

The Fixed Steady Rest is an important accessory for the Unimat. saving much time when working on slender shafts, and axles etc.

The Steady Rest is indespensable for advanced workers who venture the production of complicated turned parts.

Samples of Use: When working on a shaft of say 6" length by 1/4" diameter which is being turned between the two centres of the Unimat, it may well happen that, in the middle of the shaft - the cutting pressure of the tool bit might become strong enough to bend the shaft. This would cause inaccurate surfaces on the material. The shaft is getting thicker in the middle, causing uneveness of the surface. The deficiencies are avoided when the steady rest is used as a support.

Furthermore, the steady rest can be used as end-support when working on long parts, which are held in the lathe chuck for turning in overhung position. By doing so, all wanted plain turning or facing on the material may be performed, when the tailstock is dismounted.

Directions for Mounting: The two socket-head-screws are to be unscrewed and the lower part taken off. The three fastening screws for the sliding guide bars are loosened and these bronze bars pushed back. Now the steady rest is put on the bed in such a way that the fastening screws are towards the head-stock. The lower part is again screwed on by two socket-head-screws and the steady rest is finally located as near the tool as possible and locked there. Chucked parts must be centred correctly.

Afterwards the front sliding-pin is brought cautiously near the material until touching it and the clamping-screw is fastened. The same action must be performed with the back sliding-pin and at last with the upper one.

The work must be free to turn when the sliding bars are closed around it and locked but there must be no play. Use slow speeds to avoid wear and grease with ball bearing grease. It is advantageous to put a bit of felt oil soaked, into the hollow between the upper and rear sliding-bar, fitting to the roundness of the steady rest and sliding on the material.

CUTTING FLUIDS

The life of all your tools - lathe tools, drills and milling cutters - will be pronlonged if cutting fluids are used. These compounds should be applied to the tool in question with the aid of a small brush.

The correct type of lubricant may be ascertained from a refference book, or may-be your tool - merchant will be able to advise on the correct lubricant.

UPKEEP AND MAINTENANCE OF THE UNIMAT

After the machine has been used, all chips should be removed and all polished surfaces lubricated with a small brush or a piece of cloth dipped in oil.

The machine oil used for this purpose should be of a high quality.

Moving parts, such as the headstock spindle and the tailstock spindle should be extended as far as possible before applying the necessary lubricant.

Take good care of the machine so that it always looks as new. You'll derive a great deal of pleasure from it and a well-main-tained machine has a much longer life.

The two bearings of the headstock spindle must be greased after every 300-500 working hours. To do this, the headstock spindle should be removed from the headstock. The feed lever (No.22) must first be taken off and the headstock bolts withdrawn, as well as the setscrew in the cotter groove.

The headstock spindle can now be removed from the headstock by sliding it out at the transmission side. The nut on the pulley sheave should be slackened, the pulley sheave unscrewed (the face plate should first be mounted on the other end of the headstock spindle.) The headstock spindle has then been dis-mantled completely.

ATTENTION

Take good care of the individual ball-bearings and the ball-bearing races.

Hold a tray or some form of container under the spindle as you withdraw it. When the bearings have been thoroughly cleaned with paraffin, the ball-bearings should be replaced in high melting point grease, in exactly the same way as a bicycle hub. The headstock spindle can then be replaced.

Don't be afraid, but set to work carefully !

The limited motor rating of 65 watts and more especially the fact that the belts will start to slip if the machine is overloaded, render it almost impossible for the Unimat to be damaged, while there is practically no chance of the operator hurting himself in any way.

Nevertheless all due caution should be observed, for this is a quality which should be stimulated in young mechanically minded persons before they start working with larger machines, where very serious accidents can happen. A basic rule which should be observed therefore is: no adjustments should be carried out until the motor has been switched off; do not touch moving parts; verification of the dimensions of work with a caliper, micrometer, etc., should only be carried out when the work has come to a standstill.

It should not be forgotten that the motor is plugged into the normal domestic supply, so that the same precautions should be observed as if one was handling an electric cooker, electric iron, etc.

Do not use any wires or cables if their insulation is damaged. The use of a plug incorporating earthing facilities is recommended. If the foregoing instructions are followed carefully, no dangers whatsoever attend working with the Unimat. We sincerely trust, however, that the foregoing instructions will enable everyone to produce simple work on the Unimat.

The more one becomes accustomed to the machine, the greater the number of possibilities and short cuts one will discover and put into practice. If any of your acquaintances happens to be an instrument maker or a fitter, ask them for advice where necessary.

It is quite possible that even these experts, who have only been used to full-scale work up to that time, will derive a great deal of pleasure from your machine and will certainly be glad to place their specialist knowledge at your disposal.

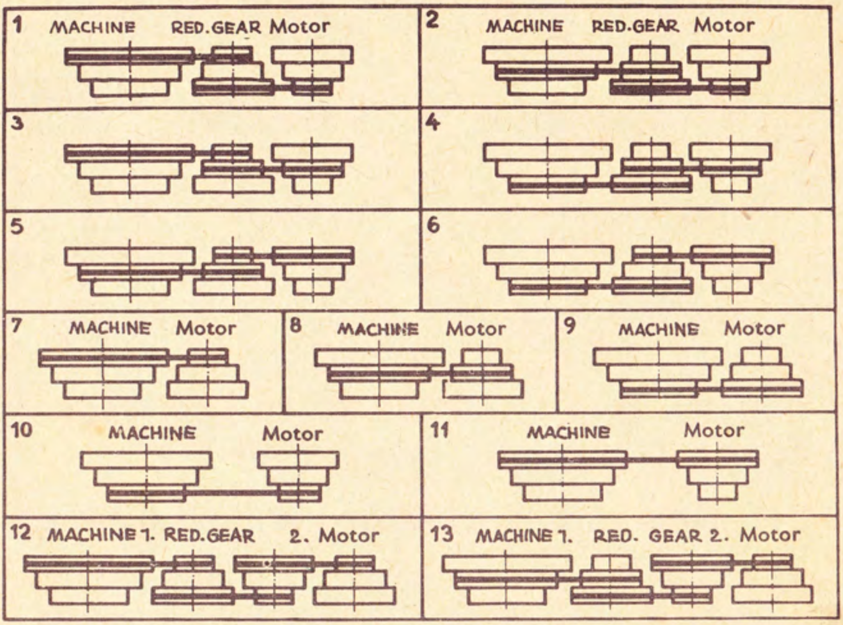


FIG. 7

	At 4000 r.p.m. and normal load:		At 3450 r.p.m. and normal load:
1)	365 r.p.m.	1)	310 r.p.m.
2)	685 r.p.m.	2)	590 r.p.m.
3)	850 r.p.m.	3)	730 r.p.m.
4)	2600 r.p.m.	4)	2200 r.p.m.
5)	3750 r.p.m.	5)	3200 r.p.m.
6)	6000 r.p.m.	6)	5200 r.p.m.
7)	850 r.p.m.	7)	730 r.p.m.
8)	1600 r.p.m.	8)	1400 r.p.m.
9)	2600 r.p.m.	9)	2200 r.p.m.
10)	1100 r.p.m.	10)	950 r.p.m.
11)	2000 r.p.m.	11)	1700 r.p.m.
12)	155 r.p.m.	12)	130 r.p.m.
13)	300 r.p.m.	13)	250 r.p.m.

Druck: W.PRIBYL, Salzburg.