the same parts in all the figures. A A is a strong framing, which supports the bed of the lathe B B. At the left-hand extremity of the bed is fixed the head C C, and through steel bushes in the tiprights, or puppets as they are termed, the spindle or mandril D works ; the projecting right hand end of the mandril is screwed, so that chucks and other apparatus for holding the work to be turned may be attached to it. One of these, the double driver, will be found figured and described afterwards. In brackets projecting backwards from the uprights another spindle E works. One of the brackets and the end of the spindle are seen in fig. 2. On the main spindle D there is a conical pulley F, carrying a pinion on its smal­ler end ; the pulley with its pinion turns on the spindle, hut in­dependently of it. To the right of the pulley is a spur-wheel H, keyed on the spindle ; to this spur-wheel the pulley can be locked at pleasure, so as to be carried round along with it. On the spindle E is a spur-wheel G and a pinion, which cannot be seen in the drawing. These are fitted respectively to gear with the spur-wheel and pulley-pinion of the main spindle. Different materials require to pass the cutting tool with different degrees of rapidity, in order to be efficiently operated upon. Cast iron requires to revolve slowly, so that it may come in contact with the cutting tool at the rate of about 100 feet per minute ; wrought iron and steel about twice as quick ; and brass is better cut at a still higher velocity. Thus, it is required that provision be made in the lathe for altering the speed, independently of the velocity of the prime mover. It is obvious, too, that the same material must require a change in the speed of the lathe, according to its diameter, that a uniform rate of speed may be maintained by its surface. This alteration in the velocity of the spindle or mandril is produced by the pulley and wheels we have just described, in the following manner :—When the belt from the prime mover, act­ing on the pulley F, causes it to revolve, if a slow motion be required, the pinion of the pulley is made to gear with the spur-wheel I of the spindle E ; and the pinion fixed on the same spindle gear­ing into the spur-wheel H of the main spindle D, causes it to revolve with a motion slow as compared with the speed of the pulley. If a higher velocity be required, the wheel and pinion of the spindle E are put out of gear with the pinion and wheel of the main spindle by sliding the spindle E a little to the left hand, and then locking together the pulley and spur-wheel H, so as to cause the main spindle to turn directly by the pulley.

The face of the spur-wheel H has drawn on it a great number of concentric circles. The circumference of each circle is divided into equal parts, and such numbers are chosen for the division as are mul­tiples of the greatest variety of measures ; at each division of the circles there is pierced a hole, into which a point is pressed by a spring. By means of this apparatus, an object in the lathe can have its surface divided into any number of equal parts. On the end of the main spindle is fixed a pinion K, which, by the inter­vention of the stud-wheels and pinion L, drives the spur-wheel M, fixed on the end of a screw N, which extends along the whole length of the lathe, and is called the leading screw. The ends of the leading screws and main spindle are made accurately of the same size, so that the wheels and pinions which have for differ­ent purposes to be fixed on them may be exchangeable. On the right hand side of the lathe is seen the shifting-head or puppet O, which is capable of being shifted along to any part of the bed, and fixed there, and which carries the centre pin. This is adjusted more nicely to its work by means of a screw turned by the wheel P, and it is fixed by the clamping screw Q. The slide-rest consists of an upper and an under slide : the latter lies across the bed, and is moved along it lengthways by means of the leading screw. The upper slide can move at right angles to the under one, and carries the cutting tools : the manner in which the slides are moved by the leading screw is, in this lathe, very in­genious. From the under slide there descends a short vertical spindle, carrying on its lower extremity a peculiarly-formed pinion β, which is constantly in gear with the leading screw. When the leading screw is in motion and the pinion fixed, the latter serves as a nut or female screw, and the slide is moved along the bed of the lathe to the right or to the left as the screw may be turned. On the upper end of the vertical spindle there is fixed a mitred wheel *b*: into this a pinion *c* works, whose spindle crosses the slide, and has a handle *d* fixed to it. On the slide having reached one or other extremity of the bed of the lathe, it may be carried to the other by reversing the motion of the screw ; but it is more speedily done by turning the handle *d* which turns the pinion *a,* and so the slide is carried along very rapidly.

The upper slide is moved across the bed of the lathe as follows : A pinion *e,* which works into the mitred wheel of the vertical spindle, is fixed on the end of a shaft *f*, on whose other end is fixed the wheel *g*; this gears into another wheel Λ, fixed on the end of a leading screw, which crosses the main leading screw, and, by means of an apparatus similar to that above described, causes

the upper slide to move at right angles to the under one. In fig. 3 the under slide is represented as fixed in its position by means of a clamp, whose handle is seen at *k* in fig. 1, and the main leading screw is, by means of the pinion *a,* the mitred wheel *b*, and the pinion and wheels *e*, *g,* *h*, working the cross lead­ing screw of the upper slide, by which it is moved across the bed of the lathe.

In plain cylindrical turning, the motion of the slide is so ad­justed in relation to the motion of the article operated upon, that the cutter carried by the slide shall not move over a space greater than the breadth of its point in the lime that the article makes one revolution. In screw-turning, the cutter again is made to travel over a space as much greater than the breadth of its point during one revolution of the spindle, as the pitch of the screw re­quires. The requisite changes in the motion are effected by changing the wheels on the ends of the main spindle and the lead­ing screw.

On the mandril nose there is represented, in fig. 1, what is called a double driver, and we here give the details of an excellent apparatus of this kind, in­vented by Mr Joseph Cle­ment of London, by which an article can be fixed per­fectly true between the centres of the lathe. The figures and description are from the Transactions of the Society of Arts of London, vol. xlvii.

“ Fig. 4 is a side or edge view of the chuck ; and fig. 5 is a face or front view. The same letters refer to the same part in both views.

*“ a a* is a circular plate or chuck, on the back of which is formed a boss *b*: the boss ⅛ contains a female screw for screwing it on the nose of the lathe-mandril. On the face of the chuck or plate *a a,* and in the middle, is screwed a conical centre *c,* on which is sup­ported one end of the thing to be turned, as shewn at *d* in fig. 4. *e e* is a parallel plate in the form of a cross, one side of which is fitted to the face of the chuck *a a ;* in the middle of the horizon­tal arms of the plate *e e* are two oblong holes *f f,* as represented by the dotted lines in fig. δ ; *g g* are two screws which pass through the holes *ff,* and screw into the face of the chuck *a a ;* the necks of the screws *g g*are made to fit the holes *f f* in one direction, but the plate *e e* is at liberty to slide to and fro beneath the heads of the screws *g g* in the contrary direction : there are also thin washers beneath the heads of the screws *g g,* which act as springs, and tend to hold the plate *e e* in the situation wherever it may be slid to; there is also an oblong hole in the middle of the plate *e e*, through which projects the centre *c :* in the vertical arms of the cross or plate *e e* are six screwed holes; *h* and *i* are two studs or drivers, which may be screwed into any of the holes marked *j*, so as to accommodate the length of the ends of the carrier *k.* There is a face view of the carrier \*, represented in its place (by dotted lines on the face of the plate, *e e,* fig. 5). The ends of the carrier are acting against the studs Λ and ».

“ Supposing a piece of metal d, to be supported between the cen­tre *c* of the chuck *a a* and the centre of the puppet-head of the lathe, and the carrier *k* to be fixed on one end of it, as shewn in fig. 4 : let the plate *e e* (see fig, 5) be slid on the face of the chuck *a a.* a little towards the left hand ; then the stud *h* will cause the upper end of the carrier *k* to move or turn in the same direction upon the centre *c.* But the stud *i*, and the lower end of the carrier *k,* will be moved in contrary directions, and will be separated from each other double the distance that the plate *e c* lias slid on the face of the chuck *a a ;* therefore, should the plate *c e* be in the above position, and the lathe put in motion, so as to turn the plate *a a* round to. wards the left hand, the stud or driver *h* would be the first that would come in contact with the carrier *k*. But when the turning-tool is ap­plied to the thing to be turned, or any resistance which tends to prevent it from turning round, the carrier *k* will cause the upper stud Λ and the plate *e e,* together with the stud *i*, to be slid to­wards the left hand till the stud *i* comes in contact with the lower end of the carrier *k ;* then the studs or drivers *h* and *i* will be act­ing with equal force against the ends of the carrier *k,* which will remove the greatest part of the twist or strain from the cen­tre *e* of the chuck *a a,* by which means any slender cylinder, &c. may be turned more perfectly than can be done by a single driver. If another stud be screwed into one of the holes opposite the dri­vers *h* or *i*, it will prevent the thing to be turned from overrun­ning itself, or back-lashing, when it has got a heavyside. The dri­vers *h* and *i* may be made of different lengths, as may be found most convenient.”

When it is required to replace in the lathe an article whose