

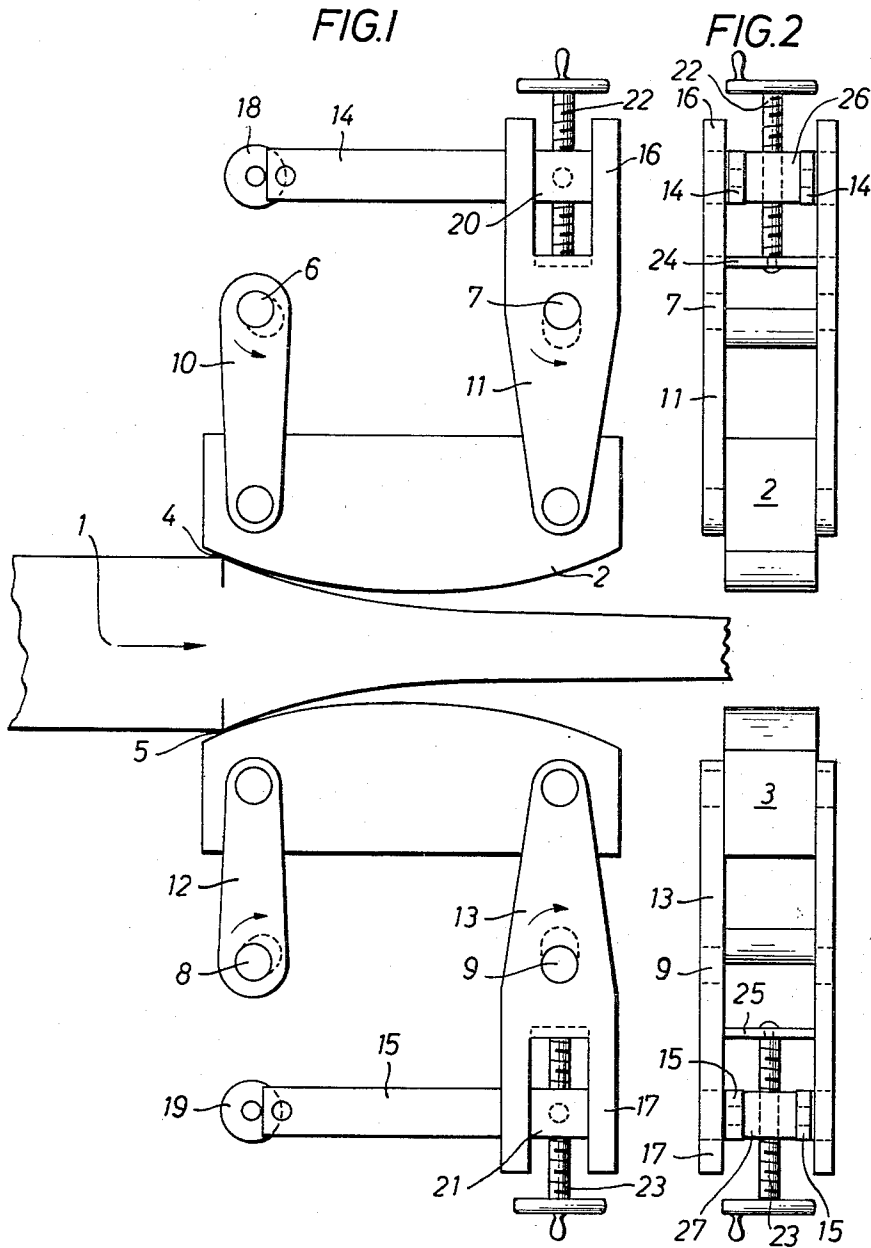
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STRETCH FORGING MACHINE

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STRETCH FORGING MACHINE

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ABSTRACT OF THE DISCLOSURE

Driving mechanism for moving a pair of walking jaws of a machine for stretch forging ductile material towards one another and forwards to deform the material and advance it through the machine, and then away from one another and backwards to release the material and return the walking jaws to their initial position, which includes two sets of driving means, one set for each of the walking jaws. Each of the sets of driving means has a first link, a first rotatable driving shaft, means pivotally connecting one end of the first link to the respective walking jaw, eccentric means pivotally connecting the other end of the first link to the first rotatable driving shaft, a second link, a second rotatable driving shaft, means pivotally connecting one end of the second link to the walking jaw, and eccentric means pivotally connecting the second link to the second rotatable driving shaft at a position intermediate the ends of the second link, and a third link, a third rotatable shaft, eccentric means pivotally connecting one end of the third link to the third rotatable driving shaft, and means pivotally connecting the other end of the third link to the second link at a position between the connection of the second link to the second rotatable driving shaft and the end of the second link remote from the walking jaw. The driving means also includes means for rotating the first, second and third driving shafts at the same speed. The first and second links extend transversely to the material travel direction through the machine and control the movement of the pair of walking jaws toward and away from each other, and the third link extends substantially parallel to the material travel direction and controls the forward and backward movement of the pair of walking jaws.

This invention relates to machines for stretch-forging ductile materials, such as metal in a plastic state, having a pair of working jaws which oscillate towards and away from each other. As the jaws approach each other they are at the same time advanced towards the output end of the machine, and in this movement they deform the material and at the same time advance it. When the jaws subsequently move apart from each other they move away from the surface of the material and return to their initial position to start the next cycle, the material at this time either remaining stationary or being advanced by a second pair of jaws. Because of this motion the jaws are called walking jaws. When the jaws approach each other they at first make contact with the not yet deformed part of the material. If a machine of this kind is equipped with two pairs of walking jaws operating in alternation, the advance of the material is reasonably smooth.

In the first known machines of this kind each walking jaw is mounted at one end on a crank or eccentric which rotates about a stationary axis, whereas the other end of the jaw is attached to a link which is mounted on a rotating crank or eccentric shaft. The two cranks or eccentrics rotate at the same speed and give the walking jaw the complex movements described above. However, with this arrangement the advancing movement given to the material is not great because it depends only on the ec-

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centricity of the crank or eccentric, which rotates about a fixed axis. This eccentricity at the same time determines the actual working stroke of the jaw, that is to say the transverse stroke performing the deformation.

As a way round this, it is possible to connect the walking jaws to their crank or eccentric pins through two parallel links extending transversely with respect to the direction of advance of the material, these transverse links giving the walking jaws a movement essentially transverse to the direction of advance of the material. Each jaw has an extra link which extends approximately parallel to the direction of advance of the material, this link being driven by a third crank or eccentric drive and giving the jaw the necessary forwards and backwards movement in directions parallel to the movement of the material. In this arrangement the extra link does not apply any deformation thrust to the material and consequently its stroke can be whatever is required for advancing the material. The crank or eccentric drive moving the extra link must of course rotate at the same speed as the other two crank or eccentric drives which provide the deforming thrust.

In this arrangement the extra link, with its crank or eccentric drive, may be positioned either upstream or downstream of the walking jaw, at about the same distance from the material as is the walking jaw. However this arrangement is not very practicable, because the extra link, with its drive, interferes with access to the walking jaw. Moreover the bearings of the extra link are subjected to considerable radiant heat from the material. A further disadvantage of this arrangement is that the extra link cannot be adjusted simply to change the length of the advancing stroke of the walking jaws.

With the aim of overcoming these disadvantages, according to the invention, in a machine for stretch forging ductile materials having a pair of walking jaws and a driving mechanism which is arranged to move the jaws towards each other and forwards to deform the material and advance it through the machine and then away from each other and backwards to release the material and return the jaws to their initial position, the driving mechanism comprises two sets of three links, one set for each walking jaw, and each set having a first link pivotally connected at one end to the jaw and at the other end eccentrically to a rotatable driving shaft, a second link which is pivotally connected at one end to the jaw and eccentrically to a second rotatable driving shaft at a position between its ends, these two links extending transversely with respect to the direction of travel of material through the machine, and a third link extending substantially parallel to the direction of travel of material and pivotally connected at one end eccentrically to a third rotatable driving shaft and at the other end to the second link between the connection of the second link to the second driving shaft and the free end of the second link, the arrangement being such that, in use, the driving shafts are all rotated at the same speed to operate the walking jaws, the first and second links controlling the movement of the jaws towards and away from each other and the third links controlling the movement of the jaws forwards and backwards.

In this way the extra link, i.e. the third link, and its drive are positioned further away from its walking jaw and from the material than are the drives of the other two links. There is therefore free space both upstream and downstream of the jaw, and the jaw is easily accessible. Furthermore the entire driving mechanism is now both simpler and more compact. Also, the drive for the first link can now be taken directly from the drive for one of the other two links.

Preferably the position of the connection of the third link to the second link is adjustable along the length of

the second link between the connection to the second driving shaft and the free end of the second link. In this way the distance of advance given by the walking jaw to the material during each working stroke may be adjusted in a simple manner to suit the deformation requirements for each particular piece of material.

An example of a machine in accordance with the present invention will now be described with reference to the accompanying drawings, in which:

FIGURE 1 is a diagrammatic side view of the machine; and,

FIGURE 2 is a diagrammatic view of the end of the machine towards which the material being stretch-forged travels.

Material 1 being stretch-forged by the machine is advanced from left to right as shown in FIGURE 1. The machine has two walking jaws 2 and 3, and are shown in FIGURE 1 at the beginning of a new working stroke. The working surfaces of the jaws 2 and 3 are in contact with the leading end of the part of the material 1 which has not yet been deformed. Although in this example the machine only has 2 walking jaws, there may be a second pair of jaws acting on the material in a plane at right angles to the plane of the pair 2 and 3.

The input end of the upper jaw 2 is connected at 6 by a transverse link 10 to an eccentric drive, and the output end of the jaw 2 is connected to a further eccentric drive at 7 by a link 11 which extends approximately parallel to the link 10. The lower walking jaw 3 is similarly connected by links 12 and 13 to further eccentric drives at 8 and 9 respectively. At the output ends of the walking jaws the links 11 and 13 extend out beyond the connection to their eccentric drives at 7 and 9, forming extensions 16 and 17. The extensions 16 and 17 each contain a bush, 20 and 21 respectively, mounted so that its position is adjustable along the length of the extension. Each bush 20, 21 carries a bearing in which is mounted the trailing end of a third link 14, 15. The leading end of each link 14, 15 is mounted on the pin of a further eccentric drive 18, 19. All the eccentric drives at 6, 7, 8, 9, 18 and 19 have driving shafts which rotate at the same speed on parallel, stationary axes. The eccentric drives at 6 and 9 give the walking jaws 2 and 3 their transverse working strokes, that is to say move the two jaws inwards towards each other to deform the material 1; and away again ready for the next inwardly directed thrust. The eccentric drives at 18 and 19 advance the walking jaws 2 and 3 along with the material during the working stroke, the jaws being in contact with the material at this time. The eccentric drives at 7 and 9 at the output end of the jaws 2 and 3 lag behind the eccentric drives at 6, 8 in their eccentric movement, giving the jaws their walking action. The directions of rotation of the driving shafts of the eccentric drives 6 to 9 are shown by arrows in FIGURE 1. In this walking movement it is the input ends of the walking jaws 2, 3 which first make contact with the material 1, this first contact being made at an undeformed part of the material. The walking jaws 2 and 3 then thrust with a rolling action along the already partly deformed part of the material (see FIGURE 1), pushing the material forwards by this rolling action towards the output end of the machine.

The bushes 20, 21 are laterally adjusted in position by means of threaded spindles 22, 23. As shown in FIGURE 2, one end of each of the spindles 22 and 23 is anchored in a bridge piece 24, 25 connecting together the two links of the pair of links 11, 13 respectively. Each threaded spindle 22, 23 rotates in a threaded bore in a crosspiece 26, 27 running across between two parts of the bush 20, 21.

I claim:

1. In a machine for stretch forging ductile materials of the kind having a pair of walking jaws and driving mechanism for moving the walking jaws towards each other and forwards to deform the material and advance said material through the machine, and then away from each other and backwards to release said material and return said walking jaws to their initial position, the improvement wherein said driving mechanism comprises two sets of driving means one set for each of said walking jaws, each of said two sets of driving means including first link, a first rotatable driving shaft, means pivotally connecting one end of said first link to said walking jaw; eccentric means pivotally connecting the other end of said first link to said first rotatable driving shaft, a second link and a second rotatable driving shaft, means pivotally connecting one end of said second link to said walking jaw, and eccentric means pivotally connecting said second link to said second rotatable driving shaft at a position intermediate the ends of said second link, and a third link, a third rotatable driving shaft, eccentric means pivotally connecting one end of said third link to said third rotatable driving shaft, and means pivotally connecting the other end of said third link to said second link at a position between said connection of said second link to said second rotatable driving shaft and the end of said second link remote from said walking jaw, said driving means also including means for rotating said first, second and third rotatable driving shafts at the same speed, said first and second links extending transversely with respect to the direction of travel of material through said machine and controlling the movement of said pair of walking jaws towards and away from each other, and said third links extending substantially parallel to said direction of travel of material and controlling the movement of said pair of walking jaws forwards and backwards.

2. A machine as claimed in claim 1, wherein each of said sets of driving means includes means for adjusting the position of said means connecting said third link to said second link along the length of said second link between said connection of said second link to said second rotatable driving shaft and said end of said second link remote from said walking jaw.

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