

SPECIFICATION

A welding apparatus for welding overlapping strips of thermoplastic material

5 The invention is concerned with an apparatus for the welding of overlapping strips of thermoplastic material by pressure and frictional heat, with fixed and with movable friction
10 jaws extending in the longitudinal direction of the strips, which jaws are under pressure and perform swinging motions around axes perpendicular to the strip surfaces. Such a device is known from the German patent Specification 28 02 034 and corresponding GB specification 2 012 664A. It is the task of the invention to develop an apparatus of this kind in such a way that it is possible to vary the welding area and to adapt it in its length to
20 the strip dimension and to the frictional heat to be generated, which is different for different strip materials.

This problem is solved with the invention in that only one movable friction jaw is provided
25 which holds the strip end and is swingable together with it and whose contact area on this one strip end is larger than the welded area.

An object of the invention is the provision
30 of a new and improved apparatus for the welding of overlapping strips of thermoplastic material wherein the area of contact of the jaws with the strips is greater than the ultimate welded area.

Another object of the invention is the provision of a new and improved apparatus of the type described wherein the zone of intimate fusion of the two strip ends blends gradually over into that zone where the strips lie on top
40 of each other substantially without fusion.

Another object of the invention is the provision of a new and improved apparatus of the type described wherein the area of frictional heat developed becomes smaller and smaller
45 and dwindles to zero at one end of the weld zone so that a weakening of the strip at the end of the welding zone substantially does not occur.

According to this invention there is provided a welding apparatus for welding overlapping strips of thermoplastic material by application of pressure and frictional heat, the apparatus having a fixed friction jaw adapted to hold one end of a strip to be welded and a
55 movable friction jaw which is adapted to hold one end of the other strip to be welded, the jaws defining therebetween a limited elongate welding zone and being adapted when in use to co-operate with one another to cause one
60 of the strips to move rapidly against the other in their plane under a constant pressure to effect the required frictional heat, wherein the movable friction jaw is pivotably mounted about an axis which, when the device
65 is in use, is perpendicular to the plane of the

strips to be welded, and when in use the movable friction jaw with its held strip end is pivotable about the said axis such that the contact surface of the movable friction jaw on the said held strip end is larger than the area of the said limited elongate welding zone.

This construction offers the advantage that the upper, moved strip end is not engaged as highly as in the rocking motion of two movable jaw parts which carry out unidirectional swinging movements. Since in the case of the rocking jaw part the motion toward the swivel axis becomes smaller and smaller and dwindles to zero, the frictional heat is also
80 with only one swivelling friction jaw non-uniformly distributed over the length of the welding area so that a weakening of the strip at the end of the welding zone does not occur. Since there exists only one friction jaw,
85 the upper strip end can be pushed more or less as far under the movable friction jaw as required. It is hereby possible to adapt the length of the welding area to the dimensions and the material properties of the specific strip
90 to be processed and to the tractive force to be transmitted. To this end the friction jaws can have on their surfaces facing each other elongate recesses therein adjustable in their width. The width of the recesses in the friction jaws
95 can be made adjustable by taper gibs which form a lateral edge and are fixable in the said recess in different positions. For this purpose indentations on the side walls of the recess or pins in its base can be arranged.

100 Preferably the surface of the movable friction jaw facing the fixed friction jaw is roughened, for example the said surface of the movable friction jaw may be denticulate.

At least one end of the fixed jaw may
105 extend beyond the corresponding adjacent end of the movable jaw.

By way of example a preferred embodiment of this invention will now be described with reference to the accompanying diagrammatic
110 drawings, wherein:

Figure 1 is a perspective of a welding apparatus illustrative of the invention;

Figure 2 is a front view of part of Fig. 1 and partly in section taken along line II-II of
115 Fig. 1

Figure 3 is a vertical and partial cross-section along line III-III of Fig. 1, and

Figure 4 is a view in the direction of arrow IV of Fig. 1.

120 The apparatus designated in its entirety by arrow 10 for the welding of plastic strips consists of a housing 50, here only indicated by a dash-dotted outline, which carries on its front edge a stationary friction jaw 15. Above
125 this stationary friction jaw 15 a movable friction jaw 16 is located which is pivoted at one end on a shaft journal 25 in the housing 50 so as to be swingable around a perpendicular axis. The stationary friction jaw 15 and the
130 movable friction jaw 16 extend in the longitu-

dinal direction of the plastic strips 17 and 18 to be joined (Figs. 2 to 4). The lower strip 18 in this set-up lies in a recess 19 of the stationary friction jaw 15 whose width B is variable and can be adapted to the width of the hooped strip. In analogous manner a recess 22 is located on the bottom side of the movable friction jaw 16 in which recess lies the upper strip end 17. Also this recess 22 is variable in its width. Instead of recesses in the friction jaws, the jaws can be provided with a roughening, particularly denticulation which impresses itself into the rim surface so that the upper strip end is taken along with the swivelling motion of the movable friction jaw 16.

For adjusting the width B of the recess 19 and the corresponding width of recess 22 taper gibs 51 and 52 are provided which lie against the tapered lateral surfaces 53 and 54 respectively and have on their wedge surfaces a gearing with which they mesh into a corresponding gearing on the wedge-shaped lateral surfaces 53 and 54 respectively of the recesses 19 and 22 respectively. In order to prevent the taper gibs 51 and 52 from dropping out, they can be fastened in the base of the recess by pins or screws (not shown in the drawings).

As becomes apparent, particularly from Figs. 1 and 3, the movable friction jaw 16 has a horizontal slotted hole 30 into which enters a piston rod 36 which is pivoted in the movable friction jaw 16 by means of a journal 56 and driven at its other end 57 by an eccentric 37 which is pivoted in the housing 50 in a manner not illustrated here in any detail. By means of a compression arrangement 40 (not shown here in any detail), pressure can be exerted in the direction of the arrow P upon the movable friction jaw 16.

In Fig. 2 reference numerals 17a, 17b and 17c denote the upper surface and side edges respectively of the plastic strip 17 and in Fig. 1 reference numerals 20 and 55 denote the upper surfaces of stationary friction jaw 15 bordering the recess 19.

The mode of operation of the apparatus is as follows;

In the first place, the width of the recesses 19 and 22 is adjusted to the width of the two plastic strips 17 and 18 to be joined by longitudinal shifting of the taper gibs 51 and 52. Thereafter the strips 17 and 18, one lying on top of the other, are introduced into the apparatus 10 and subjected to stress. In this arrangement the end of the upper strip 17 can either jut out beyond the front edge of the movable friction jaw 16 or it can, depending on the desired length of the welding area, end further back. In this set-up the movable friction jaw 16 lies with most of its surface on the upper strip end so that its contact surface is larger than the welded area in which the strip ends are softened on their surfaces lying

one on top of the other and a fusion of the material takes place.

After the drive is switched on, drive shaft 38 rotates in a sense as shown by curved arrow 30 and the eccentric 37 imparts a reciprocating motion to the piston rod 36. Hereby the movable friction jaw 16 is swung back and forth around its pivot 25, with pressure P being exerted at the same time upon the friction jaw 16 by means of the compression arrangement 40. In the reciprocating motion of the movable friction jaw 16, the upper strip 17 lying in the recess 22 is taken along and moved back and forth under pressure against the strip 18 lying underneath it. Frictional heat is hereby generated, decreasing over the length of the upper strip end toward the shaft journal 25, which heat melts the surfaces of the strip end facing each other and welds them together.

In this connection it has to be pointed out that the depth t of the recess 19 (and also of recess 22) is slightly smaller than the thickness of the corresponding end of the strip 17 and 18 so that with the reciprocating motion only the strip ends, not however the frictional jaws, lie on top of each other.

Since the deflection of a front edge 59 of the movable friction jaw 16 is considerably larger than at the rear edge close to the shaft journal 25, the temperature rise in the plastic strip 17 and 18 grating each other is also greater in the vicinity of the front edge 59 (i.e. the free end) of the movable friction jaw than in the vicinity of the shaft journal 25. In this manner, the zone of the intimate fusion of the two strips ends blends gradually over into that zone where the strips lie on top of each other without fusion.

The invention is not limited to the illustrated embodiment execution. Thus, for instance the friction jaws can also have a different shape and the movable friction jaw can be swivellingly driven in a different manner from that shown in the drawings. It is also possible to change the width of the recesses, for the strips to be joined, by different means to that shown in the drawings.

115 CLAIMS

1. A welding apparatus for welding overlapping strips of thermoplastic material by application of pressure and frictional heat, the apparatus having a fixed friction jaw adapted to hold one end of a strip to be welded and a movable friction jaw which is adapted to hold one end of the other strip to be welded, the jaws defining therebetween a limited elongate welding zone and being adapted when in use to co-operate with one another to cause one of the strips to move rapidly against the other in their plane under a constant pressure to effect the required frictional heat, wherein the movable friction jaw is pivotably mounted about an axis which, which when the device



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is in use, is perpendicular to the plane of the strips to be welded, and when in use the movable friction jaw with its held strip end is pivotable about the said axis such that the contact surface of the movable friction jaw on the said held strip end is larger than the area of the said limited elongate welding zone.

2. A welding apparatus according to Claim 1, wherein the surface of the movable friction jaw facing the fixed friction jaw is roughened.

3. A welding apparatus according to Claim 2, wherein the surface of the movable friction jaw is denticulate.

4. A welding apparatus according to any preceding claim, wherein in use the movable friction jaw is adapted to overlap laterally one strip end.

5. A welding apparatus according to Claim 1, wherein the facing surfaces of the friction jaws have elongate recesses therein, the width of each recess being adjustable.

6. A welding apparatus according to Claim 5, wherein the width of the recesses in the friction jaws is adjustable by the provision of taper gibs which form a lateral edge of said recess and are fixable in the said recess in different positions.

7. A welding apparatus according to any preceding claim, wherein at least one end of the fixed jaw extends beyond the corresponding adjacent end of the movable jaw.

8. A welding apparatus for welding overlapping strips of thermoplastic material by application of pressure and frictional heat substantially as herein described and with reference to Figs. 1 to 4 of the accompanying drawings.