

PATENT SPECIFICATION

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(54) EXPANDED MESH

(71) We COLMALCO (J & S) PTY. LIMITED an Australian Company incorporated in the State of Victoria, of 95 Collins Street, Melbourne, State of Victoria, Commonwealth of Australia, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of forming an expanded mesh, and to a mesh so formed, which may be used for open panel work, as for example grills, fences, and other structures.

The U.S.A. Patent 2,018,085 dated October 26th, 1935 and issued to O.M. Otte described a method of making a flat expanded grill wherein a sheet of material was first formed into corrugations extending in the direction in which the material was to be expanded, slitting the material at spaced positions with the slits extending at right angles to the corrugations, and then expanding or pulling out the slit portions of the material and at the same time flattening the corrugated parts into the plane of the original strip or sheet. By utilizing corrugated portions extending across the bars or strips, the extra length required in the expansion of the material was provided by the flattening of the corrugations. With this arrangement the length of the expanded product was substantially the same as the length of the unexpanded product.

Another specification which refers to the formation of an expanded metal without applying torsion to the expanded bars was the specification number 21,801 issued in Great Britain and dated the 20th September, 1910, having been issued to Tentschert, and in that specification there was described a method of forming a lattice work for a window frame or for other purposes by

drawing out laterally a metal plate provided with longitudinal ribs and intermediate slits, strips being left between each pair of longitudinal ribs on each of the slits, so as to form flanges lying in the plane of the plate when the latter is drawn out. The unperforated portions of the rib plate was provided with cross-ribs, and the plate was suitable for production for example by casting or coining metal. The unperforated metal was not of constant cross-section throughout its length.

The main object of the invention is to provide a method of forming an expanded mesh which will be much more suited to production techniques than either of the above proposals and therefore results in a low cost expanded mesh. A second object is to provide a method whereby expanded meshes of different configurations can be quickly and easily formed in expanding means with a minimum of set up time. A still further object of the invention is to provide a method which is particularly suitable for non-corrosive metals.

In our co-pending United Kingdom Patent Application No. 37904/73 (Serial No. 1400137) there is described a means and method for expanding a workpiece wherein the hooks of an expanding machine are carried on carriage blocks, the blocks moving towards one another when the bending takes place. This provides a simple and effective means for the limiting of inward movement toward one another of the carriage blocks which in turn assists in maintaining an even pattern in the expanded metal. Furthermore, the opening of the two outermost rows of slots facilitate positioning the workpiece on the hooks.

According to the present invention, a method of forming expanded mesh in this invention comprises:—

(a) extruding extrusile metal to form an

extrusion having a constant cross-sectional shape which includes ribs separated by webs,

(b) forming a row of slots in each web so that the slots of each row are staggered with respect to and overlap the slots of at least one adjacent row

(c) increasing the width of each slot in each of the two outermost rows of slots by bending at least one of the ribs flanking the respective slot,

(d) engaging the hooks of two rows of hooks of an expanding machine in respective widened slots of said respective outermost rows of slots,

(e) separating the rows of hooks from one another so as to bend the ribs and expand the slotted extrusion and, at the same time, moving the hooks in each row towards one another, and

(f) removing the expanded mesh from the hooks.

One great advantage of this invention is that it enables the widening of the outmost rows of slots to take place without any separate operation requiring handling of a workpiece, and further in this invention a slotting machine having a series of slotting rollers on a slotting roller shaft is also provided with a spreader finger shaft having at least one pair of spreader fingers which are radially outstanding therefrom and which are aligned with the respective outermost slotting rollers, the spreader finger shaft being driven along with the slotting roller shaft and arranged so that the spreader fingers are driven into the slots of the respective outermost rows of slots to thereby effect the increasing of slot width as the workpiece passes through the slotting machine. A slotting machine which can be readily modified for use with this invention is described in our co-pending United Kingdom Patent Application No. 32397/73 (Serial No. 1431456).

More specifically, the slots are formed by a series of axially spaced slotting rollers carried on a slotting roller shaft which is journaled in bearings in the frame of the slotting machine the machine also having a spreader finger shaft which is journaled in bearings in said frame and parallel to the slotting roller shaft and has a pair of radially outstanding spreader fingers thereon which are aligned with respective outermost slotting rollers, the method further comprising simultaneously:

(a) driving the extrusion in a longitudinal direction past the slotting rollers,

(b) rotationally driving the slotting roller shaft, and

(c) rotationally driving the spreader finger shaft to drive the spreader fingers into the slots of the respective outermost rows and thereby effect said increasing of slot width.

An embodiment of the invention is described hereunder in some detail with reference to and as illustrated in the accompanying drawings in which:

Fig. 1 is a cross-section of an extrusion having a constant cross-sectional shape,

Fig. 2 is a plan of the extrusion illustrated in Fig. 1,

Fig. 3 is a cross-section of the extrusion after having been slotted but before the outermost rows of slots are widened,

Fig. 4 is a plan of the slotted extrusion illustrated in Fig. 3,

Fig. 5 is a plan similar to Fig. 4 but illustrating the shapes of the outermost rows of slots after they have been widened,

Fig. 6 is a diagrammatic representation of a slotting machine which is provided with means for widening the outermost rows of slots,

Fig. 7 is a perspective view which illustrates the configuration of the slotting roller,

Fig. 8 is a section through a slotting machine which is provided with spreading fingers,

Fig. 9 is an enlarged elevational view of a spreading finger carrier with spreading fingers thereon,

Fig. 10 is a section taken on line 10—10 of Fig. 9,

Fig. 11 is a section taken on line 11—11 of Fig. 9,

Fig. 12 is a fragmentary view of portion of an expanding machine showing means utilised to correctly locate the hooks of a row of hooks relative to one another,

Fig. 13 is a diagrammatic plan illustrating the workpiece of Fig. 5 when engaged on the hooks of a metal expanding machine, but before expansion of the workpiece,

Fig. 14 is a fragmentary diagrammatic plan illustrating the configuration of the workpiece after expansion and the arrangement of the hooks,

Fig. 15 is a plan of portion of one expansion rail of an expanding machine and the position of the hook carriage as relative to one another after expansion has taken place, and

Fig. 16 is a section taken on line 16—16 of Fig. 15 but drawn to an enlarged scale.

Referring first to Figs. 1 to 5, Fig. 1 illustrates an extrusion 20 of ductile and extrusile metal, in this embodiment being of aluminium alloy, and being provided with a plurality of ribs 21 which are separated by webs 22. In Figs. 3, 4 and 5, the workpiece is shown as slotted with a series of slots designated 24, each web 22 containing a row of slots, and in this embodiment each row has its slots overlapping the slots of the or each adjacent row as the case may be, and being staggered with respect thereto. As shown in Figs. 4 and 5, the slots of each row of slots

have their adjacent ends close to one another being separated by only a short length of web 22 in each instance. In Fig. 5 it will be seen that the outermost rows of slots 24 have been widened by bending of the outermost rib 21 in each case.

Fig. 6 illustrates diagrammatically a slotting machine, and Fig. 8 is a section through the slotting head thereof. Fig. 7 illustrates the slotted roller arrangement. In Fig. 6 it will be seen that a driving chain 27 is provided with a plurality of outstanding dogs 28 which are arranged to drive a workpiece extrusion 20 in a longitudinal direction past a series of slotting rollers 29. As shown more particularly in Fig. 7, each slotting roller 29 is provided with a pair of diametrically opposite recesses 30 having between them radially outstanding and circumferentially extending projections 31 which, as shown in Fig. 8, effect the formation of slots in the workpiece. The slotting rollers 29 are separated from one another by circular packers 33 (Fig. 7), and are joined thereto by bolts 34 extending through bolts holes 35. The rollers are keyed to a slotting roller shaft 36 (Fig. 8). The circular packers 33 are contained within retaining plates 38 which are illustrated only in Fig. 7, but which are effective in preventing the workpiece 20 from distorting as the slotting takes place. As illustrated in Fig. 8, a spreader head 40 is secured to the frame of the slotting machine, being spaced on the outside of the slotted rollers 29. The spreader head 40 carries on it a pair of bearings (not shown) but which are adjustable by means of a screw jack 41 to adjust the height of the bearings, and the bearings journal a spreader finger shaft 42. In a similar way, the height adjustment of the slotting roller shaft 36 is effected by a second screw jack 43 in the slotting roller head 44. Thus the relative heights of the shafts 36 and 42 can be adjusted, enabling the required adjustment to take place in the event that the ribs 21 are higher or lower in one workpiece than in another. A driving chain 46 extends between the shafts 36 and 42 so that the slotting roller shaft 36 and the spreader finger shaft 42 rotate at identical speeds. Provision is made however for the varying of the distances between the shafts, so that the spreader head can be adjusted to have its spreader fingers 47 exactly synchronized with the slotting rollers so as to enter the slots formed in a workpiece.

Figs. 9, 10 and 11 illustrate the features of a spreader head having two diametrically opposite spreader fingers 47. The number of spreader fingers should be identical with the number of radially outstanding projections 31 when the shafts 36 and 42 are driven at the same speed. However, the number may be

varied, and in order to accommodate variation of numbers, the spreader fingers 47 are secured with bolts 50 the heads of which engage in an annular 'T' slot 51 which extends around a face of a spreader finger carrier 52 which is keyed to the spreader finger shaft 42 as shown in Fig. 8. However the spreader finger carrier 52 is slidable on the shaft 42, but is provided with screw threaded members 53 enabling it to be secured in any position which is required for the spreader fingers 47 to be aligned with the respective outermost row of slots 24 in the workpiece.

Since there are two outermost rows of slots, there are two spreader heads opposite on another, and the spreader fingers 47 are axially aligned with one another when the slots of the outermost rows are in line with one another, this being the most usual configuration.

As shown in Fig. 10, each spreader finger is of general rectangular shape but is provided with sloping surfaces 55 which enable the finger to enter the slots 24 of the respective outermost rows.

After the workpiece has been slotted and after the outermost rows of slots have been widened, the workpiece is driven by the dogs 28 of the chain 27 onto the discharge side support roll case 56.

Figs. 12, 13, 14, 15 and 16 illustrate some details of a metal expanding machine which is described in greater detail in our co-pending United Kingdom Patent Application No. 37904/73 (Serial No. 1400137). The machine is provided with side rails 60 which are movable apart from one another by means best illustrated in our co-pending Application aforesaid, each side rail 60 carrying on it a track 61 which is engaged by rollers 62 on carriage blocks 63. Each carriage block 63 has secured to it a workpiece engaging hook 65 which is best illustrated in Fig. 16, and the carriage blocks are interconnected by a flexible line 66 which, when taut, approximately positions the hooks 65 in relative relationship such that they are engageable in the widened slots 24 of a workpiece. However it is important that the hooks engage the widened slots accurately and are centrally located therein, and to ensure this accuracy use is made of a swinging gauge member 67 having hook engaging cut-outs 68 therein which engage over the hooks as the member 67 is swung downwardly and accurately locate the hooks. When the hooks have been so located, the workpiece is placed on them, whereupon the swinging gauge member 67 is removed. The detailed construction of this mechanism is described in the said United Kingdom Patent application 37904/73.

After the gauge member has been swung out of the way, the side rails 60 are moved

away from one another (if desired one of the two may be fixed) and the workpiece is expanded by bending of the metal strips between adjacent slots, as illustrated in Figs. 14 and 15. In this expansion, a minimum of stretching takes place and the carriage blocks 63 move toward one another until they finally abut one another. This ensures that the module remains unaltered for the whole of the length of the workpiece, and if desired a slight degree of stretching can be imparted to remove any irregularities after the carriage blocks 63 have abutted one another.

This invention results in a new product, namely a mesh wherein the ribs have substantially identical cross-section for the whole of their lengths, wherein there has been little or no strain imparted into the ribs, and wherein there are no cross ribs at the junctions of the ribs. The invention then makes possible products of a wide range of shape which can be aesthetically pleasing, since the cross-sectional shape of the ribs themselves can be varied.

The method makes it possible to form a workpiece with only three operator handling stations; one at the extrusion stage (Fig. 1) one at the slotting and widening stage (Fig. 5) and one at the final expansion stage (Fig. 14). It will therefore be seen that the product can be of very low cost, and that the method is inherently so versatile that the low cost can be maintained even when production runs are short.

WHAT WE CLAIM IS:—

1. A method of forming expanded mesh, comprising:

(a) extruding extrusile material to form an extrusion having a constant cross-sectional shape which includes ribs separated by webs,

(b) forming a row of slots in each web so that the slots of each row are staggered with respect to and overlap the slots of at least one adjacent row,

(c) increasing the width of each slot in each of the two outermost rows of slots by bending at least one of the ribs flanking the respective slot,

(d) engaging the hooks of two rows of hooks of an expanding machine in respective widened slots of said respective outermost rows of slots,

(e) separating the rows of hooks from one another so as to bend the ribs and expand the slotted extrusion and, at the same time, moving the hooks in each row towards one another, and

(f) removing the expanded mesh from the hooks.

2. A method according to claim 1 wherein said slots are formed by a series of axially spaced slotting rollers carried on and keyed to a slotting roller shaft which is

journalled in bearings in the frame of a slotting machine, said machine also having a spreader finger shaft journalled in bearings in said frame and being parallel to the slotting roller shaft, and having a pair of radially outstanding spreader fingers thereon, the method further comprising simultaneously:

(a) driving said extrusion in a longitudinal direction past the slotting rollers,

(b) rotationally driving the slotting roller shaft, and

(c) rotationally driving the spreader finger shaft to drive the spreader fingers into the slots of the respective outermost rows of slots and thereby effect said increasing of the slot width.

3. A method according to claim 2 further comprising adjusting the spreader fingers on the spreader finger shaft to align them with the respective outermost of said slotting rollers on the slotting roller shaft.

4. A method according to any one of claims 1 to 3 wherein said expanding machine comprises a pair of side rails each having a track extending along it, and the hooks of each said row of hooks are each carried on a carriage block having rollers thereon which engage and are supported by said track, the carriage blocks of each row being interconnected by a flexible line, the method further comprising drawing the lines taut to thereby separate the carriage blocks from one another before engaging the hooks in said respective widened slots.

5. A method according to Claim 4 wherein each said side rail has a swinging gauge member hinged thereto, the gauge member having cut-outs therein, the method further comprising swinging the gauge member so as to position the cut-outs over the hooks when the lines are taut to thereby accurately locate the hooks in a spaced relationship and retaining the hooks in that spaced relationship while engaging the hooks in respective widened slots.

6. A method according to either claim 4 or claim 5 wherein separating of the rows of hooks away from one another is continued at least until said carriage blocks abut one another.

7. An expanded mesh produced by the method of any preceding claim being of extrusile metal and comprising a plurality of continuously extending ribs each having a constant cross-sectional shape and each joined to an adjacent rib by a short length of web, the ribs being in a state of having been bent.

8. A method of forming expanded mesh, substantially according to the embodiment described in the specification with reference to and as illustrated in the accompanying drawings.

9. Expanded mesh when produced



away from one another (if desired one of the two may be fixed) and the workpiece is expanded by bending of the metal strips between adjacent slots, as illustrated in Figs.

5 14 and 15. In this expansion, a minimum of stretching takes place and the carriage blocks 63 move toward one another until they finally abut one another. This ensures that the module remains unaltered for the
10 whole of the length of the workpiece, and if desired a slight degree of stretching can be imparted to remove any irregularities after the carriage blocks 63 have abutted one another.

15 This invention results in a new product, namely a mesh wherein the ribs have substantially identical cross-section for the whole of their lengths, wherein there has been little or no strain imparted into the
20 ribs, and wherein there are no cross ribs at the junctions of the ribs. The invention then makes possible products of a wide range of shape which can be aesthetically pleasing, since the cross-sectional shape of the ribs themselves can be varied.

25 The method makes it possible to form a workpiece with only three operator handling stations, one at the extrusion stage (Fig. 1) one at the slotting and widening stage (Fig. 5) and one at the final expansion stage (Fig. 14). It will therefore be seen that the product can be of very low cost, and that the method is inherently so versatile that the
30 low cost can be maintained even when production runs are short.

WHAT WE CLAIM IS:—

1. A method of forming expanded mesh, comprising:

40 (a) extruding extrusile material to form an extrusion having a constant cross-sectional shape which includes ribs separated by webs,

45 (b) forming a row of slots in each web so that the slots of each row are staggered with respect to and overlap the slots of at least one adjacent row,

50 (c) increasing the width of each slot in each of the two outermost rows of slots by bending at least one of the ribs flanking the respective slot,

55 (d) engaging the hooks of two rows of hooks of an expanding machine in respective widened slots of said respective outermost rows of slots,

(e) separating the rows of hooks from one another so as to bend the ribs and expand the slotted extrusion and, at the same time, moving the hooks in each row towards one another, and

60 (f) removing the expanded mesh from the hooks.

2. A method according to claim 1 wherein said slots are formed by a series of axially spaced slotting rollers carried on and
65 keyed to a slotting roller shaft which is

journalled in bearings in the frame of a slotting machine, said machine also having a spreader finger shaft journalled in bearings in said frame and being parallel to the slotting roller shaft, and having a pair of radially outstanding spreader fingers thereon, the method further comprising simultaneously:

(a) driving said extrusion in a longitudinal direction past the slotting rollers, 75

(b) rotationally driving the slotting roller shaft, and

(c) rotationally driving the spreader finger shaft to drive the spreader fingers into the slots of the respective outermost rows of slots and thereby effect said increasing of the slot width. 80

3. A method according to claim 2 further comprising adjusting the spreader fingers on the spreader finger shaft to align them with the respective outermost of said slotting rollers on the slotting roller shaft. 85

4. A method according to any one of claims 1 to 3 wherein said expanding machine comprises a pair of side rails each having a track extending along it, and the hooks of each said row of hooks are each carried on a carriage block having rollers thereon which engage and are supported by said track, the carriage blocks of each row being interconnected by a flexible line, the method further comprising drawing the lines taut to thereby separate the carriage blocks from one another before engaging the hooks in said respective widened slots. 90 95 100

5. A method according to Claim 4 wherein each said side rail has a swinging gauge member hinged thereto, the gauge member having cut-outs therein, the method further comprising swinging the gauge member so as to position the cut-outs over the hooks when the lines are taut to thereby accurately locate the hooks in a spaced relationship and retaining the hooks in that spaced relationship while engaging the hooks in respective widened slots. 105 110

6. A method according to either claim 4 or claim 5 wherein separating of the rows of hooks away from one another is continued at least until said carriage blocks abut one another. 115

7. An expanded mesh produced by the method of any preceding claim being of extrusile metal and comprising a plurality of continuously extending ribs each having a constant cross-sectional shape and each joined to an adjacent rib by a short length of web, the ribs being in a state of having been bent. 120

8. A method of forming expanded mesh, substantially according to the embodiment described in the specification with reference to and as illustrated in the accompanying drawings. 125

9. Expanded mesh when produced 130



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substantially according to the embodiment described in the specification with reference to and as illustrated in the accompanying drawings.

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