SPECIFICATION

Forged cutting fingers for reapers or mowers

The present invention relates to a forged cutting or mowing finger for a mower or reaping machine, with at least one finger body, wherein each finger body includes a portion with an upper cutting surface, which carries the cutting blades of the reaping machine, which are reciprocally movable transversely of the cutting finger, wherein lateral faces defining cutting edges with the upper cutting surface extend along such cutting surface. For simplicity, the fingers referred to below are defined as "mowing fingers", as a generic term for finger-like elements which perform cutting, mowing, reaping or like operations in conjunction with reciprocable cutting blades, whilst the machinery and its function are described in relation to "reaping", as a generic term for mowing, reaping and other forms of cutting.

Known mowing fingers of this type are shown in US Patent Specification 3 978 645. In this, the cutting angle of the lateral face of the cutting surface and the cutting angle of a lateral face of a small arm portion opposite the cutting surface both amount to 90°. However, a cutting angle of 90° does not provide optimum cutting relationships between the lateral faces and the blades.

The known lateral faces can also be serrated. The serrations are produced in operations, following the forging of finger blanks, by material-removing machining methods such as e.g. milling or broaching, at right-angles to the cutting surface, at relatively high cost.

The invention is directed to the cutting characteristics of the mowing finger at reduced manufacturing costs.

According to the invention, there is provided a method of making a mowing finger comprising forging a mowing finger body and simultaneously forming on the finger body, by forging, at least one lateral face and serrations in the or each lateral face, and subsequently forming on the finger body, by machining, a cutting surface, so that the or each lateral face is inclined to it at a cutting angle smaller than 90° and defines with it a cutting edge.

The size of the cutting angle can be selected to best suit the particular operating conditions and amounts, especially for normal operating conditions, to approximately 70°.

Advantageously, the mowing finger is formed with two opposed lateral faces defining respective cutting edges which converge to a blunted point. For further improvement of the cutting characteristics, the serrations are desirably formed inclined to the cutting surface and parallel to the respective lateral face.

According to another preferred embodiment of the mowing finger of the invention, each cutting surface is formed with a depression, between its cutting edges. In most cases, the cutting edges and the lateral faces, as well as the sides of the cutting surfaces, are hardened after the forging step. Particularly in the case of inductive hardening, i.e. when an electric induction technique is used, the depression helps to prevent or at least greatly reduce distortion of the cutting surface. Moreover, the depression creates better cutting characteristics by improved support of the blades of the reaping mechanism. In use, the cutting edges of mowing fingers naturally wear more than the central regions of the cutting surfaces. This leads to a degree of crowning or cambering of the cutting surface, so that increasing and undesirable gaps are formed between the cutting edges of the cutting surfaces and the blades of the reaper. By the provision of a depression, formation of this gap is countered. Also, the presence of the depression reduces friction between the reaper blades and the cutting surfaces.

Satisfactory cutting or reaping characteristics are given if the depression is about 0.5 to 1.0 mm in depth. The depression desirably extends to at least 3mm from the cutting edges. Also, the depression can be surrounded on all sides by a peripheral region of the cutting surface which is at least 3mm in width.

In a finger body or element incorporating a small arm portion whose upper surface lies in a plane with the cutting surface, a lateral face of the small arm portion, facing the cutting surface and defining a cutting edge with its upper surface, includes with the upper cutting surface a cutting angle less than 90°, e.g. approximately 70°. Optimum cutting characteristics for the particular circumstances are thus also obtained at the small arm portion.

The lateral faces of the small arm portion can include serrations inclined at the cutting angle. Cutting is improved by these serrations.

Mowing fingers made according to the method of this invention need not be constructed only as single units, as previously described, and any mowing finger made according to the invention can alternatively take the form of a double unit, having two finger bodies joined by one or more bridge members in catamaran fashion.

The simultaneous forging of the mowing finger body, lateral face(s) and serrations and, if required, the depression, gives a considerable saving in time in all cases, since additional steps are eliminated, except for the machining of the cutting surface. This holds particularly for the provision of the serrations inclined at the cutting angle. Such inclined serrations can otherwise be made only on complicated machine tools and in several operations. Furthermore, the forged serrations of

the invention are of higher strength than those made by the removal of material, since in forging the material fibres or grain structure in the region of the serrations are not severed, but are compacted and strengthened.

In order that the invention may be more fully understood, preferred forms of mowing figers for reaping machines made in accordance to the invention are described below, by way of illustration only, in conjunction with the accompanying drawings, in which:

Figure 1 shows an underneath plan view of one form of mowing finger;

Figure 2 shows a cross section of the mowing finger of Fig. 1 taken on the line II–II;

Figure 3 shows a side view of the mowing finger of Figs. 1 and 2;

Figure 4 shows a top plan view of the mowing finger of Figs. 1 to 3;

Figure 5 shows a top plan view of a form of double mowing finger;

Figure 6 shows a side view of the double mowing finger of Fig. 5;

Figure 7 shows a front end view of the double mowing finger of Figs. 5 and 6;

Figure 8 shows a cross section of the double mowing finger of Figs. 5 to 7, taken on the line VIII–VIII shown in Fig. 5.

Figs. 1 to 4 of the drawing show a forwardly elongate forged mowing finger of guard 10, in the form of a so-called "mulching" finger or stub guard for a reaping machine. The remainder of the machine in which one or a number of such mowing fingers are incorporated is not shown, because it is not essential for an understanding of the invention. If required, reference may be made to the aforementioned US Patent Specification 3 978 645.

In reaping machines of the type in which "mulching" or mowing fingers of the type shown in Figs. 1 to 4 are incorporated, cutter blades are provided, which extend transversely of the direction of elongation of the mowing finger 10 and which are movable (e.g. reciprocable) in such transverse direction. Such cutter blades are also shown in the aforementioned Patent Specification.

The mowing finger 10 comprises a finger body 11 provided with an elongate portion 13 and formed with lateral faces 17 and 18 which converge to form a blunted point 15 of the finger 10. These lateral faces 17, 18 form, with a horizontal cutting surface 19, best shown in Fig. 3, cutting edges 21, 22. The cutting surface 19 may be provided by milling or equivalent operations, after forging of the finger body 11, lateral faces 17, 18 and respective serrations 24, 25. As shown in Fig. 2, the lateral faces 17, 18 define or include, with the horizontal cutting surface 19, a cutting angle 40 which is smaller than 90°. The serrations 24, 25 consist of zig-zag surfaces which desirably are all located at or about the cutting angle 40 in relation to the surface 19.

The finger body 11 is provided with lateral projections 27, 28 which form the respective ends of a transverse bar-shaped or arm-like portion 30, as shown in Fig. 4. An upper surface 31 of the transverse bar or arm-like portion 30, shown in Fig. 3, is coplanar with the cutting surface 19. The respective forward edge faces 33 and 34 of the respective lateral projections 27, 28 define with the surface 31 further cutting edges 36 and 37, which progressively merge with and into the respective cutting edges 21 and 22. The edge faces 33 and 34 include a cutting angle 47 with the upper surface 31 which is also smaller than 90°.

The cutting surface 19 is provided with a depression 43. As Fig. 4 shows most clearly, the depression 43 is formed within and surrounded by a marginal portion 45 of the surface 19.

In making a mowing finger, in accordance with the method of the invention and as shown in Figs. 1 to 4, the lateral faces 17 and 18, the forward edge faces 33 and 34, the serrations 24 and 25 and the depression 43 are all produced in a single operation, namely as part of the forging operation employed in making the finger body 11.

Some of the serrations 24, 25 of the mowing finger could be omitted. However, the presence of such serrations is advantageous, because it increases the cutting effectiveness. By having the serrations 24, 25 inclined to the upper horizontal cutting surface 19, which co-operates with the reciprocable blades (not shown), at the same cutting angle as the respective edge faces, i.e. 17, 18 and 33, 34, the cutting effectiveness is further improved.

The cutting edges 21 and 22, the forward edge faces 33 and 34 and the lateral faces 17 and 18, together with the marginal portion 45 of the surface 19 surrounding the depression 43, are usually hardened after the forging step. This hardening can be carried out in various ways, but one suitable way involves inductive heating of the mowing finger 10. The depression 43 is desirably provided, particularly in the case where inductive hardening is used, because it prevents or at least substantially counteracts any tendency to distortion of the forging, which might otherwise cause twisting of the cutting surface 19. Moreover, by providing the depression 43, better contact is made between the cutter blades and the surface 19, which thus further improves the cutting characteristics. The main reason for this is that the cutting edges 21 and 22 of the mowing finger 10 tend, in operation, to wear more readily than the centre portion of the surface 19, particularly if the latter were continuous and extended without interruption from one cutting edge 21 to the other cutting edge 22. If this extra wear

occurs, the result is that, without the surface 19 being provided with the recess 43, the centre portion soon projects above the marginal portions, as the material at the margins wears away. This wear would then result in crowning or cambering of the surface 19 and the consequent formation of a gap between the marginal portions (and hence the cutting edges) of the finger 10 and the coacting surfaces of the cutter blades, thus conducing to a reduction in the cutting effectiveness. By providing the depression 43, this problem is eliminated or is at least substantially reduced and, in addition, a reduction in contact friction between cutting surface 19 and the coacting surfaces of the cutter blades is obtained.

It has been found particularly advantageous if the depression 43, in a mowing finger of customary size and shape, has a depth of approximately 0.5 to 1.0 mm. The sides of the depression 43 may extend to within as little as 3 mm. of the cutting edges of the finger and, if the depression 43 is thus formed within and is peripherally surrounded by the marginal zone 45, as shown in Fig. 4, the width of the zone 45 is advantageously 3 mm. or greater, therefore.

As the lateral faces 33 and 34 of the arm portion 30 inlcude with the upper surface 31 a cutting angle 47 which is smaller than 90°, optimum cutting effectiveness is also obtained for this portion 30. The faces 33 and 34 may themselves be provided with serrations, if so desired, in order to further improve the cutting effectiveness. These serrations should desirably also be inclined to the upper surface 31 at a cutting angle which is less than 90°, for best results.

A further embodiment of the invention is illustrated in Figs. 5 to 8, namely in the form of a sickle guard or mowing finger 50 for a reaping machine, which is formed as a double mowing finger. The double finger 50 has two finger bodies 52 and 53, which are connected at their rearward ends by a bridge piece 55 and forwardly by an intermediate bridge 57, in the form of a transverse arm 58, so as to form a unit. The arm 58 extends fully across the two finger bodies 52 and 53 and is provided with respective lateral projections 60 and 61 and an upper surface 63. Each of the finger bodies 52 and 53 is provided with an upper horizontal cutting surface 65 and 66, produced by milling, for instance, and these cutting surfaces 65 and 66 are coplanar with the upper surface 63 of the arm 58, as best shown in Figs. 6 and 7.

The arm 58 is provided with a forward edge face 68. Fig. 6 shows that the edge face 68 includes with the upper surface 63 a cutting edge 69, and is disposed at a cutting angle 70 which is smaller than 90°.

Lateral faces 72 and 73 are provided on the finger body 52 and lateral faces 74 and 75 on the finger body 53 and each includes, with the respective cutting surfaces 65, 66 of these finger bodies, a cutting angle 77 which is smaller than 90°. The lateral faces 72 to 75 define with the respective cutting surfaces 65, 66 a series of cutting edges 81 to 84 (Fig. 5). The cutting edge 81 is on the outer side of the finger body 52 and is straight whereas the cutting edges 82 to 84 are provided with serrations, as shown at 86, 87 and 88 in Figs. 5 and 7. The cutting edges 81 to 84 can be any combination of straight and serrated edges, as long as at least one lateral face of each finger body is serrated. The serrations are of course formed on the respective lateral faces 72 to 75 or on any combinations of these faces 72 to 75. The cutting surface 65 of the finger body 52 is provided with a depression 90 (Figs. 5 and 8) which is circumferentially surrounded by a marginal zone 91 of the cutting surface 65. A similar depression may be provided in the cutting surface 66, if desired.

Each of the finger bodies 52, 53 is provided with a lip 93 and 94, respectively, extending rearwardly over the cutting surfaces 65, 66. Slots 95 (see Fig. 6) remain between the lips 93 and 94 and the cutting surfaces 65, 66, respectively, to receive the cutter blades (not shown) of the reaping machine.

The depression 90 can be formed in one operation, namely during the forging of the fingers 52, 53, if the lip 93 is later welded to the body 52 or is otherwise secured to the finger body 52. The cutting surface 66 may, as already pointed out, also be provided with a depression 90.

The lateral faces 72 to 75 are formed during forging of the finger bodies 52, 53, i.e., in one and the same forging operation which produces the finger bodies. The same holds for the serrations 86 to 88 on the lateral faces 73 to 75, or on all lateral faces, if preferred.

The portion of the cutting edge 69 at the lateral projection 61 of the arm 58 is serrated, due to the presence of a serration 97 at the lateral edge face 68 of the projection 61, as shown in Figs. 5 and 7. A serration corresponding to the serration 97 may also be provided on the bridge piece 57, i.e. between the finger bodies, and on the other lateral projection 70 of the arm 58. The edge face 68 and the serration 97 are also formed in one operation during the forging of the finger bodies 52, 53.

The method of manufacture according to the present invention will readily be understood from the previous description. In this method, the respective lateral faces or edge faces and any serrations thereon, as well as any depressions in the cutting surfaces, are all produced by forging in one operation, namely during the forging which produces the respective finger bodies. This results in a substantial saving of time and labour, because additional

manufacturing steps are eliminated. This is particularly true of the formation of the serrations, which are advantageously inclined at the respective cutting angle and which otherwise could be produced only on complicated machine tools involving a plurality of operative steps. Moreover, by producing the serrations during the forging of the respective finger bodies, their strength is greater than if they were produced by material-removing techniques, due to the fact that during the forging the grain flow or fibrous structure of the material in the vicinity of the serrations is not cut or disrupted, but instead is compacted and thus strengthened.

CLAIMS

1. A method of making a mowing finger, as hereinbefore defined, comprising forging a mowing finger body and simultaneously forming on the finger body, by forging, at least one lateral face and serrations in the or each lateral face, and subsequently forming on the finger body, by machining, a cutting surface, so that the or each lateral face is inclined to it at a cutting angle smaller than 90° and defines with it a cutting edge.

2. A method according to claim 1, wherein the serrations are formed inclined to the cutting surface and parallel to the respective lateral face.

3. A method according to claim 1 or 2, wherein a depression is formed in the finger body, by forging, simultaneously with the forging of the finger body so that the depression will be present in the subsequently machined cutting surface.

4. A method according to claim 1, substantially as herein described.

5. A mowing finger when made by a method according to any of claims 1 to 4.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1982.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.

manufacturing steps are eliminated. This is particularly true of the formation of the serrations, which are advantageously inclined at the respective cutting angle and which otherwise could be produced only on complicated machine tools involving a plurality of operative steps. Moreover, by producing the serrations during the forging of the respective finger bodies, their strength is greater than if they were produced by material-removing techniques, due to the fact that during the forging the grain flow or fibrous structure of the material in the vicinity of the serrations is not cut or disrupted, but instead is compacted and thus strengthened.

CLAIMS

1. A method of making a mowing finger, as hereinbefore defined, comprising forging a mowing finger body and simultaneously forming on the finger body, by forging, at least one lateral face and serrations in the or each lateral face, and subsequently forming on the finger body, by machining, a cutting surface, so that the or each lateral face is inclined to it at a cutting angle smaller than 90° and defines with it a cutting edge.

2. A method according to claim 1, wherein the serrations are formed inclined to the cutting surface and parallel to the respective lateral face.

3. A method according to claim 1 or 2, wherein a depression is formed in the finger body, by forging, simultaneously with the forging of the finger body so that the depression will be present in the subsequently machined cutting surface.

4. A method according to claim 1, substantially as herein described.

5. A mowing finger when made by a method according to any of claims 1 to 4.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1982.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.