May 5, 1936. F. BISHOP 2,039,771

METHOD OF FORMING RAKES, FORKS AND THE LIKE

Filed Aug. 1, 1934 3 Sheets-Sheet 1

FIG. 1.

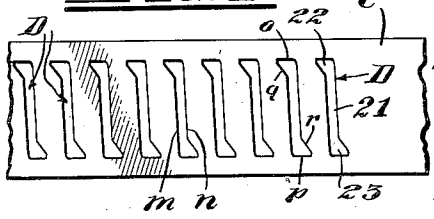


FIG. 2.

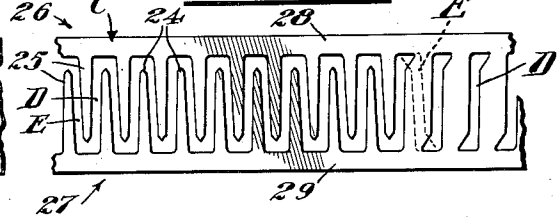


FIG. 3.

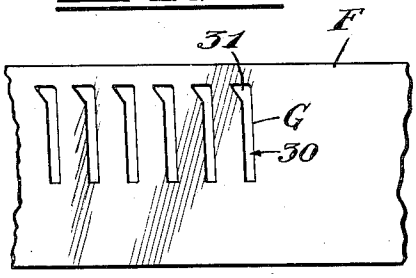


FIG. 4.

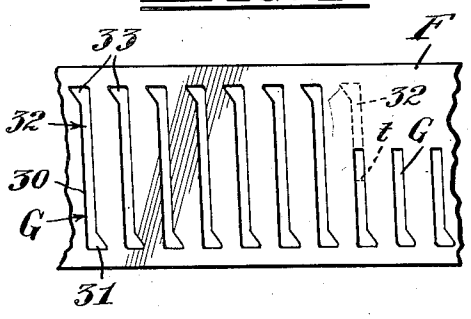


FIG. 5.

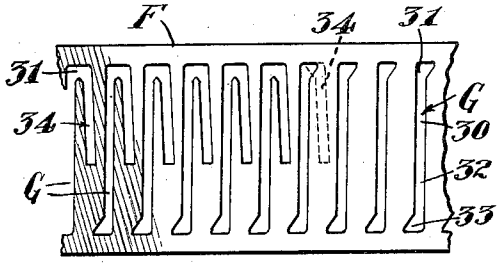


FIG. 6.

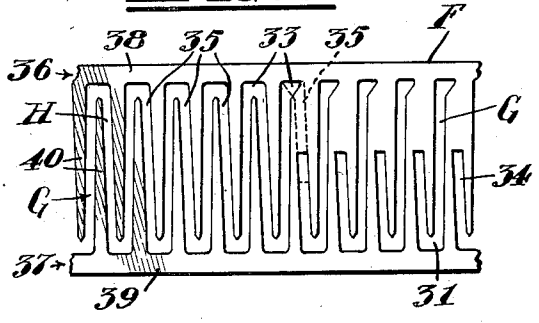


FIG. 7.

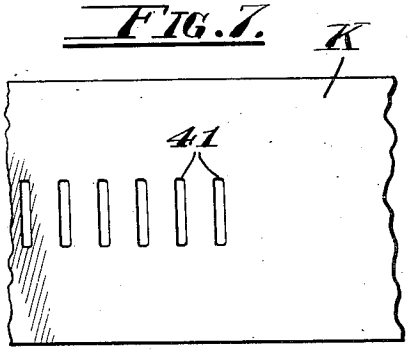
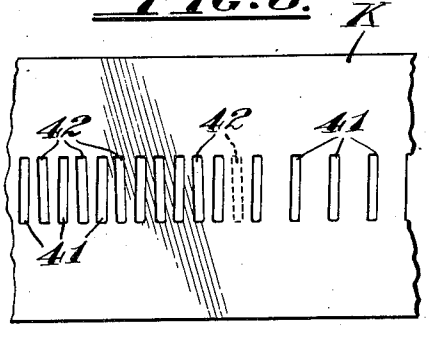


FIG. 8.



Inventor.
Frank Bishop
By R. S. Burns
Att'y.

May 5, 1936. F. BISHOP 2,039,771

METHOD OF FORMING RAKES, FORKS AND THE LIKE

Filed Aug. 1, 1934 3 Sheets-Sheet 2

FIG. 9.

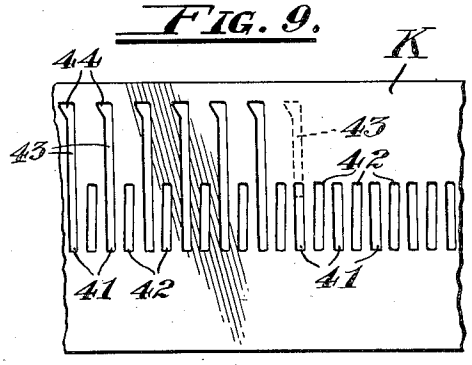


FIG. 10.

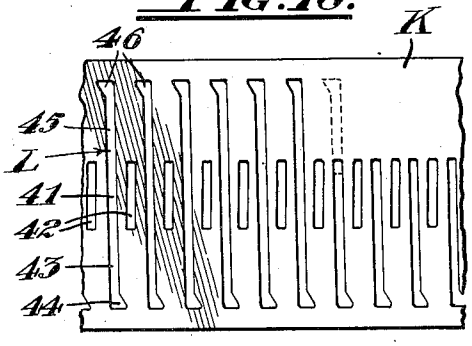


FIG. 11.

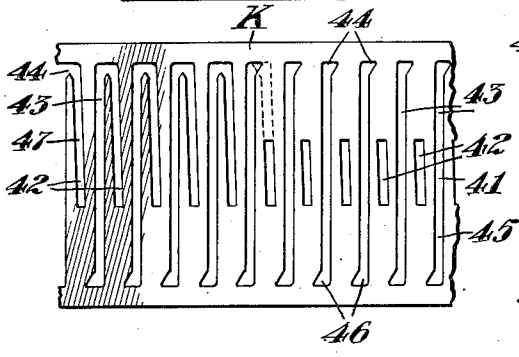


FIG. 12.

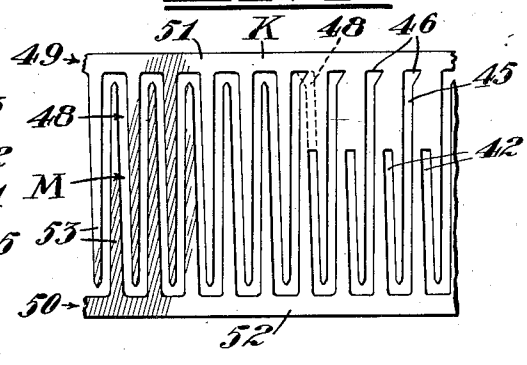


FIG. 13.

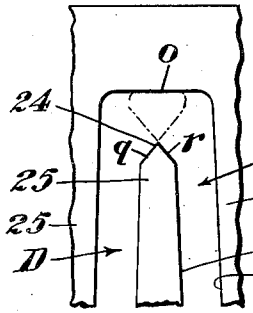


FIG. 14.

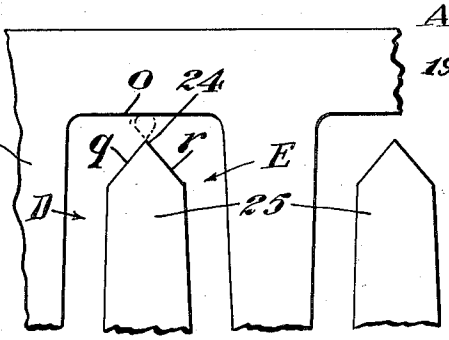


FIG. 15.

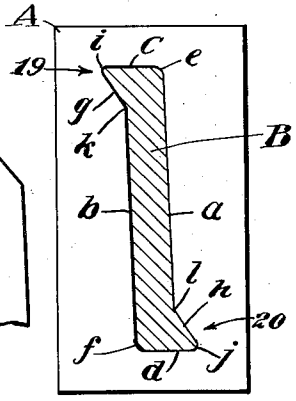


FIG. 16.

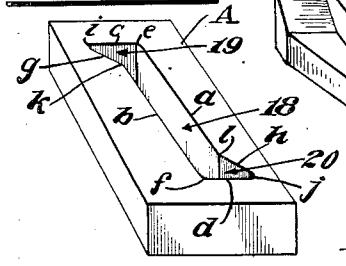
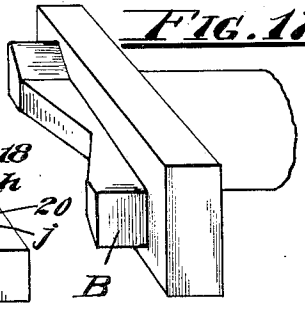


FIG. 17.



Inventor.
Frank Bishop.
By
R. S. Burns
Atty.

May 5, 1936. F. BISHOP 2,039,771

METHOD OF FORMING RAKES, FORKS AND THE LIKE

Filed Aug. 1, 1934 3 Sheets-Sheet 3

FIG. 18.

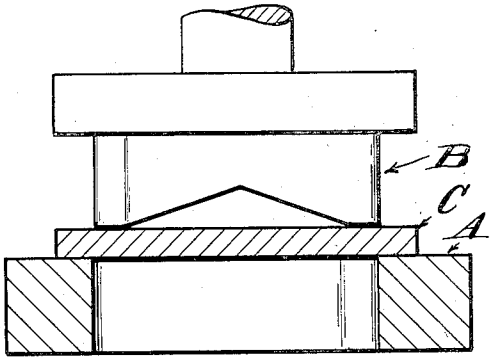


FIG. 19.

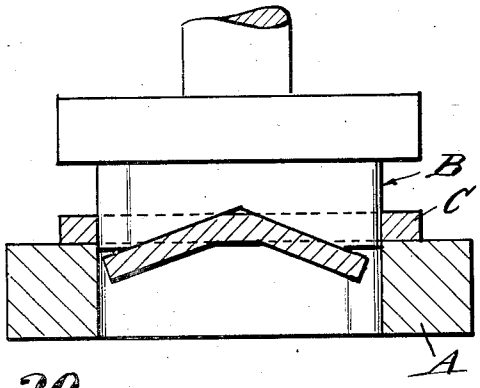


FIG. 20.

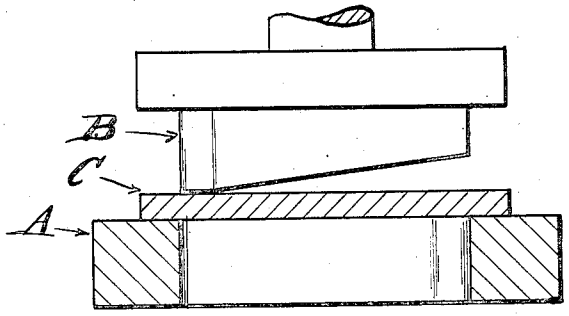
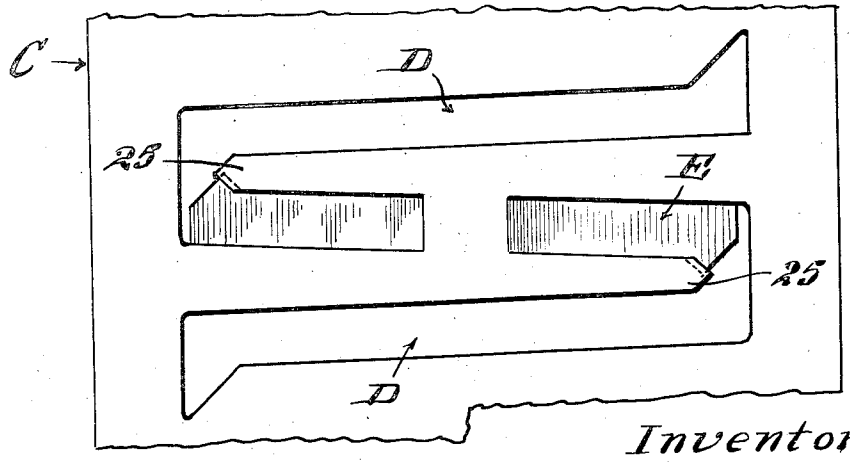


FIG. 21.



Inventor:
Frank Bishop.
By R. S. Berry,
Atty.

Patented May 5, 1936 2,039,771

UNITED STATES PATENT OFFICE

2,039,771

METHOD OF FORMING RAKES, FORKS, AND THE LIKE

Frank Bishop, Los Angeles, Calif.

Application August 1, 1934, Serial No. 737,913

10 Claims. (Cl. 76—111)

This invention relates to a method of forming rakes, forks, and similar tined implements, such as garden rakes, spading forks, coal forks, potato hooks, and cultivators, and has as its primary object the provision of a method whereby a pair of toothed strips may be formed from a single strip of sheet metal by forming the teeth of one strip from the metal extending between the teeth of the other strip in a manner similar to that set forth in United States Letters Patent, Number 1,995,466, issued to me March 26, 1935; and also illustrated in the patent to Sims, Number 199,111, issued Jan. 8, 1878; the particular object of the present invention being to provide a mode of forming such toothed strips whereby teeth or tines of various widths and lengths may be formed with a single punch and die mechanism.

Another object is to provide a method of the above character whereby rakes, forks, and the like may be formed by a punch and die operation in such manner that a small press may be utilized in punching the teeth or tines in stages of successive operations, so that the rake or fork may be formed of sheet metal and of larger dimensions than can now ordinarily be constructed with the aid of small punching machinery.

Heretofore it has been the practice in forming a pair of toothed strips from a single strip as above stated, by punching a pair of spaced diagonally extending slots projecting in the general direction of the width of a strip of sheet metal, then punching a diagonal slot connecting the ends of the previously punched pair of slots to form a pair of oppositely extending teeth disposed side by side. The punching operation is effected by a punch and die of a length adapted to form the entire length of a tooth or tine and in which operation the press must necessarily punch at least two slots at one operation thereby requiring a press of considerable power to force the pair of punches through a thickness of metal in a single operation.

In the known method just referred to a strip of metal is fed intermittently or step by step through a punching machine adapted to divide the strip into two toothed strips after performing a series of punching operations thereon.

The present invention contemplates initially forming a strip of metal throughout its length with a series of spaced slots then thereafter forming the strip throughout its length with another series of slots connecting the ends of the initially formed slots thereby dividing the strip into a pair of corresponding toothed strips. The slots are formed by a punch and die mechanism preferably by punching one slot at a time with a single punch and die, however in some instances two or more spaced slots may be punched in a single operation by a plurality of dies where a press of sufficient caliber or power is available although the invention is particularly designed to enable formation of the pair of toothed strips by employing a single punch and die with a series of operations with the aid of a small press. The invention and the manner of carrying it into effect in various fashions is illustrated in the accompanying drawings in which:

Fig. 1 is a plan view of a strip of metal as initially formed with a series of spaced transversely extending complementary slots:

Fig. 2 is a view of the strip shown in Fig. 1 as turned over and repunched with slots connecting the ends of the previously formed slots to separate the strip into a pair of toothed lengths:

Fig. 3 is a plan view showing the manner of forming the strip with spaced slots in which only a portion of the length of the slots initially formed are punched in the first punching operation:

Fig. 4 is a view of the strip shown in Fig. 3 illustrating the manner of completing the initially formed slots by a second punching operation:

Fig. 5 is a view of the strip shown in Figs. 3 and 4 depicting the manner of forming a portion of the slots of the second series of slots:

Fig. 6 is a view of the strip shown in Figs. 3, 4, and 5 showing the manner of completing the second series of slots in dividing the strip into a pair of toothed strips:

Fig. 7 is a view of the strip showing it as punched to form the central portions of the initially formed slots:

Fig. 8 is a view of the strip shown in Fig. 7 showing it as punched to form the central portions of the second series of slots:

Fig. 9 is a view of the strip shown in Figs. 7 and 8 depicting the manner of forming one end portion of the initial series of slots:

Fig. 10 is a view of the strip shown in Fig. 9 showing the manner of forming the other end portion of the initial series of slots:

Fig. 11 is a view of the strip shown in Fig. 10 illustrating the manner of forming one end portion of the second series of slots:

Fig. 12 is a view of the strip shown in Fig. 11 depicting the manner of forming the other end portion of the second series of slots in effecting severance of the strip into a pair of toothed strips:

Figs. 13 and 14 are comparative diagrams of fragmentary portions of the punched strips depicting the manner in which teeth or tines of different widths are formed with a punch and die of one size.

Fig. 15 is a plan view of a die with the punch disposed therein shown in section showing the die and punch as formed to produce slots in a metallic strip as shown in Fig. 1:

Fig. 16 is a perspective view of the die shown in Fig. 15:

Fig. 17 is a perspective view of the punch to be associated with the die shown in Fig. 16:

Fig. 18 is a view of the punch and die shown in Fig. 15 in side elevation as positioned in readiness to punch the strip:

Fig. 19 shows the die in an intermediate punching position:

Fig. 20 is a view in side elevation of the die for punching the slots shown in Fig. 3:

Fig. 21 is a plan view of the strip as partially punched as shown in Fig. 19 with the punch removed.

Referring to the drawings more specifically, reference now being had to Figs. 15, 16 and 17, A and B indicate generally a die and punch respectively, which are formed to carry the invention into effect in the manner illustrated in Figs. 1 and 2, that is, to initially form a metallic strip C with a series of spaced transversely extending slots D as particularly shown in Fig. 1, and thereafter forming the strip C with a second series of slots E uniting the ends of the slots D, as shown in Fig. 2.

In order to effectuate the desired result the slot of the die A is formed of peculiar outline and which, as particularly shown in Fig. 15, comprises an elongated portion **18** having parallel side margins *a* and *b* which portion terminates at its ends in lateral extensions **19** and **20** projecting therefrom in opposite directions relative to each other. The outer margins *c* and *d* of the lateral extensions **19** and **20** are here shown as extending on substantially straight lines and projecting at slightly obtuse angles relative to the longitudinal margins *a* and *b* of the slot portion **18**, the margins *c* and *d* merging into the side margins *a* and *b* on curves indicated at *e* and *f* respectively.

The inner margins *g* and *h* of the lateral extensions **19** and **20** lead from the longitudinal margins *b* and *a* respectively of the slot **18** on substantially straight lines and at obtuse angles of greater angular relation to the margins *b* and *a* than the angular relation of the outer margins *c* and *d* to the margins *a* and *b*; the margins *g* and *h* being preferably arranged at an angle of 45° relative to the margins *c* and *d* although other angles may be employed.

The outer and inner margins of the lateral extensions **19** and **20** thus converge toward each other, and meet on arcs *i* and *j* forming the end margins of the extensions **19** and **20** respectively and the inner margins *g* and *h* connect with the margins *b* and *a* at sharp angles *k* and *l*.

The outer margins *c* and *d* of the extensions **19** and **20** extend on parallel planes between which the elongated slot portion **18** extends obliquely at a slight angle relative to a plane extending perpendicular to the planes of the margins *c* and *d*.

The punch B has its cutting edge formed of an outline corresponding to the margins of the die slot just described and as particularly shown in Fig. 17, and accordingly the description of the die slot applies to this formation of the punch.

The die and punch are mounted in a suitable press in a conventional manner and in the usual relation to each other so as to co-operate in punching the slots in a metallic strip.

In carrying out the invention as shown in Figs. 1 and 2 the strip C is fed longitudinally between the die and punch members with the longitudinal edges of the strip extending on planes parallel to the planes of the outer margins *c* and *d* of the lateral extensions **19** and **20** of the die slot; whereupon the press is operated to initially punch a single slot D and after so doing and on withdrawal of the punch from engagement with the strip C the latter is advanced a predetermined distance governed by a suitable stop, as is common in punching operations, whereupon a second slot D is punched in the strip C. In this manner, by a series of corresponding operations, a series of the slots D will be formed throughout the length of the strip C, as shown in Fig. 1, and a strip C of any suitable length may be thus formed with the transversely extending slots D.

The slots D correspond in outline to the contour of the die slot previously described, that is having an elongated portion **21** with parallel side margins *m* and *n*, as shown in Figs. 13 and 14 extending obliquely at a slight angle relative to a perpendicular projected from the parallel margins of the strip C, and with oppositely projecting lateral end extensions **22** and **23** having outer margins *o* and *p* extending parallel with the margins of the strip C and having inner margins *q* and *r* extending in angular relation to the outer margins *o* and *p*; the margins *q* and *r* extending at angles of approximately 45° relative to the margins *o* and *p* and to the margins of the strip C, as particularly shown in Figs. 13 and 14.

This angular arrangement of the margins *q* and *r* of the slots D and likewise of the margins *g* and *h* of the lateral extensions **19** and **20** of the die slot **18** and punch, is an important feature of the present invention and is provided as a means for enabling the use of one punch and die of a given size in forming teeth or tines of different widths by varying the spacings between the initially formed slots D in the strip C, and which is accomplished as will presently be described.

After having punched a suitable length of a strip C with the spaced slots D, the strip C is inverted and is then fed to the die A and punch B in the manner before described to punch the connecting slots E in the strip, as particularly shown in Fig. 2. In this second punching operation the laterally projecting end portions of the punch B and its associated die A will, when penetrating the strip C, protrude into the lateral end portion **22** of one slot and the opposite end portion **23** of the adjacent slot, as indicated by the dotted lines in Figs. 13 and 14, thus merging the lateral extensions of the slots D with those of the slots E. The inner margins *q* and *r* of the merged lateral extensions of the slots D and E will intersect at an angle and will form points **24** on the tips of teeth **25** formed between the adjacent united slots D and E.

The strip C is thus separated into a pair of toothed strips **26** and **27** which embody bar portions **28** and **29** constituting the marginal portions of the strip C from which the teeth **25** project.

The toothed strips thus formed manifestly may be of any desired length and may be cut to desired lengths to form rakes, such as ordinary garden rakes and the like.

Where it is desired to punch a rake or fork

having teeth of a greater length than can be effectively punched with a single punch and die in a small press, the mode of punching the metallic strips shown in Figs. 3 and 6 may be employed. In this instance a die with a complementary punch is formed in the manner described with reference to the construction shown in Figs. 16 and 17 except that one lateral extension of the elongated slot portion **18** is omitted. A metallic strip F is fed longitudinally to a press equipped with a die and punch thus formed in the manner explained with reference to the construction shown in Figs. 1 and 2, but in this instance a strip of greater width than that used to form the toothed strips **26** and **27**, as shown in Fig. 2, is employed, and an initial row of slots G is formed on one longitudinal half portion of the strip F which slots G comprise an elongated portion **30** with a lateral projection **31** extending to one side thereof adjacent one margin of the strip F.

After thus punching the strip F with a series of the spaced slots G the strip is turned end for end and the other longitudinal half thereof is punched by the punch and die with which the slots G were formed, providing elongated slots **32** extending in continuation of the slots **30** and having lateral end extensions **33** projecting opposite the lateral extensions **31** as particularly shown in Fig. 4. In this manner the strip F is formed with a series of spaced slots of contours corresponding to those described with reference to the construction shown in Figs. 1 and 2 but of greater length.

After thus initially slotting the strip F the latter is turned over and again fed to the press so that the punch and die employed in forming the slots G will then punch elongated slots **34** leading from the lateral extensions **31** to a point intermediate the web extending between adjacent initially formed slots as shown in Fig. 5. After thus forming the slots **34** the strip F is turned over and re-fed to the press so that the punch and die previously referred to as employed to form the slots G will then form elongated slots leading from the lateral extensions **33** of the slots **32** and connecting with the slots **34** as particularly shown in Fig. 6, thus forming a series of slots H connecting the ends of slots G separating the strip F into a pair of toothed strips **36** and **37** embodying bars **38** and **39** carrying teeth **40**. It will now be seen that by the single punch and die employed in punching the strip F the resultant teeth **40** formed between the slots G and H may be formed of various lengths by overlapping the punch and die with the cut previously formed as indicated by the dotted line *t* in Fig. 4.

The toothed strips thus formed are cut to suitable lengths and may be employed to form the heads of long toothed rakes or spading forks, coal forks and the like.

Where it is desired to form toothed strips with longer teeth than can be effected with the punch and die employed in forming the toothed strips just described with reference to the construction shown in Figs. 3 to 6 inclusive, and yet employ a punch and die of corresponding size, the mode depicted in Figs. 7 to 12 is employed.

In this instance a metallic strip K is initially formed with a series of spaced slots **41** extending a portion of the width thereof equi-distant on the opposite sides of its longitudinal center, which slots extend on the slight incline to the perpendicular at right-angles to the margins of the strip corresponding to the inclinations of the elongated central portion of the slots to be punched to form the cut away portion between adjacent teeth of the toothed strips to be formed from the strip K. These slots **41** may be of any desired length within the capacity of a die and punch press employed.

After thus forming the central slots **41** the strip K is turned over and repunched by the same punch and die used in forming the slots **41** to form slots **42** between adjacent slots **41** as particularly shown in Fig. 8; the slots **42** inclining in a direction opposite that of the slots **41** but at corresponding angles relative to a perpendicular extending from an edge of the strip K midway between adjacent slots **41** and **42**.

After thus forming the strip K with the central row of transversely extending slots **41** and **42** the strip is fed to a press fitted with a punch and die of the character described with reference to the construction shown in Figs. 3 to 6 inclusive, whereby slots **43** corresponding to the slots **30** previously described are formed in continuation of the previously formed slots **41** extending from one end of the latter to adjacent the edge of the strip K and terminating in lateral extensions **44** as shown in Fig. 9.

After thus punching the strip K it is turned end for end and re-fed to the press and formed with slots **45** leading from the opposite ends of the previously formed central slots **41** and terminating in lateral extensions **46**, as particularly shown in Fig. 10, thus forming the strip K with a series of spaced transversely extending slots L each of which is composed of three previously punched slots **41**, **43** and **45**.

After thus forming the strip K it is turned over and re-fed to the press and punched with the same or similar punch and die to form slots **47** which connect the lateral outer ends **44** of the slots **43** with the previously formed central slots **42** as particularly shown in Fig. 11. The strip is then turned end for end and re-fed to the press and punched with slots **48** connecting the lateral ends **46** of the slots **45** with the opposite ends of the intermediate slots **42** as particularly shown in Fig. 12, thus forming transversely extending slots M composed of the previously punched slots **42**, **47** and **48** connecting the ends of adjacent slots L and completing severance of the strip K into a pair of toothed strips **49** and **50** having bars **51** and **52** carrying considerable elongated teeth or tines **53**. The strips **49** and **50** are cut into suitable lengths to form potato forks and other long tined implements.

It will now be seen that I have provided a means and method whereby a comparatively small single punch and die set may be employed in forming a single strip of metal into a pair of toothed strips in which the teeth of one strip will be formed from the material extending between the teeth of the other strip and the teeth formed of various lengths as occasion may require, and which lengths may be increased by employing a supplemental punch and die as described with reference to the construction shown in Figs. 7 to 12 inclusive.

The teeth or tines may be formed of various widths within limits by varying the spacing between the adjacent formed slots D, G, and L, and also of the subsequently punched connecting slots E, H and M; the width of the spacing between adjacent slots being subject to variation within the range of the extent of projection of the inner margins of the lateral extensions at the ends of

the punch and die; it being necessary, in order to effect formation and severance of the toothed strips, that on the punching operation completing the second series of slots E, H and M, the lateral projections at the ends of the punch and die overlap the lateral end portions of the initially formed series of slots. By forming the inner margin of the end extensions of the die and punch at an angle of 45°, or thereabout, the formation of points on the tips of the teeth will be effected whether the adjacent slots are punched relatively close together as shown in Fig. 13, or are spaced near the maximum distance apart as depicted in Fig. 14.

Where the metallic strip to be punched is formed of a thickness exceeding the width of the outer end portions of the teeth **25** it is necessary to securely hold the teeth against lateral displacement, and also against twisting during the formation of the slots E, H and M. For this purpose the die B, when constructed to form the slots D and E is formed as shown in Fig. 18 so that the end portions of its cutting edge will protrude beyond the intermediate portion thereof, and where constructed to punch the slots G and L the end portion thereof having the lateral extension is formed to protrude beyond the opposite end of the punch, as shown in Fig. 20.

By forming the punch as shown in Fig. 18, when the cutting edge of the punch is brought into initial contact with the sheet C preparatory to punching the latter, the end portions of the punch contact the strip C while the central portion of the punch is spaced from the upper face of the strip C a distance exceeding the thickness of the latter. On continued downward movement of the punch the end portions thereof penetrate the strip and form the lateral extensions of the slots before the intermediate portion of the punch effects cutting and removal of the portion of the strip intermediate the ends of adjacent teeth, so that the adjacent teeth being formed by this cutting operation will be united at their intermediate portion while cutting of the end portions thereof is being effected, and the severance of the metal is effected progressively from the outer end of each tooth to the mid-length thereof so that the final separation of the punched out metal will occur mid-way of the length of the tooth. This operation is illustrated in Fig. 19 showing the die as having penetrated the strip in effecting formation of the end portions of the slot while the intermediate portion of the punch has yet to perform its punching action.

This operation is further illustrated in Fig. 21 in which the slot E is shown as partially formed with the end portions of the metal strip being removed by the punch bent downwardly relative to the undisturbed central portion of the web, whereby the intermediate portion of the adjacent teeth are tied together thus holding the teeth against twisting or shifting laterally during the punching action of the punch.

A similar result is obtained where the punch is constructed to form the slots G and L. By this arrangement the end of the punch having the lateral extension has its cutting edge protruding beyond the opposite end of the punch so as to penetrate the strip C and form the outer end of a tooth before the opposite end of the punch completes severance of the metal. By thus forming the punch the employment of stops or abutments to hold the adjacent teeth being formed against spreading or twisting is obviated.

I claim:

1. The method of forming toothed implements consisting in initially forming a strip of sheet metal with a row of spaced transversely extending slots, then forming a second row of transversely extending slots connecting the opposite ends of adjacent of the initially formed slots thereby dividing the strip into a pair of toothed lengths.

2. The method of forming toothed implements consisting in initially punching a row of transversely extending slots one at a time successively along the length of a strip of sheet metal, then punching a second row of transversely extending slots successively one at a time with the slots of the second row extending between the slots of the initially formed row and intersecting the opposite ends of adjacent slots of the initially formed row to divide the strip into a pair of toothed lengths.

3. The method of forming toothed implements consisting in forming a strip of sheet metal with a row of transversely extending slots along the length thereof by punching said slots one at a time with each of said slots having its opposite ends protruding laterally in opposite directions and with the protrusions at corresponding ends of said slots extending in corresponding directions, and thereafter inverting the strip and punching a second row of slots one at a time with the slots of the second row extending between adjacent slots of the initially formed row and interconnecting the protruded ends of adjacent of the initially formed slots.

4. The method of forming toothed implements consisting in taking a strip of sheet metal, forming a row of spaced transversely extending elongated slots along the length of the strip by punching each of said slots independent of the others with each of said slots having parallel side margins extending at an incline relative to a perpendicular projected from the side margins of the strip with the ends of said slots terminating adjacent to the side margins of the strip and with each of the slots formed with opposed laterally projecting portions at its opposite ends, the inner margins of which extend at an incline relative to the side margins of the slot; the projecting end portions of the slots adjacent one margin of the strip extending in corresponding directions and the projections adjacent one margin of the strip extending in a direction opposite the projections adjacent the other margin thereof, then inverting the strip and punching a second row of slots one at a time with the slots of said second row complementary to the slots of the initially formed row and arranged with the lateral end projections thereof merging into the end projections of the initially formed slots.

5. The method of forming toothed implements consisting in initially forming a strip of sheet metal with a series of transversely extending slots each of which comprise an elongated central portion and opposed laterally extending end portions, forming said slots one at a time, then inverting the strip and forming a series of transversely extending slots one at a time successively connecting the opposite ends of adjacent of the initially formed slots thereby dividing the strip into a pair of toothed lengths.

6. The method of forming toothed implements consisting in initially forming a strip of sheet metal with a series of spaced transversely extending elongated slots with each of said slots having opposed laterally projecting end portions the inner margins of which extend at an incline

relative to the lengths of the slots, and then forming the strip with a series of slots connecting the laterally projecting end portions of previously formed slots, said second series of slots having opposed lateral end extensions merging into the end extensions of the initially formed slots and the inner margins of which are inclined and intersect the inclined inner margins of the lateral end portions of the initially formed slots intermediate the ends of said inclined margins.

7. The method of forming toothed implements consisting in initially forming a strip of sheet metal with a series of spaced transversely extending elongated slots by punching said slots, and then elongating said slots by again punching said strip with slots in continuation of the first formed slots, then punching the strip with slots interconnecting the opposite ends of the slots.

8. The method of forming toothed implements consisting in taking a strip of sheet metal, forming a row of spaced transversely extending slots along the length of the strip by punching each of said slots successively one at a time, punching another row of slots one at a time aligning with and merging into the slots of the first named row to form elongated slots, and forming slots connecting the ends of said elongated slots to divide the strip into a pair of toothed strips.

9. The method of forming a pair of toothed strips from a single strip consisting in initially punching a row of parallel transversely extending slots in a strip of sheet metal with a web extending between adjacent slots, then punching a slot in each of said webs connecting the opposite ends of the previously formed slots on opposite sides of the web to form a pair of oppositely extending teeth from each web; the punching of the slot in the web being effected by cutting the web progressively from the ends of the previously formed slots toward the longitudinal center of the web so as to retain the side margins of the web connected together until after the end portions of the connecting slot are formed.

10. The method of forming toothed implements consisting in punching a row of transversely extending slots in a strip of sheet metal, elongating alternate of said slots at each end thereof, then forming the strip with slots connecting the ends of the other alternate slots in the row of slots with the outer ends of the elongated slots.

FRANK BISHOP.