W. G. NICHOLS.

METHOD OF PRODUCING DIGGING TEETH.

APPLICATION FILED AUG. 5, 1918.

1,336,576. **Patented Apr. 13, 1920.**

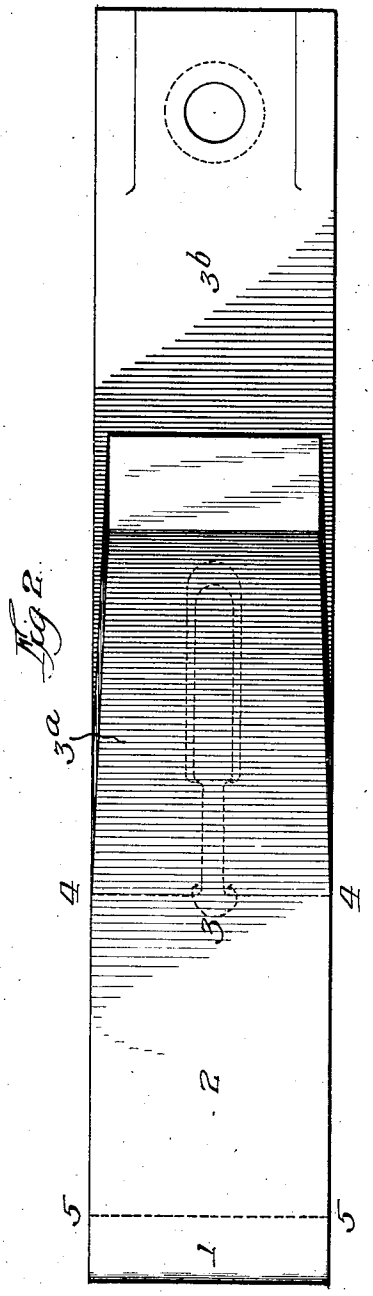


Fig. 2.

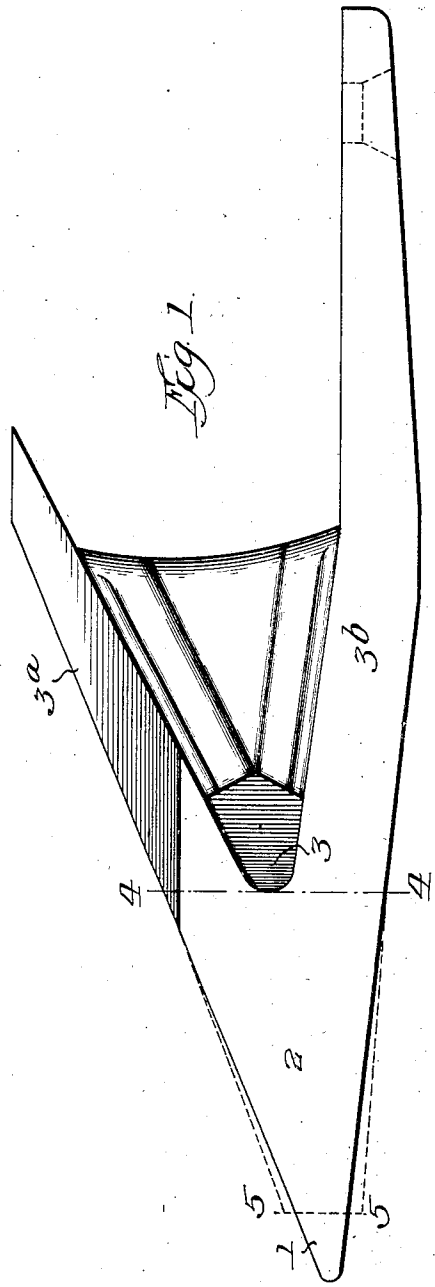


Fig. 1.

Witness:
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UNITED STATES PATENT OFFICE.

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METHOD OF PRODUCING DIGGING-TEETH.

1,336,576. Specification of Letters Patent. Patented Apr. 13, 1920.

Application filed August 5, 1918. Serial No. 248,237.

To all whom it may concern:

Be it known that I, WESLEY G. NICHOLS, a citizen of the United States, residing at Chicago Heights, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Methods of Producing Digging-Teeth, of which the following is a specification.

The present invention relates to teeth for digging implements or digging teeth used under conditions which can fairly be illustrated by the cutting or digging teeth applied to the buckets, scoops, chains or the like of excavating machines. The invention is especially applicable to and advantageous in the production of such teeth from manganese steel.

In the accompanying drawing—

Figure 1 shows in side elevation, and Fig. 2 in top plan view, a standard form of tooth for an excavating bucket or scoop, which is selected to illustrate the character of the article in the production of which the difficulties have been encountered which it is the object of the present invention to overcome. This article involves the peculiarity of enlarging from a comparatively thin cutting end 1, back through a gradually thickening portion 2, where in the present illustration, there is an opening 3, by which it is fitted to the base or object upon which it is to be mounted. The upper and lower walls 3^a, 3^b of the opening 3 being comparatively thin, and not being called upon to afford any extreme resistance to force, involve no particular problem in producing them in proper condition; but from the point 1 back through the gradually thickening metal to about the line 4—4 where the article is required, in use, to withstand very large stresses, especially in its transverse direction, it is extremely difficulty in manufacture, to avoid conditions which tend to reduce the capacity of the tooth to meet such strains.

It is a known fact that manganese steel of from 10 to 14 per cent. manganese is the most economical material for producing articles of this kind and the present invention deals particularly with the production of such articles from this material. In producing these articles from this material they must be cast with great care and under the most favorable conditions, as for instance by introducing the metal into the mold through a head or riser directly over or adjacent the heavy section 2, to insure sufficient feed of material thereto and prevent internal segregation of the material in the casting; but even with these precautions it is not always possible to insure the required density in this heavy section of the article, owing to the difficulty of employing sufficient neck or connecting passage between the mold and the head or riser referred to. If, on the one hand, a neck of ample capacity is used, subsequent breaking off or removal of the head is liable to carry the break into the casting. On the other hand, a sufficiently small connecting neck is liable to result in a structure, in the casting, of undesirable coarseness or very large crystals. Metallographists have proved that steel having a microstructure of large crystals is weaker than steel having a microstructure of small crystals. This principle holds true for manganese steel. In numerous instances, inspection of articles of the kind herein illustrated, that have failed in use, has shown that fracture occurred in the heavy section 2 and microscopic examination of the broken surface revealed the fact that the failure was due to a structure of large crystals. In many other instances such articles have been found to fail in use by developing softness or lack of resistance to wear, in some instances showing no greater resistance than carbon steel, whereas relatively expensive manganese steel had been selected for the production of the article because of its supposed superior hardness and resistance to wear. This condition of low resistance to wear has also been traced to large crystals or improper density in the texture of the steel.

The present invention successfully overcomes the difficulties above mentioned, of low resistance to transverse strains and to wear in articles of this kind. Tests made show that by the present invention the goods are improved as much as 200 per cent. in this respect when measured by length of

service rendered, in comparison with that of the ordinary cast manganese steel tooth.

In carrying out the present invention, the foundry methods will preferably be followed as heretofore but a somewhat changed pattern is employed, a work-piece being produced which varies from the ultimate form required and the latter being obtained by a forging and working of the work-piece, mainly localized upon the vulnerable or critical portion of the article, and having the effect of bringing the texture up to the required quality notwithstanding imperfections therein that may have resulted from the conditions peculiar to manganese steel that have been alluded to.

In carrying out the present invention a pattern is made corresponding to the object to be produced except at the forward end where it is modified to accord with the shape indicated by broken lines on the drawing. That is to say, a work-piece is first formed that terminates short of the point 1 but which has its transverse dimension, adjacent said point, increased to an extent sufficient to contribute the metal necessary to form the point 1 and having this additional metal so distributed thereon that in forging the work-piece to ultimate shape, the texture of the metal is treated as well, and any imperfections therein, resulting from casting the manganese steel, are eliminated. In realizing these results, the increased thickness shown at point 5 must be not merely sufficient to bring out the point 1; but it should be approximately two-thirds more than the mass of metal indicated by the outline of the point beyond the thickened portion, and it should be distributed substantially as shown. Therefore in the preferred detail of procedure the excess of metal developing the increased thickness will taper from the area 5—5 backward and will merge with the ultimate outline of the article by the time it reaches the rear limit 4—4 of the heavy portion of the ultimate tooth.

As a specific instance and by way of disclosing the best way known to me of realizing the result, it may be explained that a pattern is made corresponding to the figure of the drawing modified in accordance with the broken lines and omitting point 1. A casting is then made to correspond to this pattern, standard foundry practice being followed. The casting is then removed from the flask, cleaned and ground. It is then heated in any suitable forge or furnace to about 1800° F., throughout that portion indicated between the line 5—5 and the line 4—4 and held at such temperature until the heat has penetrated the entire section, care being taken that the temperature does not greatly exceed that degree in any part of the metal. The casting is then removed with this heat and placed under a steam or air hammer, bulldozer or hydraulic press, and the heated part worked until it assumes the shape shown in full lines in the drawing. The entire casting will then be placed in any suitable furnace and subjected to the standard heat treatment for manganese steel.

I have found in practice that an article made in the manner above outlined will be of very fine texture, having very small crystals, and will be of a density, strength and hardness which better adapt it to withstand the conditions under which it is to be used.

I claim:

1. The improvement in the art of producing tapered articles of manganese steel, requiring strength and hardness in use, which consists in casting a blank or work-piece of approximately the ultimate form desired but with an excess of metal that develops thereon an increased thickness relative to that of the ultimate article, and with the excess of metal distributed so that the increase of thickness is greater toward the thin end of the article, and then forging the work-piece, at a suitable temperature, to reduce it to the ultimate form and improve the texture of its metal.

2. The improvement in the art of producing tapered articles of manganese steel, requiring strength and hardness in use, which consists in casting a blank or work-piece of approximately the ultimate form desired but with an excess of metal that develops thereon an increased thickness relative to that of the ultimate article, and with the excess of metal distributed so that the increase of thickness is greater toward the thin end of the article, and then forging the work-piece, at a suitable temperature until its increased thickness is reduced to that of the ultimate article and the length of the article is increased to the length desired.

3. The improvement in the art of producing from manganese steel articles of tapered section having a reduced working edge and requiring great strength and resistance in use; said improvement consisting in casting from manganese steel a work-piece terminating short of the cutting edge required and of a thickness adjacent said edge increased relatively to that of the ultimate article to be produced; heating the work-piece so formed to a suitable temperature and then forging the work-piece while hot to bring it to the ultimate form desired.

4. The improvement in the art of producing from manganese steel articles of tapered section having a reduced working edge and requiring great strength and resistance in use; said improvement consisting in casting from manganese steel a work-piece terminating short of the cutting edge required and of a thickness adjacent said edge increased rela-

tively to that of the ultimate article to be produced; heating the work-piece so formed to a suitable temperature and then forging the work-piece while hot to bring it to the ultimate form desired; the increased thickness of the work-piece relatively to the ultimate article being distributed from the forward end of the work-piece rearwardly but gradually decreasing until the outline of the work-piece merges with that of the ultimate article.

Signed at Chicago Heights, this 27th day of July, 1918.

WESLEY G. NICHOLS.