Feb. 25, 1941. A. E. SHORTER 2,232,809

MACHINE FOR SURFACE HARDENING METAL ARTICLES

Filed April 29, 1938

Fig. 1.

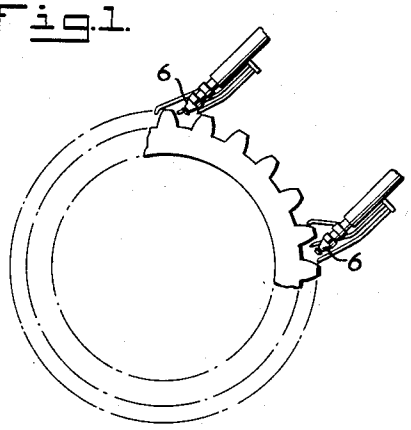


Fig. 2.

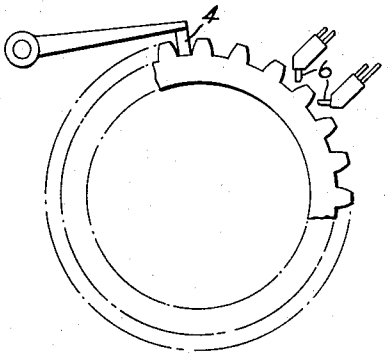


Fig. 3.

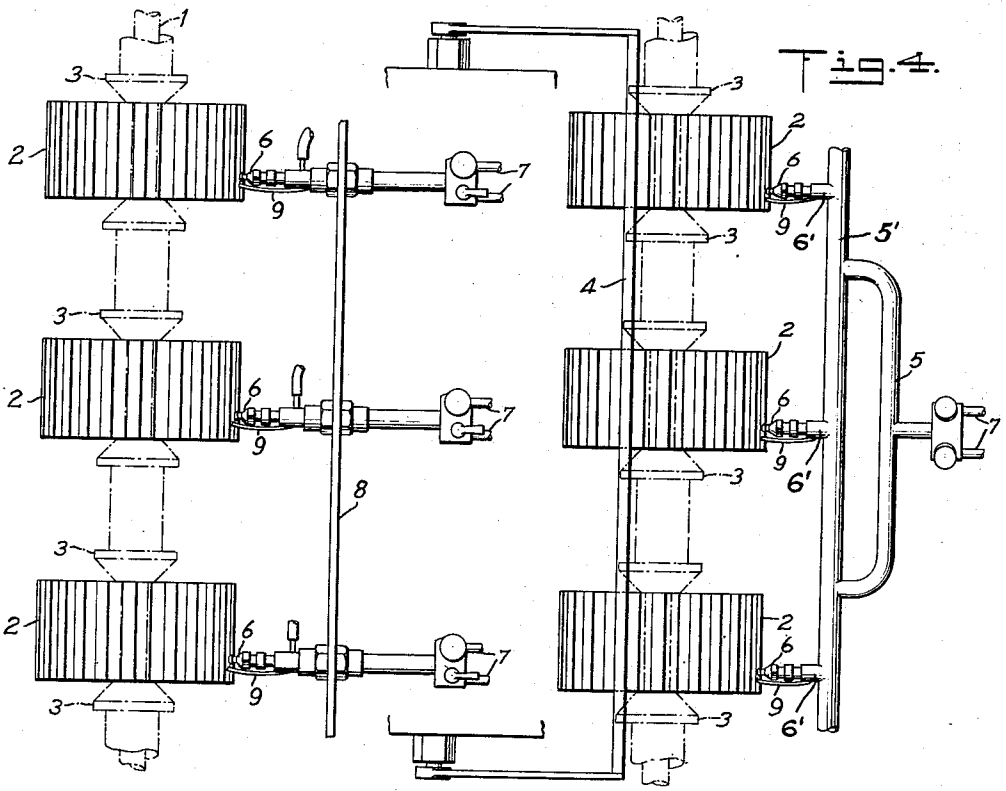


Fig. 4.

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MACHINE FOR SURFACE HARDENING METAL ARTICLES

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Application April 29, 1938, Serial No. 205,127
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2 Claims. (Cl. 266—4)

This invention relates to improvements in machines for surface hardening by heat treatment of metal articles, such as gears, by a method involving the use of an oxy-acetylene burner or other suitable heater adapted to heat a small portion of the work to a temperature sufficient for hardening whilst leaving the bulk of the work unaffected, the heater being traversed relatively to the work and the heated zones being quenched by the application of a quenching fluid, so that an extended surface is hardened progressively by the successive heat treatment of adjacent parts.

The object of the invention is to provide means whereby such articles may be simultaneously hardened by heating and quenching. Thus if the invention be applied to gears, a number of gear wheels may be heated or again several teeth of several gears may be simultaneously treated.

Heretofore in the practice of this art it has been customary to harden the teeth of gear wheels one at a time, the wheel being mounted so as to rotate tooth by tooth on a spindle against the operation of a heating jet, which moves transversely across the tooth, playing upon the part of the tooth to be hardened, this operation being followed by a quenching jet or by immersion of the wheel tooth in a bath of quenching liquid in which latter case the wheel and its spindle are mounted upon or within the quenching bath itself, quenching taking place by rotating the wheel tooth beneath the bath level after the heating operation.

The invention comprises applying the above operation to a plurality of metal articles such as gear wheels and embraces means for spacing and individually locking a series of such upon a revolvable shaft under control for regular intermittent motion and means for adjustment of a plurality of heating units, whereby they be timed to commence at one or other side of any part or tooth on each one of the articles or gears, and be traversed along the face of any given surface or tooth, with means for adjustment of the heating units for heating or quenching the article either during or after the heat treatment, and of duplicating the heating and quenching device on the other side of the mounted group of articles or gears.

The invention will be understood from the following description with reference to the accompanying drawing which shows a machine suitable for the simultaneous hardening of a plurality of gear wheels:

Figure 1 is a side elevation showing the arrangement of the heaters and cooling jets in relation to the gear wheel to be treated,

Figure 2 is a similar view showing another arrangement,

Figure 3 is a plan view showing one arrangement according to the invention for treating a number of gear wheels simultaneously, and

Figure 4 is a view similar to Figure 3 showing another arrangement according to the invention.

Referring first to Figures 3 and 4 of the drawing, the reference numeral 1 indicates a rotatable shaft which may be mounted within or upon a bath (not shown) containing oil, water or other quenching medium. Alternatively, if cold air is used as the cooling medium no bath will be necessary.

The said shaft is adapted to carry a plurality of gear wheels 2, which normally are of equal pitch diameter and bore. In order, however, to accommodate wheels of like pitch diameter but of varying bore, suitable slidable bushings, indicated at 3 in the drawing may be employed to secure the gear wheels coaxially upon the shaft suitable means being provided for fixing the wheels temporarily in adjusted positions on the shaft. A trueing bar 4 or other means (Figures 2 and 4) adapted to engage all the gear wheels simultaneously is provided to facilitate accurate setting of the gear wheels on the shaft 1 so that the teeth of all the gear wheels are properly aligned.

In the construction shown in Figure 4, a gas mixing chamber 5 and a header 5' are disposed parallel to the shaft 1 and a plurality of gas burners 6 carried upon the common header 5' are disposed at intervals along the length of the header so that there is a separate burner 6 for each wheel to be hardened. The mixing chamber 5 is supplied with oxygen and fuel gas through suitable flexible pipes indicated at 7 in the drawing, while the combustible mixture formed in mixing chamber 5 passes into header 5' from each end of the mixing chamber and from header 5' through supply conduits 6' to burners 6. The mixing chamber 5 is mounted on a sliding carriage so that the mixing chamber can be traversed in a direction parallel to the axis of the shaft 1 for the purpose of causing each burner 6 to move along the length of each tooth of the gear wheel. Any suitable gearing may be provided for mechanically traversing the mixing chamber 5.

Figure 3 of the drawing shows a modified burner arrangement in which a number of separate burners 6, one for each gear wheel to be treated, are mounted upon a slotted plate 8 ex-

tending parallel to the axis of the shaft 1, the burners 6 having separate fuel and oxygen supply pipes 7 and being individually adjustable along the length of the plate 8. The plate 8 is mounted to slide in the direction of its length and may be controlled by any suitable traversing mechanism in the same way as the mixing chamber 5.

In both of the two modifications shown in Figures 3 and 4, nozzles 9 adapted to direct jets of cooling fluid upon the work are mounted upon the burners 6, suitable control valves (not shown) being provided to enable the supply of cooling medium to be turned on at the proper times.

Any suitable mechanism may be provided for rotating the shaft 1 so as to bring the teeth of the gear wheels successively into the range of action of the burners and quenching jets.

In one method of hardening according to the invention the gear wheels to be hardened are set up on the shaft 1 as previously described so that their teeth are in axial alignment and so that a burner 6 is located in a corresponding position in relation to each gear wheel. One tooth of each gear wheel is then hardened by means of the burners 6 and nozzles 9, the burners and nozzles being traversed simultaneously so that one face of one tooth of each wheel is subjected to the action of the heating flame followed by the cooling jet. The shaft 1 is now partially rotated so as to rotate the gear wheels through the space of one tooth and one face of the next tooth on all the gear wheels is then hardened in the same manner as the last.

In an alternative method of hardening according to the invention, the shaft 1 is rotated rapidly whilst the burners 6 are in operation, the cooling jets being turned off, so that all the teeth of all the gear wheels are heated together. The burners are then turned off and the cooling jets are brought into action whilst the rapid rotation of the shaft is continued, so that all the teeth are quenched. When this method of hardening is to be practised, the burners 6 are constructed to produce wide jets capable of heating the teeth uniformly and simultaneously along their whole length and the quenching nozzles 9 similarly are constructed to produce a uniform cooling effect simultaneously over the whole length of each tooth.

In the arrangements shown in Figures 3 and 4, one burner is provided for each gear wheel to be hardened. According to a preferred form of the invention, however, two burners are provided for each gear wheel as illustrated in Figure 1 or 2 so that both sides of the same tooth or one side of each of two different teeth may be treated simultaneously. Figure 2 shows two burners 6 arranged to heat opposite sides of the same tooth each burner carrying a quenching nozzle similar to those shown at 9 in Figures 1 and 2 and arranged so that the quenching jet follows the heating flame in the traversing movement of the burner along the length of the tooth.

Figure 1 shows an arrangement in which two burners 6 are adapted to heat one side of each of two different teeth.

The burners shown in Figure 1 may both be secured to the same slotted plate 8 (Figure 3) or a separate slotted plate may be provided for each set of burners.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A machine for hardening individually and successively each tooth of a plurality of multi-toothed articles comprising, in combination, means for rotatably supporting a plurality of multi-toothed articles with the teeth in alignment; a plurality of heating units and quenching nozzles, at least one heating unit and quenching nozzle being provided for each toothed article; means for supporting said heating units and quenching nozzles in operative relationship with respect to the aligned teeth; traversing mechanism arranged to cause the heating units and quenching nozzles to traverse the toothed articles simultaneously, the arrangement being such that at least one heating unit and one quenching nozzle passes across the tooth of each article; means for rotating the articles simultaneously to bring successive teeth into position for treatment; and separate means for engaging at least one tooth of each article simultaneously to align the teeth of said multi-toothed articles.

2. A machine for hardening individually and successively each tooth of a plurality of multi-toothed articles comprising, in combination, means for rotatably supporting a plurality of multi-toothed articles with the teeth thereof in alignment; a plurality of heating burners; a plurality of quenching nozzles, at least one burner and one quenching nozzle being provided for each toothed article; means for supporting said burners and said quenching nozzles in operative relationship with respect to the aligned teeth; a plurality of mixture supply conduits, one of said conduits for each of said burners; a single header connected to such conduits and to a source of supply of a combustible mixture of gases, for supplying each of said burners with the same combustible mixture; traversing mechanism arranged to cause the burners and the quenching nozzles to traverse the toothed articles simultaneously, the arrangement being such that at least one burner and one quenching nozzle passes across the tooth of each article; means for rotating the articles simultaneously to bring successive teeth into position for treatment; and separate means for engaging at least one tooth of each article simultaneously to align the teeth of said multi-toothed articles.

ALBERT EDWARD SHORTER.