W. E. NICKERSON.

METHOD AND APPARATUS FOR TREATING STEEL.

APPLICATION FILED SEPT. 15, 1908.

931,332. Patented Aug. 17, 1909.

3 SHEETS—SHEET 1.

Fig. 1.

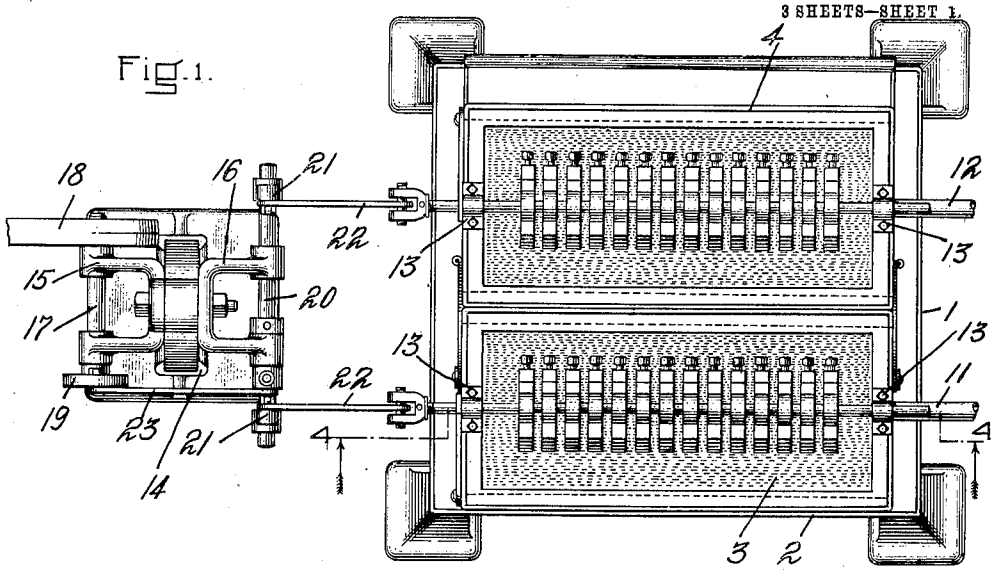
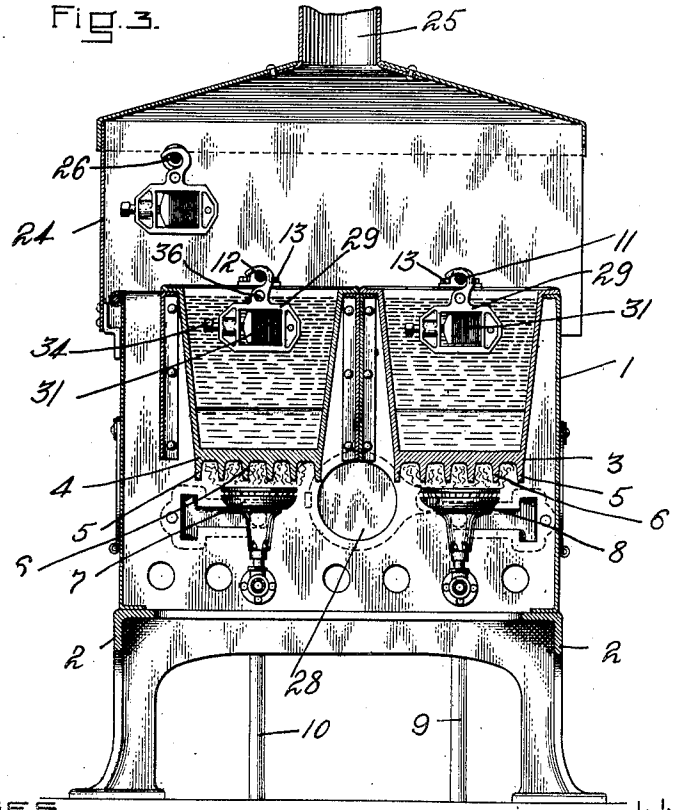


Fig. 3.



WITNESSES

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Fig. 1.

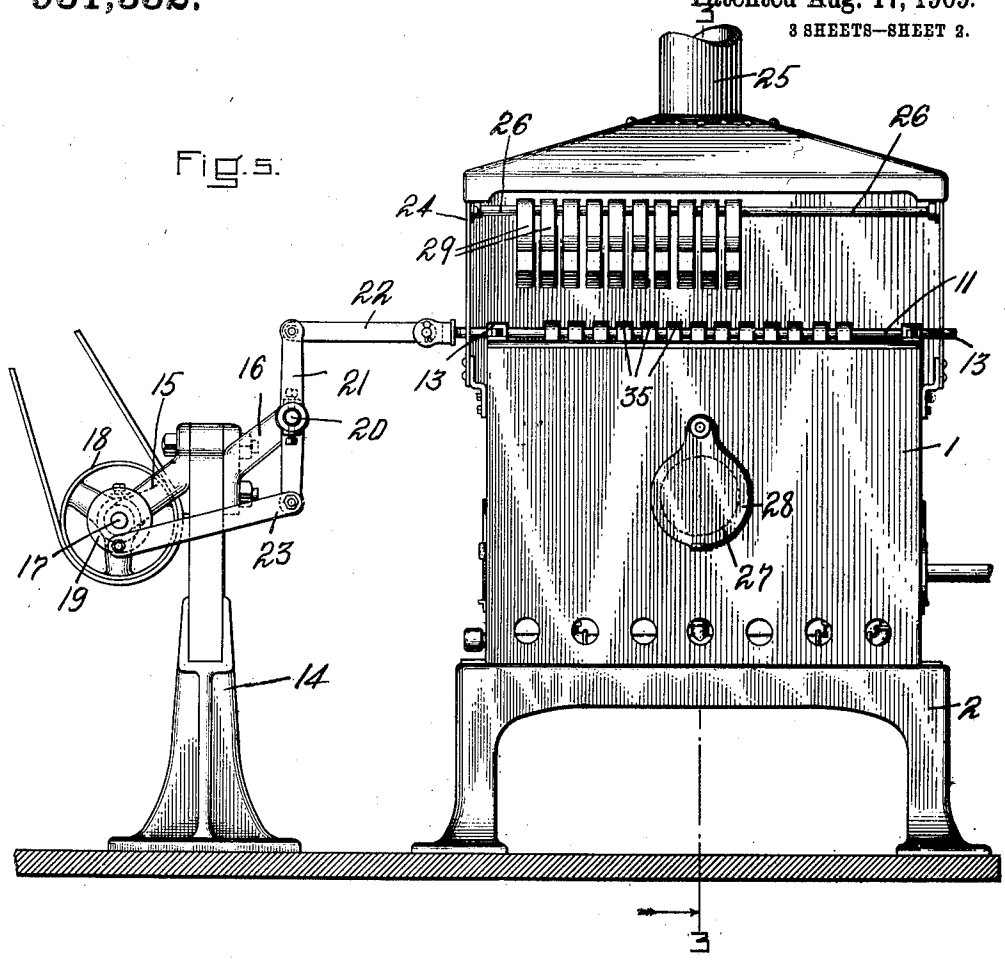
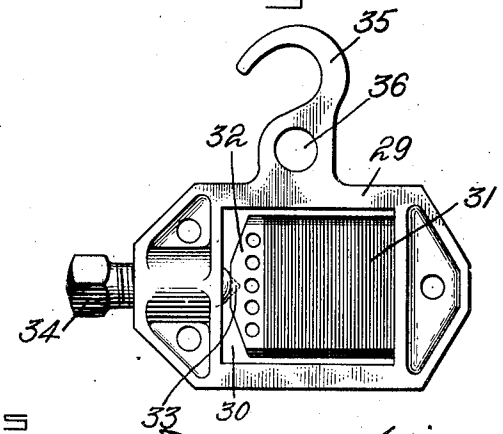


Fig. 2.



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3 SHEETS—SHEET 3.

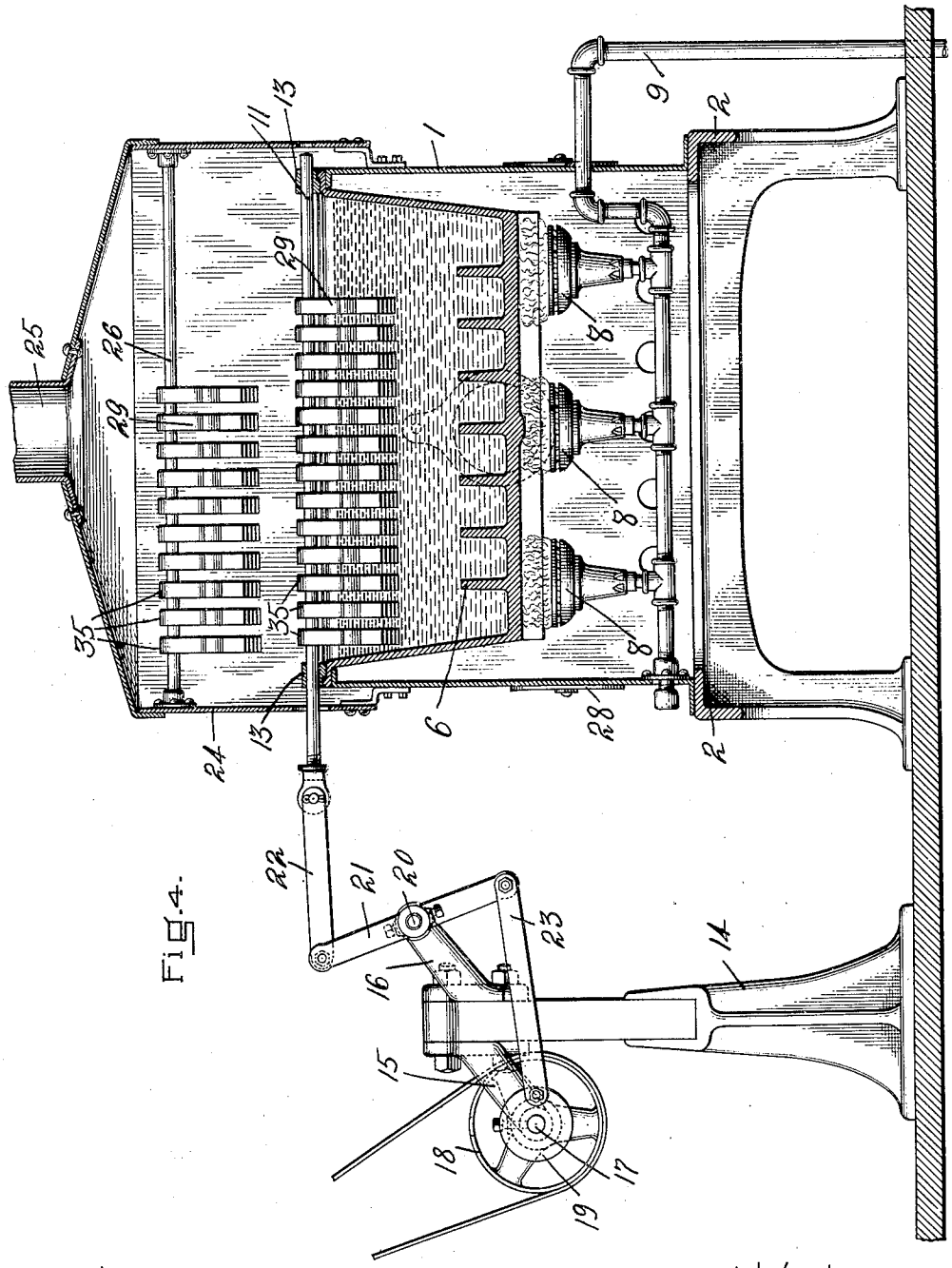

Fig. 4.

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UNITED STATES PATENT OFFICE.

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METHOD AND APPARATUS FOR TREATING STEEL.

No. 931,332. Specification of Letters Patent. Patented Aug. 17, 1909.

Application filed September 15, 1908. Serial No. 453,177.

To all whom it may concern:

Be it known that I, WILLIAM E. NICKERSON, of the city of Cambridge, county of Middlesex, and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Methods and Apparatus for Treating Steel, of which the following is a full, clear, and exact specification.

This invention relates to certain new and useful improvements in methods or processes and in apparatus for treating steel in the manufacture of cutting implements or tools, and especially to the tempering or hardening of steel plates or blanks, such as are used in the manufacture of razor blades, and the like.

The invention is particularly applicable to the tempering of blanks formed of thin sheet steel such as are produced by the ordinary rolling mill.

Steel used in the manufacture of cutting implements, after being rolled to the desired thickness, is usually first cut into the desired shape and size and then subjected to a hardening operation, as by heating to a high temperature and chilling or quenching rapidly. This hardened steel is generally unfit for use by reason of its extreme brittleness and it is necessary, therefore, to subject it to a tempering operation which will cause it to lose this brittleness. In tempering, however, it is essential that the changes of temperature be produced very gradually, and this is especially so in the treatment of articles such as those herein referred to which very easily become distorted.

A method which I have found very satisfactory for tempering steel of the character described, is as follows: The steel blanks or sheets to be treated are first clamped in a frame or device which will retain them in the shape which they are intended to possess in the finished article. While so clamped, the blanks are subjected to a preliminary warming or heating operation which may be accomplished in a warming oven or in any other suitable way. The temperature to which they are raised in this preliminary warming may be in the neighborhood of 100 degrees F., and when the blanks have been uniformly heated to about this temperature, they are removed from the warming oven and are subjected to a primary heating which can best be performed by immersing them in an oil or brine bath maintained at a uniform temperature. This primary heating should cause the blanks to be raised to a temperature of about 250 degrees F. It is desirable that the blanks be moved while submerged in order to wash the oil into contact with all portions of the edges of the blanks and so as to cause them to be properly heated, and also to agitate the bath. After the blanks have been raised uniformly to the desired temperature, they are removed from the primary bath and are then subjected to a secondary or final heating which will gradually raise and maintain them at a temperature of from 425 to 475 degrees F. This secondary heating can likewise be advantageously accomplished by immersing the blanks in an oil or brine bath maintained at the proper temperature by suitable means. It is desirable that the clamped blanks be moved in the secondary bath in the same manner as in the primary bath so as to cause the blanks to be uniformly and quickly raised to the desired temperature. When the blanks have been heated in the secondary bath to the desired temperature, for a sufficient time to insure their complete temper, they are removed from the bath and permitted to cool slowly. After removing them from the secondary bath it is desirable to place them in a warm chamber or a draft of warm air for the double purpose, first of causing their temperature to be slowly lowered and second, of drying them so that they will be free from oil. When the blanks have become sufficiently cool they may be removed from the clamping means and subjected to the necessary subsequent treatments which will convert them into the finished product. Blanks treated in the manner described will be found to be uniformly tempered and to possess and retain the exact shape desired. Where the blanks to be treated consist of flat sheets or plates, it will be found economical to clamp a considerable number of them together, face to face and to subject them when so clamped to the aforesaid operations, after which each will be found to possess the desirable characteristics heretofore described.

In some cases it may be desirable or permissible to omit the first or preliminary warming operation and the last or oil-drying operation, although I prefer to make use of both of these steps, as they render the method more efficient, but as before stated, they may be found not to be indispensable.

My process as heretofore described is independent of any particular form of apparatus, and various forms may be used for carrying out the same.

One particular form of apparatus which I have found satisfactory is illustrated in the accompanying drawings forming a part of this specification in which—

Figure 1 is a plan view of the apparatus with the warming oven removed. Fig. 2 is a side elevation of one of the clamping devices or frames in which the blanks are stacked. Fig. 3 is a vertical section taken on the line 3—3 of Fig. 5. Fig. 4 is a similar section taken on the line 4—4 of Fig. 1. Fig. 5 is a front elevation of the apparatus.

In these drawings 1 indicates the main casing of the apparatus, which is mounted upon a standard or supporting base 2, and within this casing are suitably supported the heating tanks 3 and 4 which contain the primary and secondary heating baths respectively. These baths may consist of oil, brine or other suitable liquid, but in practice I prefer to use an oil bath by reason of its many advantages. The tanks are provided with external flanges 5 and internal flanges 6, which greatly increase the heat absorbing and radiating surfaces and thus enable the liquid to be maintained at the proper temperature without appreciable variation. The heat necessary to maintain the baths at the proper temperature is furnished by the gas burners 7 and 8 respectively, mounted beneath the tanks in any suitable manner and thermostats or other suitable regulating means may be provided to insure a constant and uniform temperature. The burners are supplied by means of pipes 9 and 10.

Immediately above the top of each tank there are mounted hanger-rods 11, 12, which are slidably journaled in bearings 13, and which have moderate reciprocating movements. These rods may be operated by any suitable means, such, for instance, as that disclosed in Figs. 1, 4 and 5. As shown, such reciprocating means consist of a support or frame 14 provided with extensions 15 and 16, the former of which has journaled therein a shaft 17, carrying at one end the pulley 18 and at the other, the disk 19, and the latter having journaled therein a rock shaft 20 upon which is secured the rock levers 21 which latter are connected by links 22 with the rods 11 and 12. A link 23 connects one end of the lever 21 with a pivot on the disk 19 and thus a rotation of the pulley 18 will cause a reciprocating motion of the rods 11 and 12, as will be readily understood. Above the main casing 1 is provided a hood or oven chamber 24, and this may be provided with an outlet or flue 25 to permit the escapement of gases, fumes and the like. Within said hood, at the back and near the top thereof is mounted a rod 26, the purpose of which will be hereinafter described. At the ends of the casing are provided openings 27, covered by gravity operated shutters 28, the purpose of which will also be hereinafter described.

Fig. 2 illustrates the form of clamping member that I prefer to use in tempering thin, flat plates or blanks. The frame 29 is provided with a rectangular opening 30 and this opening is preferably of a width in excess of the length of the blanks 31 so as to leave spaces above and below the blanks to permit access of the fluid to all parts thereof. The blanks are held in position by means of a head piece or block 32, the face of which contacts therewith, and which has a conical recess 33 upon the opposite side into which the pointed end of the bolt or adjusting screw 34 is inserted. By tightening the said bolt the blanks can be clamped firmly and in a flat position, leaving their edges entirely exposed to the action of the fluid of the bath or of the surrounding air. A suspending member or hook 35 is provided on the frame and an aperture 36 is also provided to receive a poker shaped handling instrument which will be found advantageous in handling frames when hot.

In carrying out my process with the apparatus just described, a number of previously hardened blanks are placed in the frame 29 and securely clamped therein by means of the adjusting screw. The frames containing the blanks are then warmed by being hung in rows upon the rod 26 in the hood, the air of which will be found to be of the desired temperature owing to the heat of the burners, and heat radiated from the baths below. When the frames and blanks have become thoroughly warm they are then removed from the rod 26 and hooked upon the sliding rod 11 above the primary heating tank 3. This rod is reciprocated back and forth by means of the mechanism heretofore described, and the weight of the frames is sufficient to cause the hooks thereon to frictionally engage the rods and the frames are reciprocated therewith. Thus the blanks are moved back and forth in the bath and the latter is thereby constantly agitated and the uniform heating of the blanks is thereby assured. After the blanks have remained in the primary heating bath a sufficient length of time, they are removed from the reciprocating rod 11 and hooked upon the rod 12 over the secondary heating bath. The temperature of this bath having been suitably determined and maintained, the operation is repeated and the blanks reciprocated. When the blanks have been uniformly raised to the desired temperature in this bath, they may be removed and the frames again placed upon rod 26, where the excess fluid will drain off, and the current of air passing up will tend to dry them and free

them from the liquid. As soon as the blanks are sufficiently dry the frames may be removed from the hood and the blanks removed from the frames, when they will be found to be tempered in a very satisfactory manner, and will be entirely free from buckling and distortion, and at the same time will be elastic and flexible and capable of receiving a sharp cutting edge.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. The method of tempering thin, steel articles consisting in subjecting them to a series of progressively-increasing temperature-heating operations, and then cooling them slowly.

2. The method of tempering thin, steel articles, consisting in clamping them firmly against distortion, and subjecting them to a series of progressively-increasing temperature-heating operations, and then cooling them while so clamped.

3. The method of tempering thin, steel articles, consisting in subjecting them to a warming operation in a hot air chamber, then placing them in a liquid bath of higher temperature, and then cooling them slowly.

4. The method of tempering thin, steel articles, consisting in clamping them firmly in the desired shape, then subjecting them to a series of hot air and liquid heating baths, and then cooling them slowly while so clamped.

5. The method of tempering thin, steel articles, consisting in subjecting them to a warming operation by means of hot air, then subjecting them to a plurality of liquid baths of higher and progressively-increasing temperatures, and then cooling them slowly.

6. The method of tempering thin, steel articles, consisting in subjecting them to a warming operation by means of hot air, then subjecting them to a plurality of liquid baths of higher and progressively-increasing temperatures, approximately 250 and 450 degrees F. respectively, and then cooling them slowly.

7. The method of tempering thin, steel articles, consisting in clamping them firmly in the desired shape, subjecting them to a warming operation in hot air, then to a plurality of liquid baths of higher and progressively-increasing temperatures, and then cooling them slowly while so clamped.

8. The method of tempering thin, steel articles, consisting in clamping them firmly in the desired shape, then subjecting them to a warming operation by means of hot air, then to a plurality of liquid baths of higher and progressively-increasing temperatures, approximately 250 and 450 degrees F. respectively, and then cooling them slowly while so clamped.

9. The method of tempering thin, steel articles, consisting in clamping the blanks firmly against distortion, subjecting them to a hot-air, warming operation, and then to a liquid bath of higher temperature which is constantly agitated so as uniformly to act upon all exposed parts of the article being treated.

10. The method of tempering thin, steel articles, consisting in clamping them firmly in the desired shape and subjecting them to a warming operation and hot air, then subjecting them to a plurality of liquid baths of higher and progressively-increasing temperatures, approximately 250 and 450 degrees F. respectively, which are constantly agitated so as uniformly to act upon all exposed portions of the article being treated, and then cooling them slowly while so clamped.

11. The method of tempering thin, steel articles, consisting in clamping them firmly against distortion, subjecting them to a plurality of liquid baths of increasing temperature, moving the articles so clamped about in said baths, and then cooling them slowly.

12. The method of tempering thin, steel articles, consisting in clamping them firmly in the desired shape, subjecting them to a warming operation by means of hot air, then immersing them in a plurality of liquid baths of higher and progressively-increasing temperatures, moving them constantly while in said baths, and then cooling them slowly.

13. A tempering apparatus having a tempering bath, and means for moving the articles to be tempered while completely submerged in said bath.

14. A tempering apparatus having a tempering bath, means for reciprocating the articles to be treated while in said tempering bath, and means for causing said articles to be dried and slowly cooled.

15. A tempering apparatus having a tempering bath, means for heating the sides and bottom of said bath, means for suspending the articles to be tempered in said bath, and means for drying and causing the temperature of said articles to be slowly lowered.

16. A tempering apparatus having a plurality of baths of different temperatures, and a drying chamber for the articles removed from said baths.

17. A tempering apparatus comprising an air chamber or warming oven, a liquid heating tank and common heating means adapted to keep both chamber and tank at the proper but different temperatures.

18. A tempering apparatus comprising an air chamber or hot-air oven, a plurality of liquid heating tanks, independent heating means for each of said tanks, and which also operate to heat the air chamber.

19. A tempering apparatus comprising an air chamber or warming oven, a liquid heating tank and common heating means adapt-

ed to keep both chamber and tank at the proper temperatures, means for holding the articles to be treated, and means for reciprocating them in said tanks.

20. A tempering apparatus comprising an air chamber or warming oven, a plurality of liquid heating tanks, independent heating means for each of said tanks, which also operate to heat the air chamber, means for holding the articles to be treated, and means for reciprocating them in said tanks.

21. A tempering apparatus comprising a main casing, a plurality of liquid heating tanks within said casing, a hot air chamber located above said tanks, heating means beneath said tanks, and reciprocating means above said tanks to which the articles to be treated may be secured.

22. A tempering apparatus comprising a main casing, a plurality of liquid heating tanks within said casing, a hot air chamber located above said tanks, heating means beneath said tanks, longitudinally-sliding rods journaled above said tanks, and means for reciprocating said rods.

23. A tempering apparatus comprising a main casing, a plurality of liquid heating tanks within said casing, a hot-air chamber located above said tanks, heating means beneath said tanks, longitudinally-sliding rods journaled above said tanks, means for reciprocating said rods, and a hanger-rod in said air chamber located in the air path therein.

24. A tempering apparatus comprising a heating tank, and reciprocating means above said tank to which the articles being treated may be attached.

25. A tempering apparatus comprising a liquid-containing, heating tank, a longitudinally-sliding rod journaled at the upper part of said tanks, and means for reciprocating said rod.

26. A tempering apparatus comprising a liquid-containing, heating tank, means for heating the liquid in said tank, a sliding rod journaled at the upper part of said tank, and reciprocating means for said rod comprising a rock lever connected to a source of power, and a link connecting said rod and said rock lever.

27. A tempering apparatus comprising a heating tank provided with external flanges located within the zone of heat, internal radiating flanges extending part way within said tank, and heating means for said tank.

28. A clamping frame for holding articles to be tempered, provided with a suspension hook or projection, substantially as described.

29. A clamping frame for holding articles to be tempered, comprising an article space, an adjustable head-piece or butt, and an adjusting nut for said butt.

30. A clamping frame for holding articles to be tempered, comprising an article space, an adjustable head-piece or butt, an adjusting nut for said butt, and an eye to receive the handling implement.

31. A clamping frame for holding articles to be tempered, consisting of an article receptacle, a suspension hook, and an eyelet for the handling implement.

32. A clamping frame for holding articles to be tempered, comprising an article space, an adjustable head-piece or butt, an adjusting nut for said butt, and an eye to receive the handling implement.

33. A tempering apparatus comprising a liquid heating tank, means for heating the liquid in said tank, means for holding the blank to be treated in said tank so as to permit the flow of liquid about the edges of said blank, and means for agitating said blank while in the tank.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM E. NICKERSON.

Witnesses:
L. S. BACON,
CLIFFORD E. DUNN.