

UNITED STATES PATENT OFFICE

1,977,448

PROCESS OF MAKING AUTOMOBILE
BUMPERS AND THE LIKE

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Application November 27, 1925, Serial No. 71,833
Renewed October 21, 1932

28 Claims. (Cl. 29—152)

This invention relates to a method of making automobile bumpers, bumperettes or bumper fittings.

In the manufacture of automobile bumpers, certain of the surfaces are usually provided with a coating of nickel, japan, enamel or other coating material, in order to give a highly attractive appearance to the finished bumper. In preparing the surfaces of the metal for the reception of the coating of nickel or other coating material, the surfaces are ground and polished. The shaping of the stock of which the bumper is formed usually requires the application of heat to reduce the metal to the proper condition for bending. The temperatures required in this operation are such as to cause considerable oxidation of the surfaces of the metal. For this reason, the grinding and polishing of the surfaces of the stock have ordinarily been performed after the bumper has been heated and bent into its final shape. This has been unsatisfactory on account of the inaccessibility of certain parts of the surfaces to be finished to the finishing tools.

The principal objects of the present invention are to improve the processes of manufacture of automobile bumpers and other articles of the classes above stated and to produce an improved process of making these products in which one or more surfaces of a strip of metal of which the bumper or the like is to be formed, are finished or polished while the strip is in a simple form readily accessible to the finishing tools and in which the finished surfaces are protected more effectively from oxidation during the heating, bending, hardening and tempering operations than in processes heretofore devised.

With these and other objects in view, the invention consists in a process embodying the novel and improved features hereinafter described and particularly pointed out in the claims, the advantages of which will be readily understood by those skilled in the art.

In the present application, the process is described with particular reference to the making of an automobile bumper, but it is to be understood that certain features of the invention may also be applied to the making of other articles, such as bumper bars, bumperettes and bumper fittings. The process shown and described in this application contains certain subject matter common to the present process, to that disclosed in applicant's Patent No. 1,917,267 dated July 11, 1933, and to that disclosed in applicant's application Ser. No. 5,818, filed January 30, 1925.

The invention will be clearly understood from

the accompanying drawing illustrating certain steps in the process and the following detailed description of the various features of the process.

In the drawing:

Fig. 1 illustrates a piece of strip steel from which the buffer is to be formed;

Fig. 2 illustrates diagrammatically the manner in which the strip is bent into ring form;

Fig. 3 illustrates one method of surface grinding the strip after it is formed into a ring;

Fig. 4 illustrates the manner in which the rings or ring sections are heated preparatory to the forming operations;

Fig. 5 is a plan view of a mechanism which may be employed in the forming and quenching operations, this view showing the ring in place with relation to this mechanism just before the initial forming operation is performed;

Fig. 6 is a view in vertical section of the mechanism shown in Fig. 5, and illustrating certain of the parts in different positions; and

Fig. 7 is a view illustrating the step of tempering the buffer after it has been bent into its final shape.

In making a bumper by the novel process of the present invention, a steel strip such as shown in Fig. 1 of the desired cross-sectional dimensions and of the length required to make a single bumper or a number of bumpers of the desired design, is employed. This strip may be formed of untempered and unhardened stock of any desired steel composition, and is preferably from $\frac{1}{4}$ " to $\frac{3}{8}$ " in thickness and from $1\frac{1}{2}$ " to $2\frac{1}{2}$ " in width. Highly satisfactory results have been obtained with steel stock containing from .30% to .33% of carbon, this steel being known in the art as "knife back" steel. The finishing operations to prepare the surfaces of the strip for a plating of nickel or other plating metal may be performed when the strip is in a substantially straight or other bar form. Certain of the finishing operations may also be performed after the strip has been bent into buffer form.

In finishing certain surfaces of the strip, while in a substantially straight or other bar form, the strip may be subjected to the action of rotary grinding wheels, graded to produce the proper finishes upon the faces of the bumper. Ordinarily, both the back and front faces of the strip are ground, although where it is desired to reduce the cost, one face only of the strip, which is to form the outer face of the finished bumper may be ground. Both of the lateral faces of the strip, or both edges of the strip may be ground or polished simultaneously by passing the strip be-

tween rotary grinding or polishing wheels arranged in opposed relation.

Preferably instead of finishing the surfaces of the strip while the strip is in substantially straight or other bar form, the strip is rolled while cold into the form of a ring, before the grinding and finishing operations are performed. These operations may be performed more quickly and efficiently when the strip is in ring form. The expressions "ring" or "ring form" are to be understood as not necessarily referring to a perfect circular ring but may include other ring shapes which are rotatable to present different portions of the ring successively to the action of the finishing tools. The rolling operation may be efficiently carried out in a three-roller bending machine as shown in Fig. 2, and the untempered and unhardened condition of the stock enables the same readily to be bent beyond the elastic limit of the steel permanently into a ring formation.

The strip having been rolled into ring form, the ends of the strip are welded together, preferably by an electric welding operation, and the flash formed in the welding operation is then removed in any suitable manner. The rolling operation will usually result in the formation of a slightly flat portion at each end of the strip. After the ends of the strip are welded together, the ring is preferably placed in an expanding or in a shrinking machine which reduces the ring to a substantially perfect circular form, the flat portion at each side of the weld being removed in this operation. The forming of the strip into a ring while cold loosens some of the mill scale and causes a considerable part of the same to flake off, thereby reducing the amount of labor and time that would be required in removing the scale from the surface to be finished by grinding wheel in the first part of the finishing operation.

The grinding and polishing of the ring preparatory to the plating may be performed substantially in the manner described in my co-pending applications Serial No. 745,432, filed October 23, 1924, and No. 5,818, filed January 30, 1925. Both the inner and outer faces of the strip may be ground and polished simultaneously by rotating the ring in contact with revolving grinding and polishing wheels. Thus both the inner and outer surfaces or the inner and outer edges of the bar or strip may be finished simultaneously by rotating the ring between opposed grinding or polishing wheels as shown in Fig. 3. One face only of the ring may be subjected to the action of the finishing wheels, if only one face of the bumper is to be finished.

In finishing the surface of the straight bar or of the ring for the reception of the coating of nickel or other plating, preferably flexible wheels having different grades of emery surfaces are employed successively, the wheels employed in successive operations increasing in fineness. In the final finishing operation a wheel having a very fine emery surface is employed in connection with emery paste, which is a grease containing emery usually of the same fineness as the wheel itself. This wheel tends to smooth out or cause a surface flow of the steel eliminating to a very large extent the grinding marks. This results in the production of a very highly finished surface which is advantageous in securing electro-deposition of nickel or other plating metal.

The length of the strip which is initially employed in the present process may be such as to form a number of bumpers, bumper bars, bumperettes or bumper fittings. The finishing of a strip

of this length, either in bar form or in ring form may be performed much more quickly and efficiently than the finishing of a number of relatively short lengths or sections. The grinding and polishing operations are performed continuously from one end of the strip to the other and the material requires less handling than relative short lengths of material.

After the finishing operations have been performed on the strip, the strip may be cut into a plurality of bars or ring sections of the length required for the bumper, bumper bar or other article to be produced.

The steel is preferably heated by immersing the same in a bath of fused salts having a temperature range between the melting point and the boiling point sufficiently large to secure the desired degree of heat while the bath remains in a liquid condition. This bath material is of such a character that it will have substantially no chemical action upon the steel during its relatively short period of immersion in the bath and that it will adhere to the surface of the metal and protect the same from oxidation when the metal is removed from the bath. This salt bath may consist of any salts or mixtures of salts found suitable to heat the metal to the required temperature during a relatively short period without appreciable action on the metal and to protect the metal from oxidation when removed from the heating bath. Preferably, however, this bath consists of a mixture of 50% potassium chloride and 50% sodium chloride, a bath of this kind having been found to produce the most efficient results in actual practice. Each bar, ring, or ring section, after the finishing operation, is immersed in the heating bath which is heated to a temperature between 1400° F. and 1550° F., depending upon the carbon content of the steel. The bar, ring, or ring section is heated in this salt bath usually from two to three minutes. The immersion of the metal for this length of time in the salt bath is sufficient to heat the metal to the proper temperature for bending into the desired bumper form and for thereafter hardening the metal and does not give the bath material sufficient time to attack the metal and destroy or injuriously alter the fine finish placed upon it in the polishing operations.

The strips in ring, arcuate or other form may be heated in a salt bath in a pot 2 setting in a crucible 4, as shown in Fig. 4.

When the steel has been immersed in the heating bath for the length of time required to heat the metal to the proper temperature for bending and hardening, it is removed from the heating bath with a coating of bath material adhering thereto and bent into the desired shape. The ring, ring section or bar is preferably bent into the desired form by inserting the same in a suitable forming mechanism. When the metal is heated in ring form, the ring may be placed in a forming mechanism of the character disclosed in application, Serial No. 745,432, referred to above and bent into shape by the action of this mechanism. This mechanism is illustrated in Figs. 5 and 6 and comprises forming shoes 6 and 8 secured together in pairs for engagement with the ring at diametrically opposite points therein. These forming shoes are movable away from each other to elongate the ring, and the shoes of each pair are hinged together so that they may be moved into substantially parallel planes, as shown in Fig. 6, to form an end fold buffer.

While the metal is still at a high temperature, and preferably while still held by the forming mechanism, it is immersed in a suitable quenching bath. The forming shoes 6 and 8 may be arranged over a tank 10 containing the quenching bath 12. After the forming shoes have been moved relatively to elongate the ring and to bend the same into the desired buffer form, the shoes are moved downwardly to carry the buffer into the quenching bath, as shown in Fig. 6. After the quenching of the metal the shoes are first moved relatively toward each other and are then moved upwardly to carry the buffer out of the tank. A quenching bath is selected which will quickly dissolve the coating of the mixture of sodium and potassium chlorides from the heating bath adhering to the surface of the metal and which will harden the metal uniformly to the desired degree. The quenching bath employed should also be such as to prevent the formation of oxide on the metal surfaces while cooling and also to provide an adherent coating for protecting the surface of the metal from rapid oxidation when it is removed from the bath.

Quenching baths suitable to produce these results may be made up of various substances or mixtures. In actual practice, a bath of the following proportions has been found to produce highly efficient and satisfactory results:—

500 gallons of water
250 pounds of sodium chloride
125 pounds of sodium cyanide
50 pounds of lime

When the steel is plunged into this quenching bath, the salt coating of the heating bath is instantly removed from the metal and the metal is cooled rapidly and uniformly. The solid constituents of this bath left upon the steel by the evaporation of the water when the steel is removed from the bath protects the metal from rapid oxidation.

When a day's time is to elapse between the removal of the bumper from the quenching bath and the placing of the bumper in the plating bath, the quenching bath is thoroughly agitated to keep the ingredients of the bath in suspension. This causes a relatively heavy coating of the bath constituents to be formed upon the metal when it is removed from the bath to protect the surface from rapid oxidation.

When the steel is to be plated within an hour or two after it is removed from the quenching bath, the quenching bath is not agitated but the precipitates are allowed to settle to the bottom of the bath.

The coating of the quenching bath materials may be easily removed from the steel by washing the same in water.

After the formed bumper has been immersed in the hardening bath, it is removed from the bath preferably while it still retains some of its original heat and is then allowed to cool slowly to room temperature. A slight draw is thus imparted to the steel. The hot metal causes the rapid evaporation of the water from the film of quenching bath solution adhering to the bumper when it is removed from the bath, leaving a coating of the solid constituents of the bath thereon. During the quenching operation, sizzling takes place while the metal is cooling, which gradually diminishes and this constitutes an indication as to the proper time for withdrawing the steel from the bath.

During the quenching operation the bumper is subjected to heavy internal stresses and should then be held from distortion by suitable mechanism. The bumper may be held on the forming mechanism during the quenching operation to hold the same from distortion.

Instead of removing the bumper from the quenching bath while it retains some of its original heat, it may be left in this bath until it has cooled substantially to the temperature of the bath and then removed from the bath and heated to a suitable temperature to draw the temper to the desired degree. The heating of the bumper to temper same may be performed by placing the bumper in a suitable heating bath as described in applicant's co-pending application, Serial No. 5,818, filed January 30, 1925. Fig. 7 shows the formed buffer immersed in a heating bath 14 contained in a pot 16. This pot is inserted in the crucible 18. The temperature suitable for this operation, I have found to be between 600° F. and 800° F., depending upon the carbon content of the steel.

The immersion of the metal in the heating and quenching baths removes all traces of the grease which may remain on the metal after the final finishing of the same with emery paste. This is highly important since a film of grease upon the surface of the steel to which the plating material is to be applied may ruin the plating operation. The bumper, after removal from the quenching bath and after its temper is drawn is subjected to a cleansing operation before receiving further treatment for the production of a finished bumper. When the bumper is to be nickled it is placed in a bath of hot alkali in order to remove any oil on the surface which may come from the hands of the operator or from the contact of the bending mechanisms therewith. To increase the effectiveness of the grease-removing action an electric current is preferably passed through the solution with the bumper as one pole and with the tank as the opposite pole, thereby setting up an electrolytic action in the solution. The alkali solution not only removes any oil or grease but also assists in the removal of the sodium cyanide and sodium chloride and other substances of the sodium bath adhering to the bumper. The bumper is then thoroughly washed in water to remove the alkali and is then placed in a pickling solution of hydrochloric or other suitable acid, to remove any traces of oxide which may have formed at the points at which the forming mechanism contacted with the bumper during the forming operation, thus excluding the quenching medium from contact at these points. This oxide is ordinarily removed by allowing the bumper to remain in the pickling solution from 15 to 30 seconds. The bumper is then removed from the pickling solution, and is thoroughly washed in water to remove all traces of the acid.

The bumper, after it is cleansed in the manner above described, is ready for insertion in the plating bath. The plating operation may be performed in accordance with any of the usual methods to secure a deposition of plating metal of the desired thickness upon the finished surface of the bumper. After the plating operation the bumper is again washed to remove all traces of the plating solution and is then dried. The plated surfaces of the bumper are then preferably subjected to the action of rotating buffing wheels to give these surfaces a high polish.

When a relatively thin strip of steel stock having a highly polished surface is heated to harden-

ing temperature in a salt bath of the above character which protects the polished surface from oxidation and is then plunged into an aqueous quenching bath, such as that described in this application, a mottled appearance will be imparted to the polished surface of the steel. This mottled effect is reproduced upon the surface of the metal plating which follows the somewhat irregular surface of the steel formed by heating and quenching the steel in the manner described. This mottled appearance on the nickel surface is similar in appearance to hammered silver except that the reflecting surfaces or facets are not nearly so pronounced. As the treatment of the steel is varied to impart diminishing degrees of hardness to the same, these facets become smaller and smaller until, with a treatment which imparts a relatively low degree of hardness to the steel, they practically disappear. These individual reflecting surfaces reflect the light in many different directions as compared with the smooth or plane surfaces formed under ordinary conditions and thus give a very distinctive appearance to the nickel surface of the bumper.

If it is desired to manufacture a bumper having an unground surface in accordance with the present process, the grinding and polishing operations may be eliminated. The strip of steel in the form of a ring or in any other simple form without any preliminary surface finishing or grinding, but with the mill scale adhering thereto, can be inserted in the salt heating bath, formed into bumper or other shape and then quenched in the quenching solution. The heating of the metal and the immersion of the same in the quenching solution removes practically all the mill scale so that the bumper, after washing and drying, is ready to receive a coating of japan, enamel or similar coating material. However, if it is desirable to polish one surface of the strip of steel, this surface can be ground, leaving the mill scale on the edges of the strip and on the opposite surface thereof. When the strip is then inserted in the salt heating bath and thereafter is immersed in the quenching solution, the mill scale is substantially removed and the bumper can then be nickel-plated or japanned. When this method is followed, the bumper after receiving a coating of japan or nickel will be provided with a smooth surface having a high polish on the outside only of the bumper. When the bumper is to be nickel-plated, it is important to remove the mill scale completely on the surfaces to be plated. The immersion of the metal in the heating and quenching baths does not produce this result but there are very minute surfaces where the scale still adheres. This is not objectionable when the bumper is japanned or enameled. When the bumper is nickeled, these minute particles of scale are removed in the pickling operation.

In making an unplated bumper in accordance with the present process, the bumper after removal from the quenching bath and after its temper is drawn, is thoroughly washed in water and dried. A coating of japan, enamel or other suitable coating material may then be applied to the surface of the bumper to give the same the desired finish.

Having explained the nature and object of the invention, and having specifically described the manner in which the invention may be applied, what I claim as new is:

1. The process of making automobile bumpers and the like which comprises the finishing of a strip of unhardened steel for the reception of a

nickel or other coating, heating said strip in a fused salt bath to hardening temperature, bending the heated strip into bumper or other form while a coating of the fused salt remains thereon, plunging the same into an aqueous quenching medium which hardens the metal and produces a mottled effect on the finished surface and at the same time removes the adherent coating of the salt therefrom, withdrawing the formed bumper or the like from the aqueous quenching medium while still at a temperature sufficient for drawing the temper of the steel and causing the rapid evaporation of the water portion of the quenching medium, leaving its solid constituents on the surface of the steel to protect the surface from rapid oxidation, and thereafter cleaning and applying a finishing coating.

2. The process of making automobile bumpers and the like, comprising the rolling of a strip of unhardened steel into ring form, finishing the strip while in ring form for the reception of a nickel or other coating, heating said ring in a fused salt bath to hardening temperature, bending the ring into bumper or other form while a coating of the fused salt remains thereon, plunging the ring into an aqueous quenching medium which hardens the metal and produces a mottled effect on the finished surface and at the same time removes the adherent coating of the salt therefrom, withdrawing the formed bumper or the like from the aqueous quenching medium while still in a heated state, thereby drawing the temper of the steel and causing the rapid evaporation of the water portion of the quenching medium, leaving its solid constituents on the surface of the steel to protect the surface from rapid oxidation, thereafter cleaning and applying a finishing coating.

3. The process of making automobile bumpers and the like, comprising the finishing of a strip of unhardened steel for the reception of a nickel or other coating, heating said strip in a fused salt bath to hardening temperature, bending the heated strip into bumper or other form while a coating of the fused salt remains thereon, plunging the same into an aqueous quenching medium which hardens the metal and removes the adherent coating of the salt therefrom, removing the formed bumper or the like from the aqueous quenching medium while still at a temperature sufficiently high for tempering the steel and causing the rapid evaporation of the water portion of the quenching medium, leaving its solid constituents on the surface of the steel to protect the surface from rapid oxidation, thereafter cleaning and applying a finishing coating.

4. The process of making automobile bumpers and the like, comprising the rolling of a strip of unhardened steel into ring form, finishing the strip while in ring form for the reception of a nickel or other coating, heating said ring in a fused salt bath to hardening temperature, bending the heated ring into bumper or other form while a coating of the fused salt remains thereon, plunging the ring into an aqueous quenching medium which hardens the metal and removes the adherent coating of the salt therefrom, withdrawing the formed bumper or the like from the aqueous quenching medium while still at a temperature sufficiently high for drawing the temper of the steel and causing the rapid evaporation of the water portion of the quenching medium, leaving its solid constituents on the surface of the steel to protect the surface from rapid oxidation,

thereafter cleaning and applying a finishing coating.

5. The process of making automobile bumpers and the like, comprising the heating of a strip of unhardened steel in a fused salt bath to hardening temperature, bending the heated strip into bumper or other form while a coating of the fused salt remains thereon, plunging the same into an aqueous quenching medium which hardens the metal and removes the adherent coating of the salt therefrom and also removes substantially all of the mill scale, withdrawing the formed bumper or the like from the aqueous quenching medium while still at a temperature sufficiently high to draw the temper of the steel and to cause the rapid evaporation of the water portion of the quenching medium, leaving its solid constituents on the surface of the steel to protect the surface from rapid oxidation, thereafter cleaning and applying a finishing coating.

6. The process of making automobile bumpers and the like, comprising the rolling of a strip of unhardened steel into ring form, heating said ring in a fused salt bath to hardening temperature, bending the heated ring into bumper or other form while a coating of the fused salt remains thereon, plunging the ring into an aqueous quenching medium which hardens the metal and removes the adherent coating of the salt therefrom and also dislodges substantially all of the mill scale, withdrawing the formed bumper or the like from the aqueous quenching medium while still at a temperature sufficiently high to temper the steel and to cause the rapid evaporation of the water portion of the quenching medium, leaving its solid constituents on the surface of the steel to protect the surface from rapid oxidation, thereafter cleaning and applying a finishing coating.

7. The process of making automobile bumpers and the like, comprising the rolling of a strip of unhardened steel into ring form, finishing the outer surface of the ring for the reception of a nickel or other coating, heating said ring in a fused salt bath to hardening temperature, bending the heated ring into bumper or other form while the coating of the fused salt remains thereon, plunging the same into an aqueous quenching medium which hardens the metal and removes the adherent coating of the salt therefrom and also removes the greater part of the mill scale from the unfinished surfaces, withdrawing the formed bumper or the like from the aqueous quenching medium while still at a temperature sufficiently high for drawing the temper of the steel and causing the rapid evaporation of the water portion of the quenching medium, leaving its solid constituents on the surface of the steel to protect the surface from rapid oxidation, thereafter cleaning and applying a finishing coating.

8. The process of making automobile bumpers and the like, which comprises the finishing of a strip of unhardened steel for the reception of a nickel or other coating, severing said strip into a plurality of sections, heating said strip sections in a fused salt bath to hardening temperature, bending the said sections into bumper or other form while a coating of the fused salt remains thereon, plunging said sections into an aqueous quenching medium which hardens the metal and produces a mottled effect on the finished surfaces and at the same time removes the adherent coating of the salt therefrom, withdrawing the formed bumpers or the like from the aqueous quenching

medium while still hot, thereby tempering the steel and causing the rapid evaporation of the water portion of the quenching medium, leaving the solid constituents on the surface of the steel to protect the surface from rapid oxidation and thereafter cleaning and applying a finishing coating.

9. The process of making automobile bumpers and the like, which comprises the finishing of a strip of unhardened steel for the reception of a nickel or other coating, severing said strip into a plurality of sections, heating said strip sections in a fused salt bath to hardening temperature, bending the heated strip sections into bumper or other form while the coating of the fused salt remains thereon, plunging said sections into an aqueous quenching medium which hardens the metal and removes the adherent coating of the salt therefrom, removing the formed bumpers or the like from the aqueous quenching medium while still hot, thereby tempering the steel and causing the rapid evaporation of the water portion of the quenching medium, leaving its solid constituents on the surface of the steel to protect the surface from rapid oxidation, thereafter cleaning and applying a finishing coating.

10. The process of making automobile bumpers and the like, comprising the finishing of one lateral surface of a strip of unhardened steel for the reception of a nickel or other coating, severing said strip into sections, heating said strip sections in a fused salt bath to hardening temperature, bending the heated strip sections into bumper or other form while a coating of the fused salt remains thereon, plunging the strip sections into an aqueous quenching medium which hardens the metal and removes the adherent coating of the salt therefrom and also removes a greater part of the mill scale from the unfinished surfaces, and withdrawing the formed bumpers or the like from the aqueous quenching medium while still hot, thereby tempering the steel and causing the rapid evaporation of the water portion of the quenching medium, leaving its solid constituents on the surface of the steel to protect the surface from rapid oxidation, thereafter cleaning and applying a finishing coating.

11. The process of making automobile bumpers and the like, comprising the finishing of a strip of unhardened steel for the reception of a nickel or other coating, severing said strip into a plurality of sections, heating said strip sections in a fused salt bath to hardening temperature, bending the heated strip sections into bumper or other form while a coating of the fused salt remains thereon, plunging the same into an aqueous quenching medium which hardens the metal and removes the adherent coating of the salt therefrom, withdrawing the formed bumpers or the like from the aqueous quenching medium and tempering the steel, thereafter cleaning and applying a finishing coating.

12. The process of making automobile bumpers and the like which comprises the finishing of a strip of unhardened steel for the reception of a nickel or other coating, severing said strip into a plurality of sections, heating said strip sections in a fused salt bath to hardening temperature, bending the heated sections into bumper or other form while a coating of the fused salt remains thereon, plunging the same into an aqueous quenching medium which hardens the metal and removes the adherent coating of the salt therefrom, withdrawing the formed bumpers or the like from the aqueous quenching medium and

tempering the steel, thereafter cleaning and applying a finishing coating.

13. The process of making automobile bumpers and the like which comprises the rolling of a strip of unhardened steel into ring form, finishing the strip while in ring form for the reception of a nickel or other coating, severing said ring into a plurality of ring sections, heating said ring sections in a fused salt bath to hardening temperature, bending the heated ring sections into bumper or other form while a coating of the fused salt remains thereon, plunging the ring sections into an aqueous quenching medium which hardens the metal and removes the adherent coating of the salt therefrom, withdrawing the formed bumpers or the like from the aqueous quenching medium and tempering the steel, thereafter cleaning and applying a finishing coating.

14. The process of making automobile bumpers and the like, comprising the heating of a strip of unhardened steel in a fused salt bath to hardening temperature, bending the heated strip into bumper or other form while a coating of the fused salt remains thereon, plunging the same into an aqueous quenching medium which hardens the metal, withdrawing the formed bumper or the like from the quenching medium while still sufficiently heated to cause the relatively rapid evaporation of the water portion of said medium, leaving its solid constituents on the surface of the steel to protect the surface from rapid oxidation, thereafter cleansing the steel and applying a finishing coating.

15. The process of making automobile bumpers and the like, comprising the rolling of a strip of unhardened steel into ring form, heating said ring in a fused salt bath to hardening temperature, bending the heated ring into bumper or other form while a coating of the fused salt remains thereon, plunging the ring into an aqueous quenching medium which hardens the metal, withdrawing the formed bumper or the like from the quenching medium while still sufficiently heated to cause the relatively rapid evaporation of the water portion of said medium, leaving its solid constituents on the surface of the steel to protect the surface from rapid oxidation, thereafter cleaning and applying a finishing coating.

16. The process of making automobile bumpers or the like which comprises heating a strip of unhardened steel in a fused salt bath to hardening temperature, bending the heated strip into bumper or other form while a coating of the fused salt remains thereon, plunging the same into an aqueous quenching medium which hardens the metal, withdrawing the formed bumper or the like from said medium while still heated, and thereafter cleaning and applying a finishing coating.

17. The process of making automobile bumpers or the like, comprising the rolling of a strip of unhardened steel into ring form, heating said ring in a fused salt bath to hardening temperature, bending the heated ring into bumper or other form while a coating of the fused salt remains thereon, plunging the same into an aqueous quenching medium which hardens the metal, withdrawing the formed bumper or the like from said medium while still heated, and thereafter cleaning and applying a finishing coating.

18. The process of making automobile bump-

ers or the like, comprising finishing a surface of a strip of steel for the reception of a nickel coating, bending the strip into the desired bumper or other form, and plating with nickel the finished surface of the strip.

19. The process of making automobile bumpers which comprises heating a relatively narrow strip of steel to a temperature suitable for bending the same, bending the strip into the required bumper or other shape, and quenching the steel in an aqueous quenching bath containing mineral salts for protecting the surface of the steel from oxidation when removed from the bath.

20. The process of making automobile bumpers and the like which comprises heating a strip of steel in a fused salt bath to bending temperature, bending the heated strip into bumper or other form while a coating of the fused salt remains thereon, plunging the steel into an aqueous quenching medium containing mineral salts to protect the surface of the steel, and withdrawing the formed bumper or the like from the quenching medium while still sufficiently heated to cause the rapid evaporation of the water portion of said medium, leaving its solid constituents on the surface of the steel to protect the same from rapid oxidation.

21. The process of making automobile bumpers and the like comprising the heating of a strip of steel in a fused salt bath to bending temperature, bending the heated strip into bumper or other form while a coating of the fused salts remains thereon, plunging the bumper into an aqueous quenching medium and withdrawing the formed bumper or the like from the medium while still heated.

22. The process of making automobile bumpers or the like which comprises heating a strip of steel to a relatively high temperature and plunging the strip into a quenching bath having a relatively low temperature and containing suitable salts to protect the surfaces of the steel.

23. The process of making automobile bumpers and the like which comprises heating a strip of steel in a bath of fused salts to a relatively high temperature and plunging the strip into a quenching bath containing suitable salts to protect the surfaces of the steel.

24. In a process of making automobile bumpers, heating a strip of steel to a relatively high temperature, plunging the strip into a quenching bath, removing the strip from the bath while hot, and allowing the same to cool.

25. In a process of making automobile bumpers, heating a strip of steel to a high temperature, bending the strip into the required bumper or other shape, plunging the strip into a quenching bath, removing the strip from the bath while still hot and allowing the same to cool.

26. In a process of making automobile bumpers, bending a strip of steel into ring form, bending the ring into bumper shape, and applying a finishing coating to the bumper.

27. In a process of making automobile bumpers, bending a strip of steel into ring form, bending the ring into bumper shape, and finishing certain surfaces of the bumper.

28. In a process of making automobile bumpers, bending a strip of steel into ring form, finishing one or more surfaces of the ring, and cutting the ring into sections.

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