April 28, 1942. M. STÖSSEL 2,280,866

PRODUCTION OF SPRAY METAL NEGATIVES OF MODELS

Filed May 29, 1940

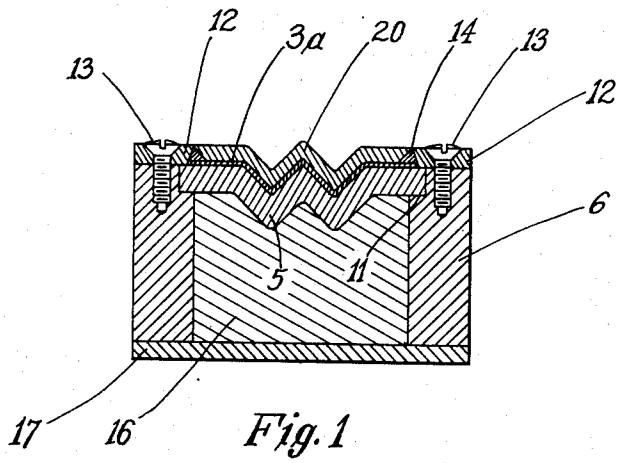


Fig. 1

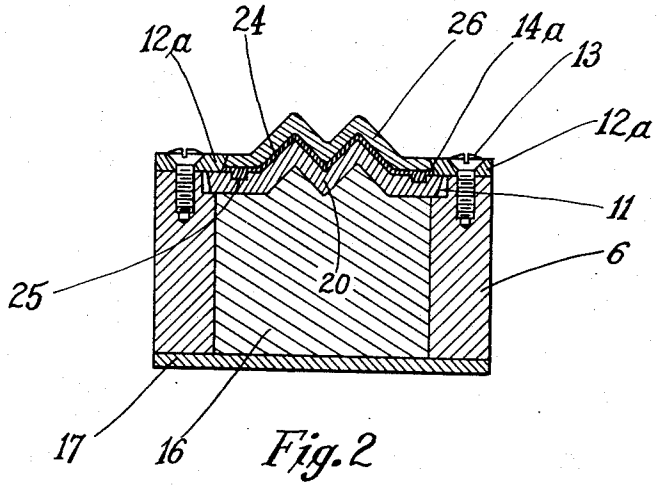


Fig. 2

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Patented Apr. 28, 1942 2,280,866

UNITED STATES PATENT OFFICE

2,280,866

PRODUCTION OF SPRAY METAL NEGATIVES OF MODELS

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Original application May 22, 1939, Serial No. 274,951. Divided and this application May 29, 1940, Serial No. 337,791. In Great Britain January 11, 1938

4 Claims. (Cl. 22—190)

The invention relates to the production of spray metal negatives of models, and particularly the production of molds, dies, patterns, or the like, of the type that are useful in the casting or molding of plastics such as synthetic resins, rubber, Celluloid or glass and the like. This is a division of my application Serial No. 274,951 filed May 22, 1939.

At the present, molds for this use are generally produced by cutting the molds from solid metal blocks by means of machining and engraving tools. This method involves considerable time and expense and is not commercially practicable for low-cost production, except when the molds thus made are used in mass production, where the cost of the mold can be distributed over numerous products made therefrom. Even then the length of time necessary to produce a mold is a material drawback.

A few attempts have been made to produce molds for this work by spraying metal upon a model or a positive and thus forming a mold or negative. Such attempts were unsuccessful because of distortion and inaccuracy and the tendency of the sprayed metal to peel off the model, particularly when spraying with metals having a fusion point above 600° C. This tendency to peel is apparently due to uneven thermal stresses produced in the metal when it is sprayed upon the model and is particularly prevalent when the metal is sprayed to a thickness exceeding 0.1 millimeter, or 0.0025 inch. This "peeling" makes it impossible to spray an accurate negative or mold having sufficient strength or rigidity for any practical use.

It is the purpose of my present invention to produce an accurate and usable negative or mold economically and commercially by spraying a model, either the original or a reproduced model, in such a manner as to overcome the heretofore mentioned difficulties, as well as other defects and limitations. If it is desired to spray an original article, it is of course understood that the surface of such article must be one adapted to be coated with spray metal.

Further objects and their resultant advantages will be apparent from the following description taken in connection with the following drawing in which:

Fig. 1 is a vertical section illustrating the making of a negative in accordance with the invention; and

Fig. 2 is a vertical section of a further illustration showing the making of a negative in accordance with the invention.

In accordance with the invention, a frame member is placed around a suitable model so as to form a shoulder along and in contact with the model surface, whereupon metal is sprayed onto the model into the space defined by the model surface and the frame member until the desired thickness is obtained, the model being thereafter separated from the spray metal negative thusly produced.

Specifically referring to the drawing a spray metal negative, according to the invention, may be produced for example in the following manner:

The model is preferably placed in a frame support 6 in order to insure against possible deformation or distortion of the model. The frame support 6 has its upper edge channeled at 11 to receive the edge portion of the model 5. An upper clamping plate or frame 12, which is preferably of sufficient width to overlap the top surface of the model, may be secured to the base portion by screws 13 or any other suitable means. The inner edge of the clamping plate or frame 12 may be beveled as at 14 and is preferably roughened in any suitable manner. It is preferred to further support the model 5 by filling the frame support 6 beneath the model 5 with some supporting material such as metal or sand 16 and to close the frame support with a bottom plate 17. It is also of advantage to coat the beveled edge 14 of the plate or frame 12 with a suitable low melting point metal, such as tin, to facilitate separation of the negative from the model. This may be done by spraying, dipping or plating. The inner surface of the model 5 is then sprayed with successive layers 20 of a suitable metal such as bronze until a negative of the model of the desired thickness of the metal 20 has been formed. It is of advantage to apply these layers of metal 20 by first spraying a relatively thin layer over the entire surface of the model and against the inner sloping edge 14 of the plate or frame 12, after which the metal 20 is preferably thickened around the marginal edge and against the edge 14. Thus, when proceeding in accordance with the invention, the final layers are retained and held in contact with the model and the metal is prevented from peeling or separating from the surface of the model 5. Additional layers of metal may be sprayed on until any desired thickness has been reached, preferably until the center is as thick as the edge. Ordinarily, a thickness of 0.25 to 0.4 inch is sufficient to give the desired and necessary strength to the negative of the model. After a spray

metal negative of the source of the desired thickness or strength of metal **20** has been prepared, it may be removed from the model. If the beveled edge **14** of the frame **12** was previously tin coated, the removal of the spray metal negative from the frame is facilitated by melting the tin.

If desired, the model surface may be constituted of a metal having a melting point lower than the melting point of the spray metal of which the negative is to be formed. Selection of such a model has the advantage of permitting separation of the spray metal negative from the model by heating them to the melting point of the low melting point metal. In the specific embodiment illustrated in the drawing, the layer **3***a* of low melting point metal, such as tin, is so heated, thus severing the bond between the spray metal negative, composed of the relatively harder metal **20**, and the model **5**, permitting the two to be readily separated. After separation, the spray metal negative is preferably carefully cleaned by brushing, while still hot, dipping into an acid or by any other suitable method.

If desired, the spray metal negative, obtained in accordance with the foregoing, may then be used for making a duplicate of the original model. As shown in the drawing (Fig. 2) such duplicate may be made for instance as follows:

The spray metal negative **20** is, for example, clamped in and supported by a frame support **6**, as described in connection with the first model **5** (Fig. 1), in order to avoid distortion of the model while the metal is being sprayed thereon. For example, the first negative **20** may be inverted and seated in the recessed frame support **6**, as shown in Fig. 2 and preferably held therein by an upper clamping plate or frame **12***a* having, if desired, a sloping edge **14***a* and preferably an inner diameter, smaller than that of frame **12**, to retain the inverted negative **20** within the frame support **6**. As in the case of preparing the first negative, the lower side of the inverted negative **20**, when placed in the frame support **6**, is preferably also supported by a metal **16** or sand, or some other suitable material. In order to assure good adherence of the metal used for building the second spray metal negative the inverted negative **20** is preferably covered with a relatively thin coating **24** of metal of relatively low melting point such as tin, cadmium or zinc. This coating may be applied by hot dipping or, preferably, by electro-plating and not only aids in the adherence of the spray metal to the inverted negative but also facilitates separation of the two after the duplicate is completed. The inverted coated negative **20** is then sprayed with successive layers **26** of suitable higher melting point metal (relative the coating metal) until a spray metal coating of the desired thickness has been produced. The layers **26** of sprayed metal will build up under the inclined edge **14***a* of frame **12***a*. The second spray metal coating **26**, constituting a duplicate of the original model **5**, can be readily separated from the inverted first negative by heating the two to the melting point of the coating of lower melting point metal **24** to break the bond between the duplicate and the negative.

The inverted negative **20** may be notched or grooved, if desired, as at **25**, which notches or grooves are filled with low melting point metal. This additional amount of low melting point metal becomes fused and seeps in between the duplicate and the negative when they are heated and further facilitates separation.

In certain cases where extreme precaution is required, to prevent possible distortion of the model while the metal of the negative is being sprayed thereon, it may be desirable to cool the model while the metal is so sprayed. This can be accomplished readily by circulating a cooling medium through the lower portion of the frame support **6**.

It will be obvious to those skilled in the art that molds may be produced in accordance with the foregoing much quicker than the usual weeks of time now required and at a cost materially less than heretofore. Accurate molds may be produced at a low cost, which molds are satisfactory and adequate for the reproduction of molded articles even if such articles are desired for samples or small consumption rather than for mass production, in which case it was heretofore economically impossible to do this because of the expense in producing a mold.

The spray metal negative or mold produced in accordance with the invention may be used either for the production of another model or the reproduction of articles.

The material of which a spray metal is to be made may be selected according to the conditions to which it is to be subjected or the use to which it is to be put. For example, aluminum or aluminum alloys, bronze or similar metals may be used if little strain is to be put on the mold or if the number of articles to be made therefrom is small. If, on the other hand, however, the mold is to be used for mass production, or if for any other reason it must be of harder material, such metals as steel, nickel or chrome-nickel alloys, or the like may be used.

It will be apparent to those skilled in the art that minor variations and deviations from the foregoing as described may be indulged in without departing from the spirit and scope of this invention, as defined in the appended claims.

I claim:

1. Method of preventing warping in the manufacture of a spray metal negative of a model adapted to be coated with spray metal, which comprises placing a frame member substantially in delimitation of the model surface and immediately adjacent to the border of such surface so as to define a shoulder with said surface, applying to such model and said frame member a coherent coat of spray metal, said coat being anchored to the frame member by the spray metal within the corner defined by said shoulder and being so bonded as to be strippable from said model, removing substantially intact the spray metal shell thus formed overlying said model and recovering a substantially accurate non-warped spray metal negative of said model.

2. Method in accordance with claim 1 in which the inner surface of said frame member is provided prior to the spraying operation with a coating of a metal of a melting point lower than the melting point of said spray metal, in which that portion of said coat overlying the coated frame member is relatively highly bonded thereto and in which said low melting point metal coating, in removing said spray metal shell, is heated to its melting point.

3. Method of preventing warping in the manufacture of a spray metal negative of a model adapted to be coated with spray metal which comprises placing a frame member substantially in delimitation of the model surface and immediately adjacent to the border of such surface so as to define a shoulder with said surface, applying to such model and said frame member a rela-

tively thin coherent coat of spray metal, said coat being anchored to the frame member by the spray metal within the corner defined by said shoulder and being so bonded as to be strippable from said model, spraying additional metal into said corner to further anchor said coat to said frame member, spraying metal on the coated model until said model is covered with metal to the desired thickness, removing substantially intact the spray metal shell thus formed overlying said model, and recovering a substantially accurate, non-warped spray metal negative of said model.

4. Method in accordance with claim 3 in which the inner surface of said frame member is provided prior to the spraying operation with a coating of a metal of a melting point lower than the melting point of said spray metal, in which that portion of said coat overlying the coated frame member is relatively highly bonded thereto and in which said low melting point metal coating, in removing said spray metal shell, is heated to its melting point.

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