A NEW PROCESS FOR DAMASCENING, INLAYING, AND BLENDING METALS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

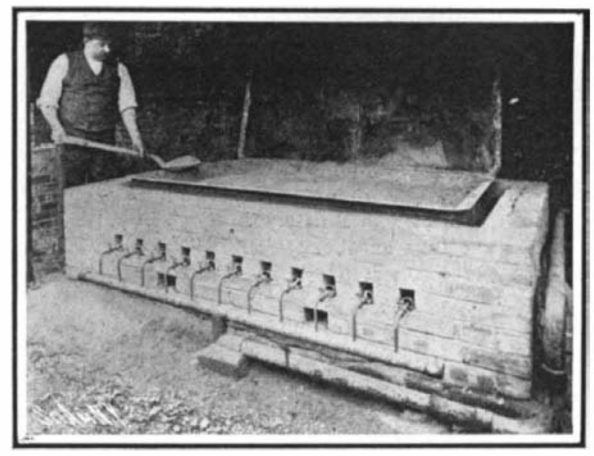
The beautiful art of damascening, the origin of which is buried in the depths of antiquity, but which no doubt hails from the East, has been subjected to repeated modifications during the past few years in order to render it more commercially applicable than it probably ever was even in its halcyon Oriental days. The hand-wrought work so exquisitely performed at the expenditure of considerable time centuries ago is far too costly for the present age, except to the connoisseur. This process briefly consisted in chasing the design upon a metallic foundation of the object to be decorated and then filling the incisions with fine wire or strips of other metal, generally silver and gold, by means of a special tool, the whole finally being smoothed and polished. In order to render the inlay as immovable as possible, the recesses were undercut, so that the decorative metals were in reality dovetailed into the main fabric.

Prayer book cover in copper inlaid with zinc.

Such a delicate operation calls for remarkable skill and patience combined with a sensitive hand, and for this reason cannot be executed by machinery. Yet at the same time there prevails at the present day a widespread demand for metal inlay work, and various methods have been evolved for the more rapid and cheaper accomplishment of the work, such as the ether, parcel, or close plating, fusion, electrical, and lead processes. Recently, however, attention has been centered in the new system of inlaying and ornamenting metallic surfaces that has been perfected by Mr. Sherard Cowper-Coles, the well-known British electro-metallurgist, which possesses great commercial possibilities, owing to the exquisite character of the work, combined with the rapidity and cheapness with which it can be carried out.

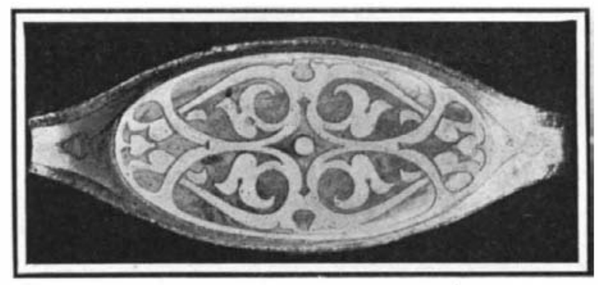
This process is based upon a discovery made by the inventor some five years ago during a series of experiments upon which he was engaged in connection with the annealing of iron. In the course of these investigations he found that metals in a fine state of division, that is in the form of powder, when raised to a certain temperature which was actually several hundred degrees below their melting point, in contact with a solid metal, volatilize or give off vapor, which condenses on the solid metal immersed in the powdered metal. Recently the inventor in following up the discovery has turned it to distinct advantage for decorative work, the results of which are similar to damascening, but with the additional and important advantage that there is no possibility of the metals so blended together subsequently becoming separated, as is often the case in ordinary damascening. At the same time it also enables a more extensive range of effects to be secured, as a large number of metals can be blended together which previously have been impossible, and alloys of many colors and tints can be obtained in one operation of baking. Moreover, the thickness and depth to which the metals are to be inlaid and onlaid can be controlled at the will of the operator.

The process is exceedingly simple. The article to be decorated is first covered with a stopping-off solution about the consistency of cheese, and can thus be easily cut with a knife. The design of the desired inlay is then executed upon this composition by means of a specially designed tool having a sharp edge.



Oven in which the damascening is done.

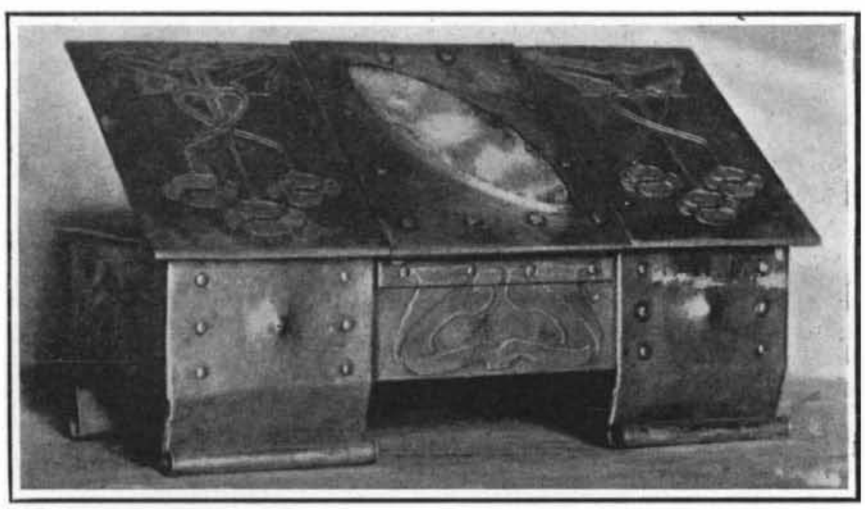
The articles to be decorated are covered with metal dust and then heated to the required temperature.



Copper tray covered with the stopping-off composition ready for baking.

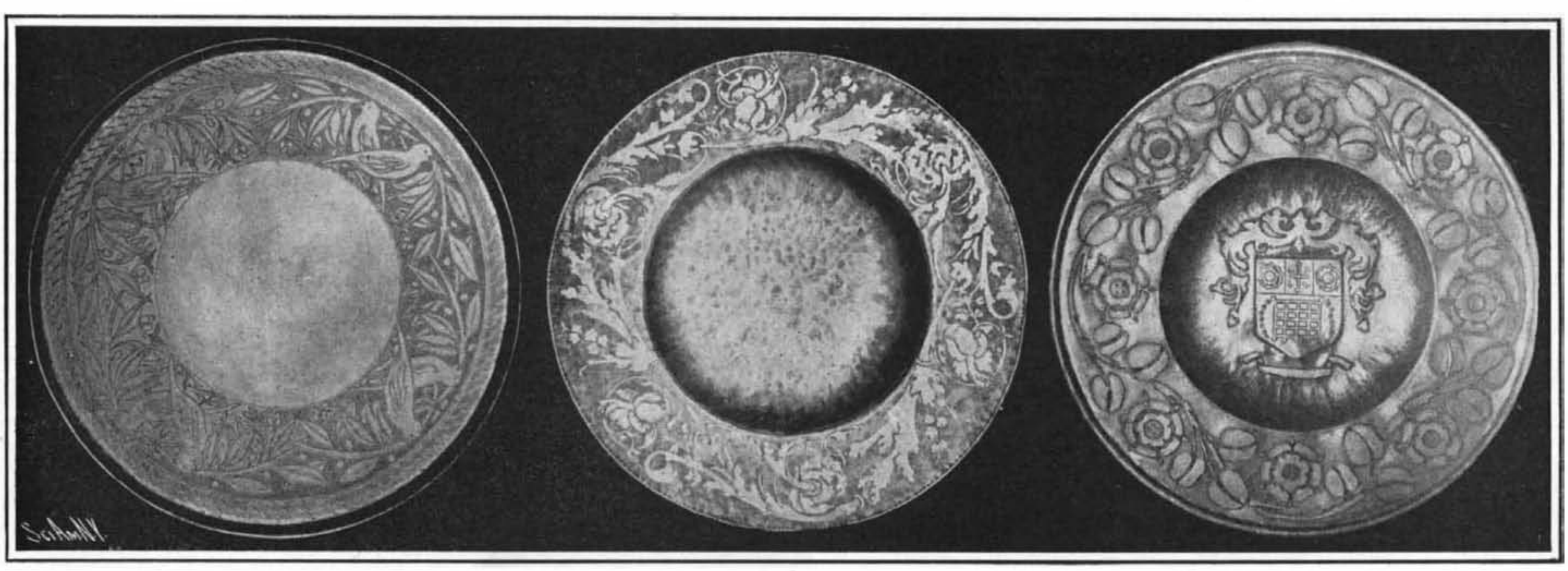
Those portions to be removed are then lifted and cleared away, leaving the surface of the foundation metal exposed. This operation completed, the article is placed in an iron box containing the metal which is to be used for the inlay in a powdered form. If, for instance, the inlay metal is to be zinc, the box is accordingly charged with zinc dust, a product obtained direct from the zinc-smelting furnaces. The iron re-

Copper teapot inlaid with zinc and brass.



Iron box inlaid with zinc and enamel.

Copper and brass vessel inlaid with zinc.



Copper tray inlaid with zinc and brass.

Foliage and birds a combination of brass and copper.

Hammered copper dish inlaid with zinc.

Hammer marks show through the inlay.

Copper dish inlaid and onlaid with zinc.

Onlay is raised as much as $\frac{1}{16}$ inch above the copper surface.

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ceptacle, together with the objects to be ornamented and the zinc dust, are inserted in a suitable baking oven and heated to a temperature of about 500 deg. Fahr., while the melting point of zinc is 686 deg. Fahr. The time and temperature vary according to the thickness and depth of the inlaying which is required, and range from a few minutes to several hours. A little experience, however, soon teaches the operator the precise time and temperature necessary for obtaining given results with different metals.

When the article has been sufficiently baked, the box is permitted to cool, opened, and the articles withdrawn. Brushing with a stiff brush serves to remove the superfluous dust and also the stopping-off composition which the process of baking has loosened. The stopping-off and baking processes can be repeated several times when it is desired to inlay two or more metals.

The point may be raised that the metal box containing the metal dust will in a short time become thickly incrusted with metal, but such experience has proved not to be the case, for the reason that the metal box is hotter than the powdered metal. A useful type of furnace or baking oven for general work, such as panels, trays, and other flat articles, is that shown in the accompanying illustration. It consists of an iron vessel 8 feet in length by 4 feet in breadth and 1 foot deep. The box is half filled with the metal dust, and the objects to be treated are well immersed in the powder, care being observed that they are adequately covered over therewith. The box is covered with a lid, and over this an iron framework is placed carrying fire bricks and provided with a small central flue to draw the heat from the burners up the sides of the box and over the top, to secure even and regular heating over its whole surface. Such a furnace can be constructed at a cost of about $150 complete.

The damascening produced by this method is of a more permanent character than the ordinary ancient hand-wrought process. It is impossible for the inlay to become detached from its foundation, for the simple reason that the two under the application of the heat become alloyed together. It is also found that the inlaying metal in the case of zinc is very much harder than the brass or copper into which it is inlaid.

One very notable feature of the process, which is of considerable importance, is that a wide variety of colors and alloys can be obtained in the one operation of baking. For instance, a copper tray is to be inlaid with zinc, and at the same time it is desired to convert certain portions of the copper into brass. This is accomplished by varying the thickness of the stopping-off composition, and by baking at a somewhat higher temperature than would otherwise be employed. The result is that certain portions become converted into golden-colored brass, while the other portions remain unalloyed copper. The inlay work is carried out so delicately and evenly, that in hammered metal objects the hammer marks in the original article will show through the inlay as if the decorative metal had been hammered in. If desired, the metal foundation can possess the stippled hammered effect while the inlay has a smooth surface, thus giving a striking and pleasing contrast. Some of the effects obtained are very beautiful in character. The zinc inlay can be made so that it is surrounded by a fine line of brass, or be both inlaid and onlaid, in which event the latter ornamentation can be raised as much as one-sixteenth of an inch above the surface of the copper. Again, iron can be inlaid with both zinc and enamel, which yields an attractive effect, or a variety of hues produced by burning the whole of the copper surface with zinc and then etching the pattern down to the different alloys formed intermediate between zinc and brass. By this arrangement the variety of tones secured is both extensive and beautifully graded. It must not be thought that the effects secured are only obtainable by the use of zinc and copper. Such is not the case, since the more subtle shadings and hues between tin, aluminium, nickel, cobalt, and other metals can be as easily produced. In the photographs accompanying this article the contrasts of zinc and copper only are shown, for the simple reason that the colors possible by using other metals do not produce a sufficiently striking effect in a photograph.

Nor is the process merely confined to the embellishment of flat surfaces. It is as readily applicable to raised surfaces and objects of all shapes and sizes, such as teapots, coal vases, and other similar articles. It can also be adapted to the finest filigree as easily as to bold work, as is required in panels or heraldry. An important development has been in connection with its application to book covers, the appearance of such damascened metal-bound volumes being appreciably enhanced.

One distinct charm about this new process, and one that moreover is unique, is the absence of the sharp line of demarkation as is characteristic of damascening. Instead there is a soft transition from the inlay to the surrounding foundation metal. That is to say, where zinc is inlaid into copper, the inserted metal is surrounded by a narrow band or halo of golden-colored alloy. It is obvious therefore that very beautiful toned colored effects of great subtlety can be produced, ranging from silver white zinc to yellow brasses and bronzes of innumerable shades, graduating to red copper and gradations of yellow and golden browns.

THE FIRST OF THE 1909 FLIGHTS FOR THE SCIENTIFIC AMERICAN TROPHY.

The provisional winning for the second time on the 17th instant of the beautiful aeronautic Trophy given by this journal two years ago to further the science of aviation makes this a fitting time for us to again show it to our readers. For the benefit of those who have not seen it before, a brief description is herewith appended.

SCIENTIFIC AMERICAN TROPHY.

First competitive trial for 1909 won by Glenn H. Curtiss on July 17th.

Upon a globe representing the firmament, Prof. Langley's following-surface biplane is seen soaring through the clouds. Surmounting the globe is an American eagle holding the wreath of victory in its beak. The globe rests upon a whirl of clouds that rises from a base, from the sides of which spring winged horses carrying riders that bear aloft olive branches. This beautiful piece of silver was presented to the Aero Club of America to stand for the highest achievement in aviation the world over. At the time it was given, two years ago, no one in America, with the exception of the Wright brothers, had made a flight in a heavier-than-air machine, and the fact that these two aviators had at last conquered the air was not generally known. It was at first proposed to hold competitions at stated times and places for the Trophy, but this was found impracticable, so that now the aviator who wishes to compete is allowed to choose his own time and place and the Aero Club will send a representative to witness the flight. The winner for any year is now the aviator who makes the longest and best flight in a closed circuit during the year.

The conditions required at first were a flight of 1 kilometer (0.621 mile) in a straight line; but it was not until July 4th, 1908, that an attempt was made to fulfill these conditions. Upon that date Glenn H. Curtiss (who had been experimenting with Dr. Alexander Graham Bell in the latter's Aerial Experiment Association), made a flight of a little over a mile in the association's fourth aeroplane "June Bug," and was consequently declared the first winner of the Trophy. In view of the flights that were being made by French aviators, the conditions were then changed to 25 kilometers (15½ miles) in a closed circuit. The first of the present year the conditions were changed as above stated, 25 kilometers remaining as the minimum distance to be flown. This is 5 kilometers (3.1 miles) more than is required in the international contest for the Bennett trophy and $5,000 cash prize, which is to be held at Rheims, France, on the 29th of August.

After having built and delivered to the Aeronautic Society his new biplane that he constructed expressly for this organization, Mr. Curtiss decided that he would attempt a flight for the Scientific American Trophy with this machine on July 5th at Morris Park, just a year after he had won it the first time. The flight was not attempted until dusk on that afternoon because of too much wind, and when it was made it was merely a U-shaped flight of about a mile. The machine was then taken to Mineola, L. I., and on July 17th another trial for the Trophy was made. This was entirely successful, as told in our last issue. We give herewith some further particulars regarding this flight, such as the times for each round of the triangular 1.313-mile course, etc.:

TIME OF LAPS IN G. H. CURTISS'S FLIGHT FOR THE SCIENTIFIC AMERICAN TROPHY.

		Time of lap
Start	5:23:16	
1st lap	5:25:52	2:36
2nd lap	5:28:32	2:40
3rd lap	5:31:08	2:36
4th lap	5:33:48	2:40
5th lap	5:36:27	2:39
6th lap	5:39:11	2:44
7th lap	5:42:01	2:50
8th lap	5:44:45	2:44
9th lap	5:47:25	2:40
10th lap	5:50:15	2:50
11th lap	5:52:58	2:43
12th lap	5:55:50	2:52
13th lap	5:58:40	2:50
14th lap	6:01:32	2:52
15th lap	6:04:26	2:54
16th lap	6:07:14	2:48
17th lap	6;10:03	2:49
18th lap	6:12:53	2:50
19th lap	6:15:40	2:47

Total elapsed time 52 minutes, 30 seconds.
Total measured distance, 24.947 miles.
Average speed, 28.51 miles an hour.

The course was triangular, careful measurement made by Mr. Charles M. Manly after the flight showing the legs to be 2,045, 2,442, and 2,446 feet in length respectively. One circuit over the lines between stakes was therefore 1.313 miles, but the machine of course covered a considerably greater distance, as it made fairly wide turns. The speed of the aeroplane was undoubtedly over 30 miles an hour. The minimum distance required to win the Trophy was flown through with the completion of the twelfth lap, the time for this 15.73 miles being 32 minutes and 34 seconds, so that the flight was of 20 minutes more duration than was required. It was only ended because of the fresh breeze that sprang up, and also because Mr. Curtiss feared his fuel would give out and he would not be able to land within 100 meters (328) feet) of the starting line, as required in the rules. He landed within 287 feet of the line.

Mr. Curtiss's success in flying double the distance required in the Bennett Cup race, and the fact that the duplicate machine he has built to compete has a larger motor, gives him a good chance of beating whatever speedy French monoplanes may be entered against him in the race at Rheims on the 29th ultimo. Six of these machines—three Pelterie, two Bleriot, and one Santos-Dumont—and ten biplanes have been entered in the French elimination race to be held on August 22nd. Three machines have been entered by England, France, and Italy, and one each by Austria and America. Some of the contests to be held during this aviation week are as follows:

Grand Prix de la Champagne ($30,000) for longest continuous flight; speed test prize ($4,000) over distance of 30 kilometers; height prize ($2,000) for greatest altitude in excess of 50 meters; speed prize ($2,000) for the fastest circuit of the course; and passenger prize ($2,000) for carrying the greatest number of passengers 10 kilometers at the fastest speed.