

# UNITED STATES PATENT OFFICE.

THOMAS ERNEST HALFORD AND ROBERT MORANT, OF LONDON, COUNTY OF MIDDLESEX, ASSIGNORS TO DAN RYLANDS, OF STAIRFOOT, ENGLAND.

## METHOD OF MAKING METAL ARTICLES WITH A GLASS LINING.

SPECIFICATION forming part of Letters Patent No. 397,641, dated February 12, 1889.

Application filed October 4, 1887. Serial No. 251,477. (No model.) Patented in England March 15, 1887, No. 3,907.

*To all whom it may concern:*

Be it known that we, THOMAS ERNEST HALFORD, engineer, of 16 Addison Road, Bedford Park, Chiswick, and ROBERT MORANT, engineer, of 45 Regent's Square, London, both in the county of Middlesex, England, subjects of the Queen of Great Britain, have invented an Improved Method of Making Metal Articles with a Glass, Porcelain, or other Lining, (for which we have applied for Letters Patent in England, such application being No. 3,907, and dated March 15, 1887;) and we do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

This invention has for its object the production of metal articles lined with glass, porcelain, earthenware, stoneware, wedge-wood, or other lining of such shapes and at such cost as has hitherto been unattainable by the methods in use previous to this invention. It has been found that when casting metal direct onto the lining the heat of the molten metal will cause the lining to crack, and with the thin linings we use the contraction of the metal on cooling crushes the lining, even if the said lining is heated, so as to avoid cracking during casting, added to which there is a great difficulty in obtaining close contact between glass and metal at all points, without which articles so made are useless for resisting internal pressure. These difficulties we overcome entirely by means of our present invention, which consists in interposing a porous elastic non-conducting material between the metal and lining during the operation of casting, which non-conductor prevents the heat of the molten metal from cracking the lining, and also forms a cushion or buffer, to prevent the crushing of the lining by the contraction of the metal on cooling, or from the expansion of the lining when hot liquids are poured into or through the article or vessel.

According to this invention, we first wrap the glass, porcelain, or other lining with slag-wool or asbestos, or coat the said lining with a mixture of diatomaceous earth and clay-wash or any other suitable non-conducting material to the desired thickness, and thoroughly dry the same. The lining thus pre-

pared is then placed in a suitable mold, so as to form the core, and the metal cast round the same. The metals we prefer to use for this purpose are brass and cast-iron. When cool, the article is taken from the mold and dressed in the usual way.

This process is particularly suitable for making pump-barrels, fittings for glass, porcelain, or similarly-lined tube-fittings and the like.

When making fittings for tubes lined as above, in order to avoid the risk of breaking the lining while screwing the ends of the fitting, we prefer to partly cover the said lining with pieces of screwed tube and fill in the space between the said pieces of tube and lining with cement and thoroughly dry the same, and then cast sufficient brass or other metal round the same to hold the whole firmly together.

In the above process care must be taken to have the non-conducting material thoroughly dry before casting, or the steam given off during the operation will cause the lining to crack.

In conclusion, we would remark that we are aware of Patent No. 2,904, dated January 10, 1843, granted to Enoch Robinson, and English Patent No. 9,681 of 1843.

We do not claim simply casting metal round a glass or other lining, as the same is useless for our purpose; but

What we do claim, and desire to secure by Letters Patent, is—

1. The process of making metal articles with a glass or other lining, which consists in coating the said lining with a suitable non-conducting substance and casting the metal around the prepared lining, all substantially as described.

2. The process of making metal articles with a glass or other lining, which consists in coating the said lining with a suitable non-conducting substance, thoroughly drying the same, and casting the metal around the prepared lining, all substantially as described.

THOMAS ERNEST HALFORD.  
ROBERT MORANT.

Witnesses:

WILLIAM COOMBES,  
W. SMALLPIECE.