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EXTRUSION LUBRICANT

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ABSTRACT OF THE DISCLOSURE

A solid lubricant for use in the hot extrusion of metals comprises a coherent disc having about 2% to 15% by weight of a fiber such as asbestos or hemp with the rest calcium silicate.

In the hot extrusion of metals and alloys it is generally necessary to supply a lubricant between the die and the billet, between the billet and the walls of the container of the extrusion press, and when hollow products are being extruded by means of a mandrel, between the mandrel and the inside of the hollow billet. For metals and alloys that must be extruded at high temperatures it is common practice to employ as the lubricant glass in various forms, including discs or plates made from glass powder or from heat treated basalt powder, bundles of glass fiber, and sheets made from glass fiber.

Although these materials have quite satisfactory lubricating properties, the surface finish of the extruded products is still far from perfect, and scores and blemishes often occur that must be eliminated by further processing. Moreover, lubricant that has passed through the die tends to adhere firmly to the extruded product and must be removed by pickling or shot-blasting.

There is thus still a need for a lubricating material for use in the hot extrusion of billets which are heated to high temperatures, e.g., 1050° C. and above, that is cheap and effective and enables products to be made that have an improved surface finish.

According to the invention a composition comprising calcium silicate ($CaO \cdot SiO_2$) and a fibrous material, which may be incombustible or combustible, interdispersed therethrough is used as a hot extrusion lubricant. These fibrous materials may be either incombustible fibers, for example, asbestos, glass fiber or mineral wool fiber, or combustible fibers, of either natural or synthetic origin, e.g., hemp, cotton, wool, or, less preferably, on the ground of heat stability, synthetic organic fibers such as polyethylene, polypropylene, nylons, polyacrylamide, polyacrylonitrile, polyethylene terephthalate, etc.

The calcium silicate serves as the main lubricant, while the fibrous material serves as a binder to hold the composition together as a coherent mass. Generally speaking, the proportion of fibrous material amounts to from 2% to 10% or 15% by weight of the composition. When the fiber is combustible, enough must be present to ensure that it is not all burned away before the extrusion is complete. The fibers are at least about one-quarter to about one or two or four inches long. The mechanism by which such a composition acts as a lubricant is not fully understood, but it is believed that the asbestos serves to insulate the billet surface from the adjacent part of the press or press tools and to hold the calcium silicate in position while the latter lubricates the flow of metal or alloy. Unlike glass, the lubricant does not appear to act by forming a fused layer between the hot metal or alloy billet being extruded and the extrusion tools; rather the calcium silicate particles appear to behave like miniature ball bearings between the metal or alloy billet and the tools.

One suitable composition is made by forming into a slurry with water the following ingredients, the proportions being in parts by weight:

12 parts hydrated lime (75% CaO)
10 parts powdered quartz (SiO_2)
1 part kieselguhr (80% SiO_2)
4 parts chrysotile asbestos.

The slurry is cast into molds and the molds and their contents are heated in an autoclave to 360° C. by means of steam at a pressure of 140 pounds per square inch (p.s.i.). The resulting solidified blocks, still in the molds, are then heated in a furnace or kiln for 24 hours at 360° C. to complete the reaction of the lime and silica to form calcium silicate. After removal from the molds, the fully cured blocks are sawn or otherwise cut to the desired size, for example, to discs to be placed between the die and the billet. Before it is inserted into the container of the press, the composition is preferably preheated to from 250° C. to 300° C.

It is found that the composition is particularly suitable for use as a lubricant for the hot extrusion of nickel alloys. It gives products having very good surface finish and uniform dimensions, and does not adhere to the extruded product so that it is readily removed without the need for picking or shot blasting.

Some examples will now be given.

EXAMPLE I

A billet 14 inches long and 6.875 inches in diameter of a nickel-base alloy containing 20% chromium, 2.3% titanium and 1.3% aluminum, the balance being nickel and impurities, was heated to 1155° C., a sheet of glass cloth was wrapped around its cylindrical surface, and the billet was placed in the container of a 3500 ton extrusion press with a circular disc one inch thick and 7.05 inch diameter of the above-mentioned composition between its leading end and the die. It was then extruded at an extrusion ratio of 20:1 to a channel section. The extruded product was found to have a very smooth surface substantially free from scores. Its surface finish was considerably better than that obtained by the use of a pad of glass fiber as die lubricant in place of the calcium silicate-asbestos disc.

EXAMPLE II

Another similar billet of the same alloy as in Example I was similarly extruded to a round bar 0.875 inch in diameter (i.e., at an extrusion ratio of 70:1), an extrusion temperature being 1170° C. The surface of the extruded bar was again very smooth and free from scores, and its diameter was very uniform throughout its length. Again there was a substantial improvement over the results obtained with the use of a glass wool pad as die lubricant.

EXAMPLE III

A similar billet of a nickel-cobalt alloy containing 20% chromium, 17% cobalt, 5% molybdenum, 1.2% titanium and 4.5% aluminum, the balance being nickel and impurities, was heated to 1145° C., wrapped in a glass-fiber cloth and extruded to a rectangular section 1.5 inch by one inch, with a one inch thick disc of the calcium silicate-asbestos composition of the invention as lubricant between the leading edge of the billet and the die. The surface finish of the extruded product was much superior to the best hitherto obtainable by the use of a disc of basalt powder as die lubricant.

EXAMPLE IV

One suitable lubricant composition in which hemp is used as the fibrous binder is made as follows:

Lumps of calcium silicate are crushed to a powder fine enough to pass a 100 mesh BSS sieve and mixed with

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3% by weight of hemp that has been chopped to pieces 0.25 to 0.5 inch in length and sufficient water to form a slurry. The slurry is cast into a mold of the desired shape and allowed to dry, and if desired, is cured by heating it at 200° C. for about 2 hours.

A cylindrical billet 14 inches long and 6.875 inches in diameter of a nickel-chromium alloy containing 20% chromium, 2.3% titanium and 1.3% aluminum, the balance being nickel and impurities, was heated at 1170° C., a sheet of glass cloth was wrapped around its cylindrical surface and the billet was placed into the container of a 3,500 ton extrusion press with a circular disc of a calcium silicate-hemp composition one inch thick and 7.05 inches in diameter prepared in the manner described interposed between the leading end of the billet and the die. The billet was then extruded at an extrusion ratio of 44:1 to round bar. The extruded product was found to have a very smooth surface substantially free from scores. Its surface finish was better than that obtained by the use of a pad of fiber glass as a lubricant in place of the calcium silicate-hemp disc.

Although the present invention has been described in conjunction with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention, as those skilled in the art will readily understand. Such modifications and variations are considered to be within the purview and scope of the invention and appended claims.

I claim:

1. In the hot extrusion of metal billets wherein a solid lubricant is interposed between the forward end of a heated billet to be extruded and the extrusion die, the improvement which comprises providing the solid lubricant as a coherent disc consisting essentially of about 2% to about 15%, by weight, of interdispersed fibrous binder material from the group consisting of asbestos, glass fiber, mineral wool fiber, hemp, cotton, wool, and synthetic organic fibers and the balance essentially calcium silicate.

2. As a new article of manufacture, an extrusion lubricant comprising a coherent disc consisting essentially of about 2% to about 15%, by weight, of interdispersed fibrous binder material from the group consisting of asbestos, glass fiber, mineral wool fiber, hemp, cotton, wool and synthetic organic fiber and the balance essentially calcium silicate.

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