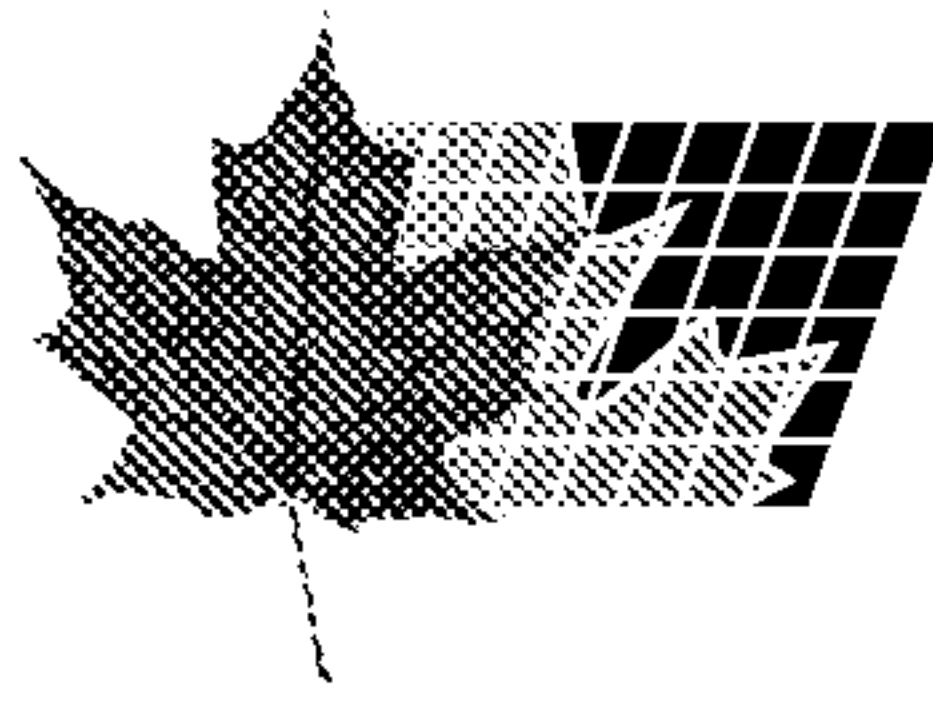
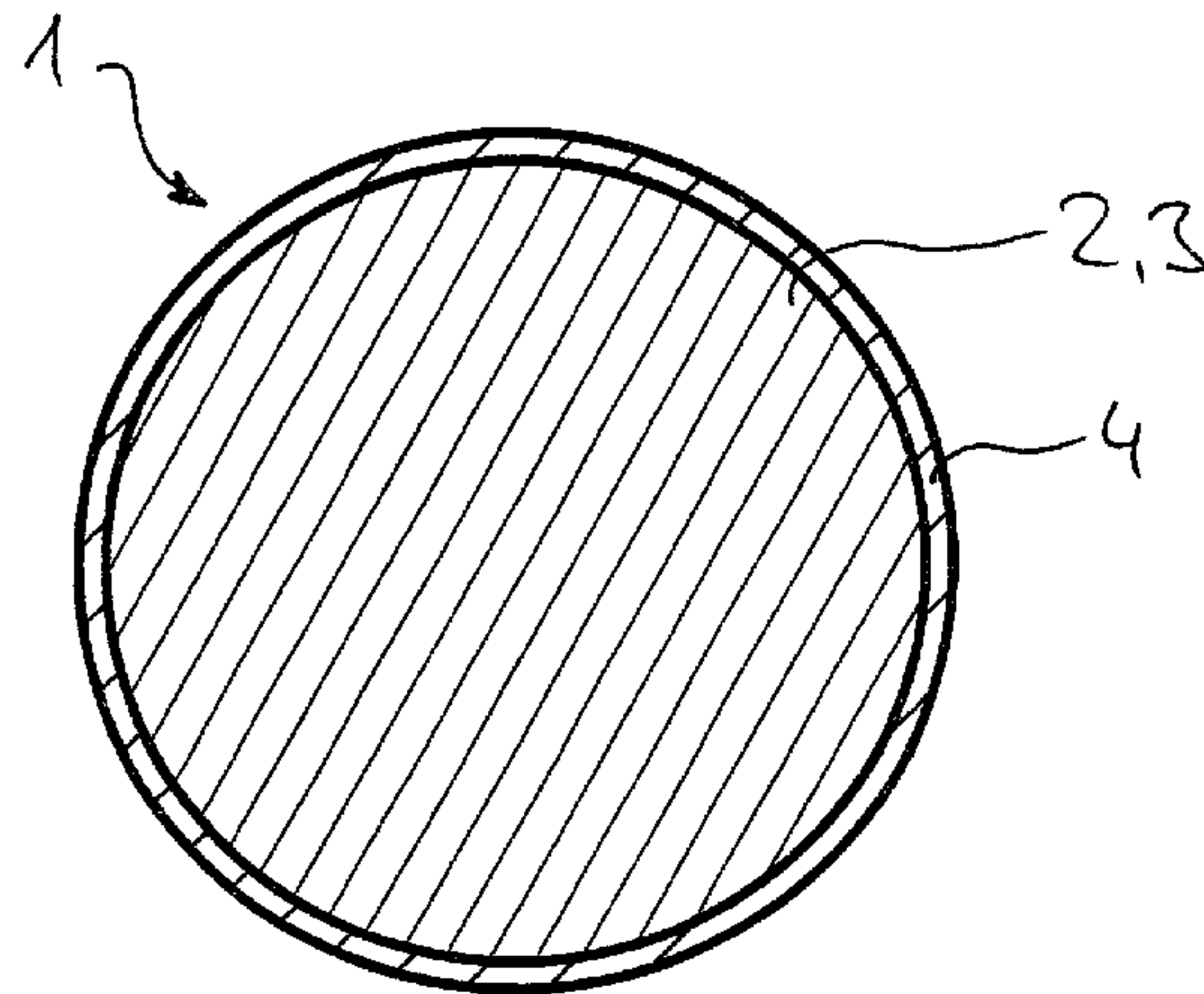




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(54) **TIGE RENFORCEE**
(54) **REINFORCING ROD**



(57) The invention relates to a reinforcing rod, which functions particularly for the heat-insulated transfer of force between two structural components, preferably made of concrete, wherein the reinforcing rod is made of a fiber-reinforced plastic and has a metallic casing on its outer side.

ABSTRACT

The invention relates to a reinforcing rod, which functions particularly for the heat-insulated transfer of force between two structural components, preferably made of concrete, wherein the reinforcing rod is made of a fiber-reinforced plastic and has a metallic casing on its outer side.

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Reinforcing Rod

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Description

The invention relates to a reinforcing rod, which functions particularly for the heat-insulated transfer of force between two structural components preferably made of concrete, wherein the reinforcing rod is made of a fiber reinforced plastic. Reinforcing rods are used, for example, in structural component joints together with an insulation body traversed by the reinforcing rods, in order to obtain a sufficient heat insulation in addition to a force transmission.

With regard to plastic reinforcing rods of this type, experiments have been carried out increasingly in the past, in order to provide for certain applications an alternative besides the metal rods traditionally consisting of reinforcement steel or stainless steel. A significant incentive for experiments with plastic reinforcing rods lies in the small heat conductivity of certain plastics (such as polyester, vinyl ester, etc.); in addition, the tensile strength and thus the stability of the reinforcing rod can be matched very exactly to the respective application by using different fiber types such as glass, aramide, and other fibers.

A significant problem of the known plastic rods, however, lies in the fact that though they are indeed corrosion-resistant in the joint region between two concrete structural components, corresponding to the stainless steel rods customarily installed there, the fibers used there become corroded in the areas impinged by the concrete due to the prevalence of the alkaline medium there, so that consequently they can no longer completely carry out their force-transmitting function. This is caused by the fact that the plastics used as a hard matrix of the tension rods generally have a certain potential for microcracks, which develop into macrocracks under the additional tensile load. Due to these macrocracks, the hard matrix loses its protective function with regard to the reinforcing fibers, so that, for example, alkaline water present in the concrete has access to the fiber surface and can act there in a damaging or corroding manner. This is the essential reason for the fact that reinforcing rods with reinforcing fibers made of E-glass and aramide have until now still not found any notable application in construction.

Taking this as a starting point, the object of the present invention is to make available a reinforcing rod made of plastic material, which distinguishes itself by increased resistance against the alkaline media prevalent in concrete and mortar.

This purpose is achieved according to the invention in that the reinforcing rod has on its outer side a metallic casing (shell or wrapping), which runs in a closed manner over the outer side and protects the fiber-reinforced plastic from the environment in a diffusion-impermeable manner. Thus, the metallic casing functions as a protective layer, so that the fiber-reinforced plastic can be selected with regard to its static and heat insulation properties, without hereby having to give priority to the chemical resistance.

This metallic casing can be made, for example, of a metal foil or film and, in particular, of a stainless steel foil, where even the smallest foil thicknesses are sufficient to prevent the penetration of alkaline media, wherein at the same time because of the small foil thickness, the heat conductivity is not of consequence or, in a stainless steel foil, has values that are quite good anyway.

The essential advantage of a metallic casing comes to bear if the metallic casing forms a lost mold which is used in the manufacture of the reinforcing rod, for example is put into the mold before casting the reinforcing rod, and is then filled with the fiber-reinforced plastic material and thereby is directly connected to the plastic material throughout. The metallic casing can also function during a pultrusion process as a forming casing or mold, or forming sheath. The advantage of this process is that in a quasi "wet-in-wet" manner, an inner bond can be created between the matrix material (plastic resin) and the outer metallic casing.

In order to bring the metallic casing made from a strip-shaped plate or foil material into the required tube or hose shape adapted to the rod cross section, the plate or foil material can be connected together at its longitudinal edges, in particular by crimping over, stamping, adhering, welding and similar connection methods.

Furthermore, it is of course also possible that the metallic casing comprises a coating that either contacts the casting mold for the fiber reinforced plastic and is affixed after casting on the outside of the reinforcing rod, or that contacts the plastic reinforcing rod after its manufacture.

Independently of the type of application of the casing, however, it is essential that the casing be manufactured from a metallic material having a small heat conductivity, in particular made of stainless steel. It is thereby ensured that the advantage of the plastic reinforcing rod due to the small heat conductivity is not significantly harmed, since otherwise rods made completely out of metal could be used directly. Moreover, the casing should be made of a corrosion-resistant material, in order to be able to protect the plastic reinforcing rod from the alkaline medium of the concrete for a long period of time.

As far as the shape of the casing is concerned, it is recommended that it be given a structured outer and/or inner surface, which is manufactured, for example, by stamping or similar processes, in order to improve thereby the closure of the mold with the concrete, on the one hand, and with the plastic material on the other hand, which at the same time

also improves the bonding properties of the reinforcing rod in concrete or mortar. On the whole, it is recommended, according to the embodiment with ribbed metal rods, that the plastic reinforcing rod according to the invention be designed with ribs on its outside, wherein expediently also fibers or other suitable filling materials are set in the ribs, in order to be able to securely and lastingly intercept the shear stresses occurring there. As far as the shape of the ribs is concerned, this can be optimized without problem for rods manufactured according to the invention and adapted to the respective application conditions.

When using stainless steel foil as a metallic casing material, both a diffusion impermeability against alkaline media can be obtained, as well as a corrosion resistance for rod areas not surrounded by concrete. If, however, instead of stainless steel, other metals are used, and for this purpose because of the very small costs conventional canning metal sheet recommends itself for example, these metals certainly possess the necessary diffusion impermeability, but they generally lack the desired corrosion resistance. Such a corrosion resistance can be achieved, however, without great expense, in that the reinforcing rod is coated with a metallic casing, for which purpose epoxy resins, for example, are satisfactory.

An advantageous coating process consists in loading the reinforcing rod electrostatically and conducting it through a powder turbulence chamber, wherein by the electrostatic loading the epoxy resin powder particles can settle on the rod surface. Then, the thus-loaded rods are conducted through a section of a furnace, and the epoxy resin particles are melted on by the supply of heat from outside to inside. It is especially advantageous in this context that first the metallic casing makes possible the electrostatic loading, whereas the fiber plastic is non-conducting and thus cannot also be directly electrostatically loaded.

Additional advantages and features of the present invention appear from the following description of embodiments based on the drawing. Shown are:

Figure 1 a reinforcing rod according to the invention in cross section; and
Figure 2 an alternative embodiment of a reinforcing rod according to the invention also in cross-section.

The cylindrical plastic reinforcing rod 1 depicted in Figure 1 comprises a plastic or plastic resin as a matrix material 2 and reinforcing fibers 3, which can comprise, for example, glass fibers, aramide fibers, and the like, running approximately parallel to the rod axis. Essential to the reinforcing rod is a metallic casing 4, applied on the outside of the plastic rod, which extends over the entire circumference and is constructed as a diffusion-impermeable seal against the rod surroundings.

In the embodiment of Figure 1 the metallic casing 4 is constructed in a tube or a hose shape without a longitudinal seam.

Such a longitudinal seam connection 15 of a casing 14 is depicted in Figure 2, where it can also be recognized that the longitudinal seam connection selected there comprises an adhesive bond or a welded bond, which is selected in such a way that it ensures the manufacture of a complete seal and also meets mechanical demands. In other respects, however, the reinforcing rod 11 shown in Figure 2 corresponds to the reinforcing rod 1 of Figure 1.

It should also be noticed that instead of a tube-shaped or hose-shaped casing that does not have a longitudinal seam, and instead of a crimping over of two casing halves made from a foil material, other manufacturing methods are, of course, also possible, in order to obtain a closed casing, for example a longitudinal seam weld, and also a thread-shaped winding of a foil material while folding over or welding adjacent winding edges.

In summary, the present invention offers the advantage that while the mechanical properties of known plastic reinforcing rods remain the same, a more secure impermeability against alkaline media can be produced, whereby the accordingly encased reinforcing rods can also be installed permanently in concrete structural components.

Patent Claims

- 5 1. Reinforcing rod made of fiber-reinforced plastic,
characterized in that,
the reinforcing rod (1, 11) has on its outer side a thin metallic casing (4, 14).
- 10 2. Reinforcing rod according to claim 1,
characterized in that,
the casing (4, 14) surrounds the fiber-reinforced plastic (2, 12) in a closed manner and
shields it against the alkaline and moist surroundings.
- 15 3. Reinforcing rod according to at least one of the previous claims,
characterized in that,
the metallic casing (4, 14) comprises a metallic foil, in particular a stainless steel foil.
- 20 4. Reinforcing rod according to at least one of the previous claims,
characterized in that,
the metallic casing (4, 14) is a broken mold, which is used in the manufacture of the
reinforcing rod (1, 11).
- 25 5. Reinforcing rod according to at least one of the previous claims,
characterized in that,
the metallic casing (4, 14) is made of a strip-shaped plate or foil material, which is
connected together at its longitudinal edges (15) to create the tube-shaped or hose-shaped
closed casing.
- 30 6. Reinforcing rod according claim 5,
characterized in that,
the connection of the longitudinal edges (15) is done by crimping over, stamping,
adhering, welding or the like.
- 35 7. Reinforcing rod according to at least one of the previous claims,
characterized in that,
the metallic casing comprises a coating.
- 40 8. Reinforcing rod according to claim 7,
characterized in that,
the casing is a coating of the manufacturing mold for the fiber-reinforced plastic.
- 45 9. Reinforcing rod according to claim 7,
characterized in that,
the casing is a coating of the finished plastic reinforcing rod.

10. Reinforcing rod according to at least one of the previous claims,
characterized in that,
the casing has a structured outer and/or inner surface.

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11. Reinforcing rod according to claim 10,
characterized in that,
the structured outer and/or inner surface is produced by stamping.

10 12. Reinforcing rod according to at least one of the previous claims,
characterized in that,
the reinforcing rod is designed with ribs on its outside.

15 13. Reinforcing rod according to at least one of the previous claims,
characterized in that,
the casing (4, 14) is made of a metallic material having a low heat conductivity, in
particular made of stainless steel.

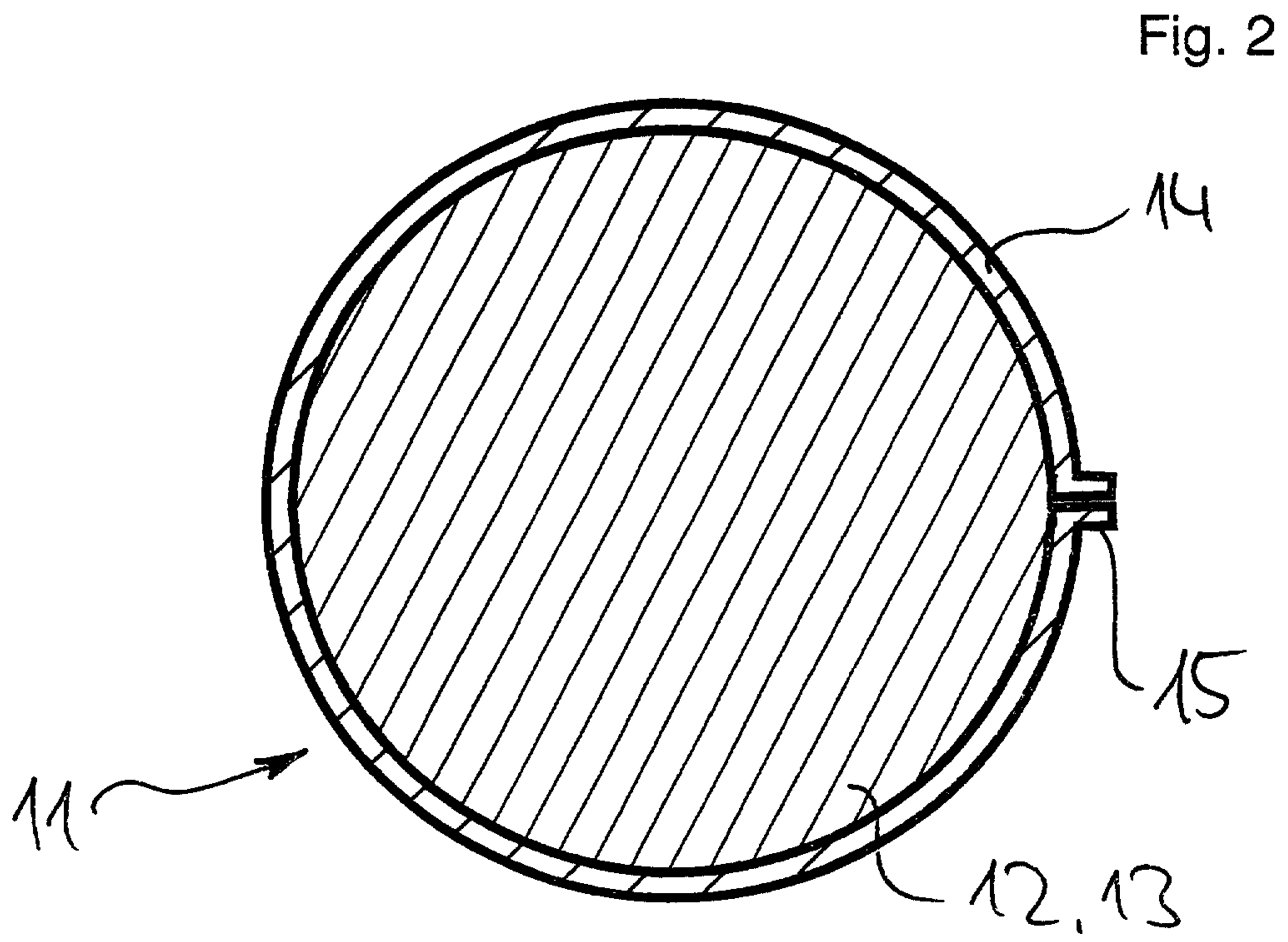
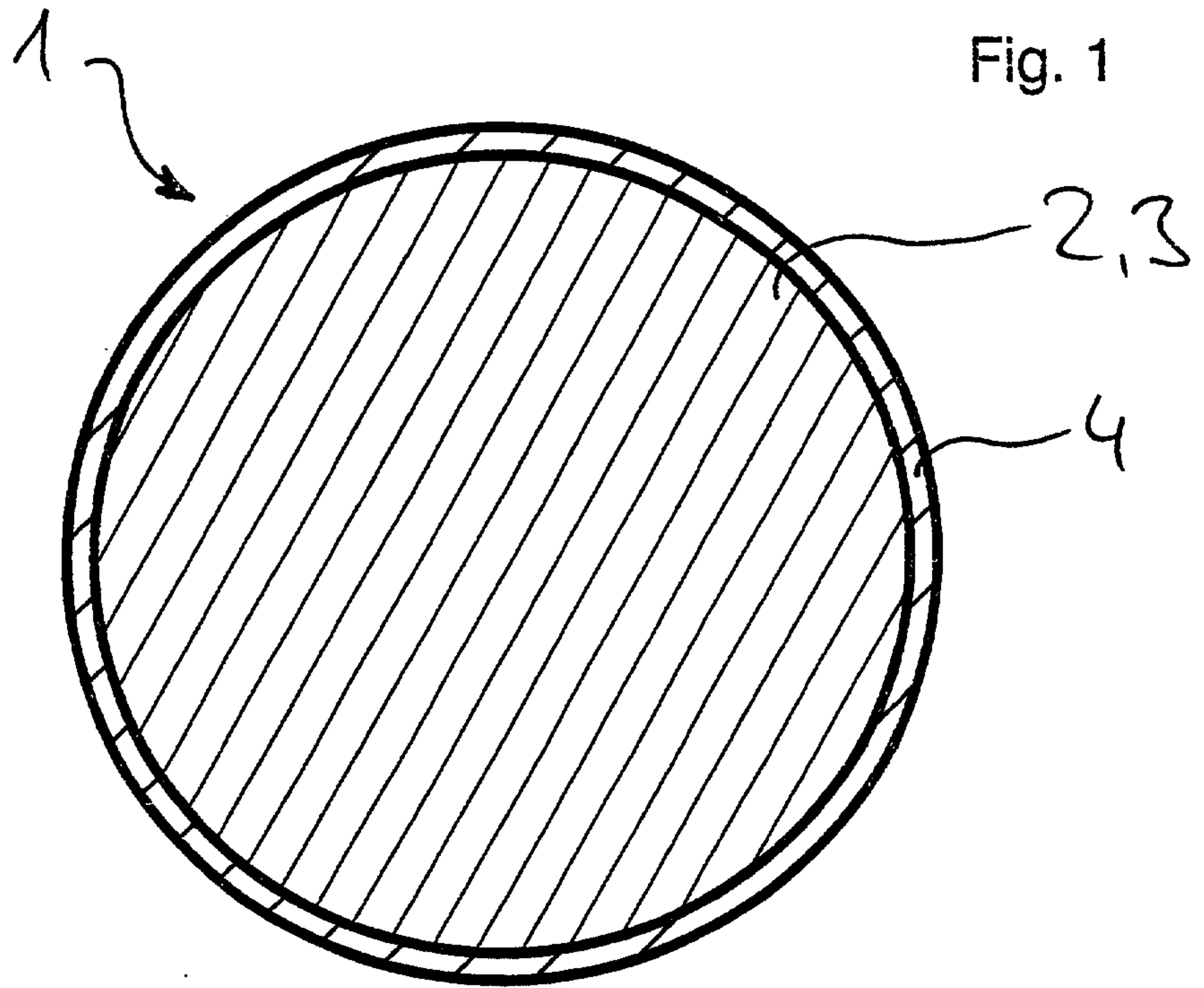
20 14. Reinforcing rod according to at least one of the previous claims,
characterized in that,
the casing (4, 14) is made of a corrosion-resistant material.

25 15. Reinforcing rod according to at least one of the previous claims,
characterized in that,
the casing (4, 14) is diffusion impermeable, especially to alkaline media.

30 16. Reinforcing rod according to at least one of the previous claims,
characterized in that,
the casing (4, 14) is coated on its outer side.

17. Reinforcing rod according to at least claim 16,
characterized in that,
the coating is made of a powder coating and particularly of epoxy resin.

35 18. Reinforcing rod according to at least claim 17,
characterized in that,
the epoxy resin coating is made by electrostatic loading of the metallic casing, by then
applying the epoxy resin in a powder swirling chamber with subsequent heat treatment.



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