

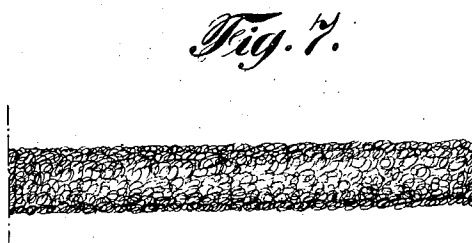
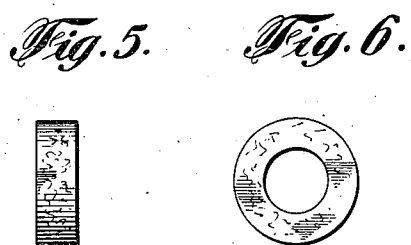
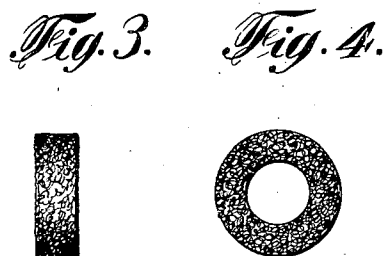
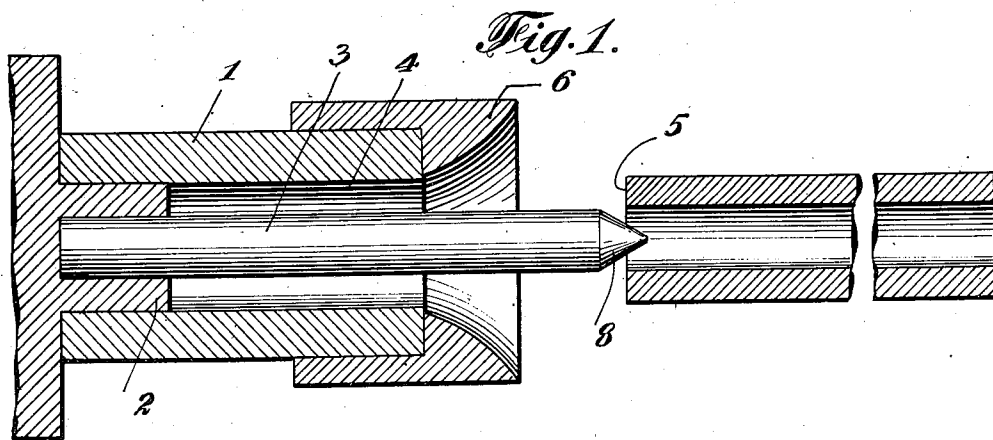
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C. FIELD

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CONSOLIDATED METALLIC FIBER ARTICLE

Filed June 7, 1924



INVENTOR
Crosby Field
BY *L. C. Klean*
his ATTORNEY

UNITED STATES PATENT OFFICE.

CROSBY FIELD, OF BROOKLYN, NEW YORK, ASSIGNOR TO GRAY PRODUCTS, INC., A CORPORATION OF NEW YORK.

CONSOLIDATED METALLIC FIBER ARTICLE.

Application filed June 7, 1924. Serial No. 718,476.

My present invention relates to articles made by subjecting metal strands or fibers to high pressures in a suitable mold. The preferred material is what is known as metal wool, preferably medium size as, for instance, what is known in the trade as No. 0 metal wool, although the finer gauges such as No. 00 or No. 000, or the larger gauges such as Nos. 1, 2 and 3, may be employed for special purposes. Preferably, the metal wool used is cut from copper or bronze wire, although other metals may be preferable for certain purposes. One material which I have employed with very satisfactory results in No. 0 wool cut from hard drawn copper or brass wire. The commercial copper wire most easily obtainable has a certain amount of springiness and the cutting process results in a copper metal wool which is quite springy. Preferably, I use this in the condition in which it comes from the knives, although for certain purposes it may be softened by annealing or may be freed from a film of lubricant which it may acquire during the cutting process, when lubricant is used to prevent heating of the knives.

As an illustration, No. 0 copper metal wool referred to above, in the uncleansed and unannealed condition, may be packed or wadded into a mold having the shape of the desired article and subjected to pressures sufficient to bend, set and pack the metal into a solid body of the desired shape. The amount of pressure applied may be varied within wide limits but is usually high and frequently is of the order of pressures employed for stamping or die shaping metal articles. In certain cases, particularly with the softer materials, the pressure may be great enough not only to set the fibers in intimate relation, but also to cause incipient or partial welding at more or less distributed points in the mass.

In most cases the pressure is such as to produce a peculiarly novel metal article possessing a porous structure and which is noticeably compressible and resilient, although the structural strength may be so great that the article will maintain its form and dimensions under relatively heavy stresses.

Such fibrous solid, when made up in the form of bearings, either for slide surfaces

or shafts, is advantageous because of the above described peculiar quality.

An important feature of my invention is incorporating with the copper wool a desired amount of lubricant, preferably sufficient to fill part or all of the interstices between the fibers of the compressed article, the latter being in most cases characteristic of the finished article, even though the die pressure be very great.

The lubricants employed have included flake graphite either alone or mixed with vaseline, bearing grease, or oil. The graphite without oil may contribute materially to the solidity and strength as well as the smooth surface finish of the completed article.

As above stated, the articles may be molded to any desired shape to afford an anti-friction bearing surface between sliding, oscillating, rotating or other relative motion. It is particularly adapted for use in the form of oilless bearings for shafts either as a substitute for or in combination with the ordinary bearing. It is particularly useful as bushings for the shafts of small motors or other machinery.

Another important use is as a packing material where a shaft has to project through a bushing or one or both sides of which may be materials that are absorbent of oils as, for instance, ammonia in refrigerating machines.

In the forms which depend on graphite and not on a liquid oil film for lubrication, it is particularly adapted for wet bearings, that is, bearings which are normally immersed in water or other liquids which would ordinarily dilute, absorb or dissolve an oil film. For the same reasons, these embodiments of the invention are useful in connection with surfaces which are exposed to high temperatures and these may be substantially above the temperatures at which oil would vaporize.

An illustrative embodiment of my invention may be more fully understood from the following description in connection with the drawings, in which—

Fig. 1 is an axial sectional view, indicating more or less diagrammatically one form of mold that may be used for producing one form of the article;

Figs. 2 and 7 are side elevations indicat-

ing in a general way the material from which the article may be made;

Figs. 3 and 4 are respectively edge and face views of an annular bearing embodying one form of my invention;

Figs. 5 and 6 are similar views of a modification.

In these drawings the external cylinder 1, base 2 and core or mandrel 3 constitute the female die having the cylindrical annular cavity 4 in which fits the annular plunger 5. The metal wool may be packed into the space 4 in any desired way, preferably facilitated by some sort of a guide as 6. One convenient way is to shape the material in the form of a cylinder 7 of relatively loose metal wool which may be forced by hand or otherwise over the point 8 of mandrel 3 and into the cavity 4, the loose structure of the metal wool mass permitting easy penetration by said point 8. Desired pressure is then applied to the plunger 5 to compress the mass to the final form shown in Figs. 3 and 4. The amount of compression may be greatly varied, but preferably a powerful press of any known or desired type will be employed.

Instead of simply wadding the material into the space 4 or perforating it on cylinder 3, it may be roughly carded in lengths of proper diameter for coiling down in the annular space 4.

In Figs. 3 and 4 an attempt is made to illustrate a visibly fibrous surface that may be produced when copper wool is used without any filler or binder such as graphite. The visible inequality of the surfaces may be very greatly decreased by burnishing the surfaces by sliding movement either in the forming die or in the finishing die which may be employed for the purpose.

In Figs. 5 and 6 an attempt is made to show that when the graphite or other filler is used, the surfaces may be very definite and very smooth, merely from the sliding movement of the metal wool along the walls of the die during compression.

When graphite is used, it may be dusted onto the metal wool while in a loose state and the latter may be moistened either to the slight degree it is naturally moistened by the lubricant employed in the cutting process or a special liquid, either of an oily nature or of a volatile nature, may be employed. If vaseline or grease is used, it is preferably applied hot so as to be as liquid as possible in order to avoid excess, and various other expedients may be employed to squeeze out excess or properly determine the amount of the various lubricants or binders that may be used.

Plastic clay or cementitious material may be employed where very rigid articles are required. In such case, the binding or cementitious material may furnish the de-

sired hardness, while the metal wool will constitute metallic reenforcing analogous to reinforced concrete.

While I have referred to a modification employing metal of such character and subjecting it to such great pressure as may cause more or less welding of the fibers at the points of intimate contact, it will be understood that in most cases there is no welding, the structural strength particularly the tensile strength of the article being only that derived from intermeshing and set of the metal fibers. In some cases the solidification is evidenced mainly by resistance to compression stresses and an important feature of the resistance in such cases is that it is resilient because afforded by what amounts to a mass of hair-like springs compacted so that the individual fibers have taken a set in all sorts of shapes but most if not all under a substantial remnant of spring stress. It may be imagined, therefore, that when any one fiber of a wear surface becomes worn through, it results in two minute, free-springing ends that may easily contribute far more support to a shaft or other element carried thereby, than would the original unsevered loop or length of the fiber. Thus, the bearing is not only initially resilient but also it is, within limits, self-restoring as against wear.

In most if not all the preferred forms, the resilient nature of the article makes it a poor conductor of sound and other vibrations. Hence the bearings tend to be noiseless as well as anti-frictional.

As the range or distance of yield, as well as the power of resilient resistance and restoration, are controllable by varying the pressure and extent to which the article is compressed in the making, the product may be made suitable for cushioning in various connections, for instance, in situations where a relatively rigid positioning is required but solid unyielding contact of metal on metal is undesirable because of damaging mechanical vibration that may be transmitted from one of the parts to the other.

I claim:

1. As an article of manufacture, a material including as an essential a fibrous mass of springy metal wool composed of resilient fibers retaining their resilience under stress compressed and having its fibers set to maintain solid form.

2. As an article of manufacture, a material including as an essential a fibrous mass of springy metal wool composed of resilient fibers retaining their resilience under stress compressed and having its fibers set to maintain solid form and with a lubricant in the interspaces.

3. As an article of manufacture, a material including as an essential a fibrous mass of springy metal wool composed of re-

silient fibers retaining their resilience under stress compressed and having its fibers set to maintain solid form and with graphitic material in the interspaces.

- 5 4. An article including as an essential a fibrous mass of intermeshing springy metal wool fibers composed of resilient fibers retaining their resilience under stress compressed and with the fibers set in the shape
10 of the desired article, the fibers being of a springy metal of a hardness equal to or less than that of brass.

- 15 5. An anti-friction bushing including compressed springy metal wool composed of resilient fibers retaining their resilience under stress of a soft or non-abrasive metal of a hardness equal to or less than that of brass molded by pressure into a compact solid.

- 20 6. An anti-friction bushing including compressed springy metal wool composed of resilient fibers retaining their resilience un-

der stress mingled with a lubricant and molded by pressure into a compact solid.

7. An anti-friction bushing including com- 25 pressed springy metal wool composed of resilient fibers retaining their resilience under stress mingled with graphite and molded by pressure into a compact solid.

8. An anti-friction bushing including com- 30 pressed springy metal wool composed of resilient fibers retaining their resilience under stress of a soft or non-abrasive metal of a hardness equal to or less than that of brass mingled with graphite and molded 35 by pressure into a compact solid.

9. An anti-friction bushing including com- 40 pressed springy metal wool composed of resilient fibers retaining their resilience under stress.

Signed at New York city, in the county of New York, and State of New York, this 6th day of June A. D. 1924.

CROSBY FIELD.