

Jan. 14, 1941.

G. IMAI

2,228,828

NOISELESS TOOTHED WHEEL

Filed Dec. 29, 1938

2 Sheets-Sheet 1

Fig. 1

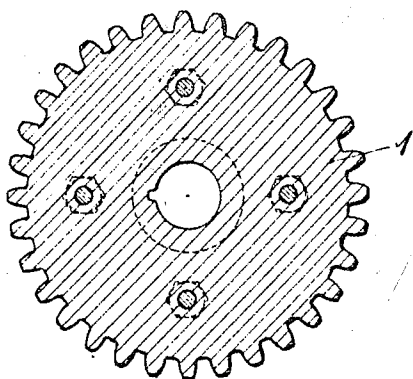


Fig. 3

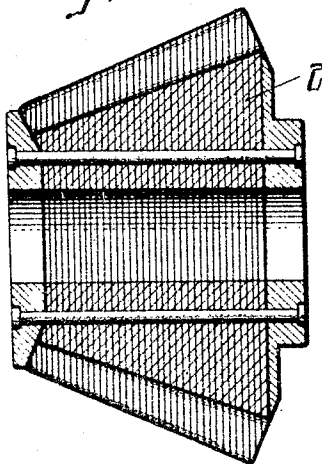


Fig. 2

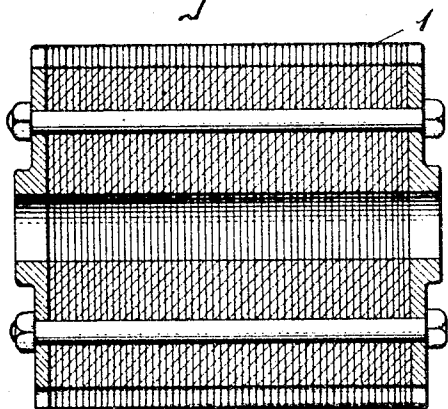


Fig. 5

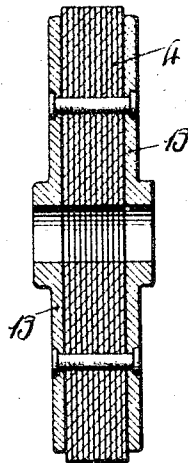
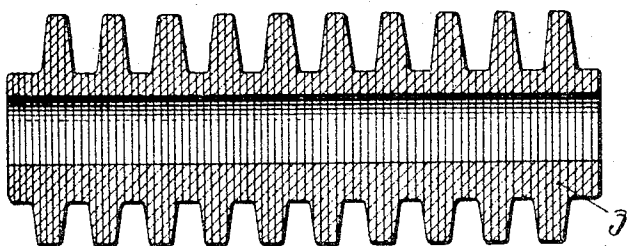


Fig. 4



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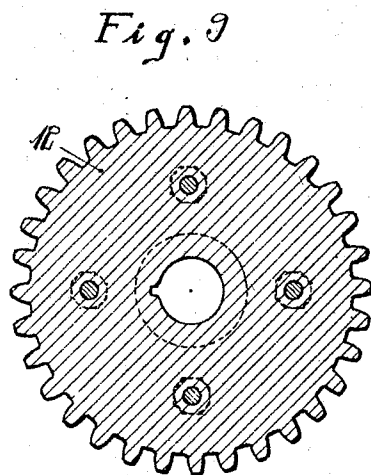
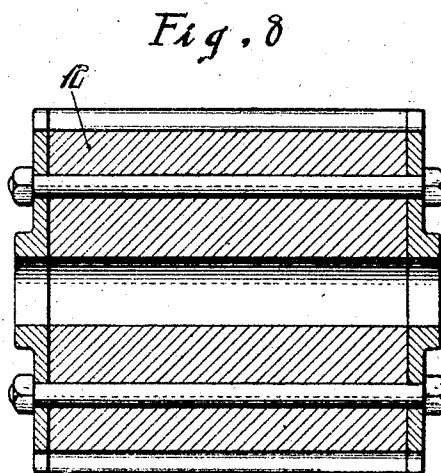
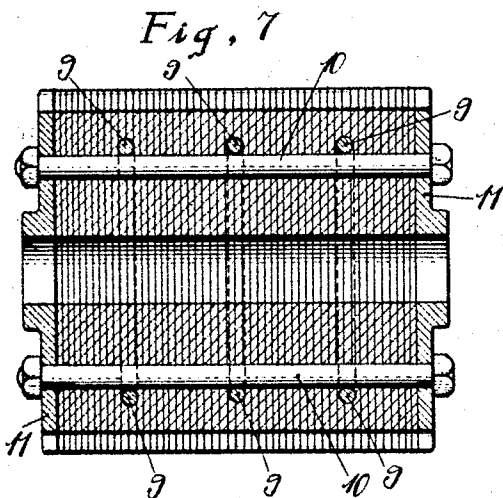
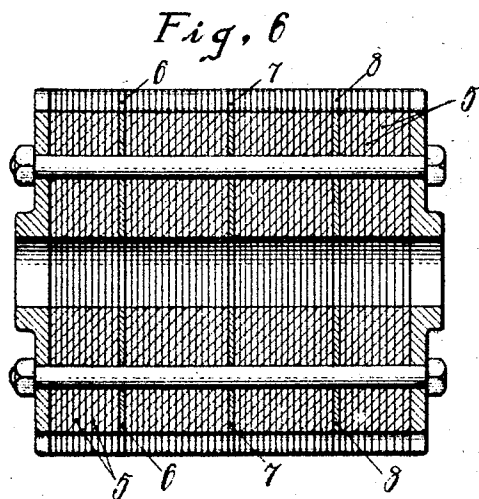
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NOISELESS TOOTHED WHEEL

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,228,828

NOISELESS TOOTHED WHEEL

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Application December 29, 1938, Serial No. 248,311

1 Claim. (Cl. 74-445)

The present invention relates to a noiseless toothed wheel, made of silk fibrous materials, and is characterized by the following features and constructions:

5 (1) Compressed silk fibre plates are obtained by mixing silk fibre solution to broken silk fibres laid crosswise and then by compressing them to plates and drying; numerous plates thus obtained are piled up; or properly moistened silk fibres
10 are heated and then softened sericins are compressed, so as to make the fibres adhere together compactly, and then they are cooled and dried, thus forming silk casting. From the compressed plates or silk castings formed as mentioned above,
15 various wheels such as spur wheels, bevel wheels, worm wheels or pulleys of appropriate shapes are produced.

(2) In piling up numerous silk compressed plates, several metallic sheets are inserted between the compressed plates at proper situations.

(3) In forming suitably shaped toothed wheels by piling up numerous compressed silk fibre plates or from silk castings, several annular reinforcement pieces are provided, closely surrounding tie
25 rods.

(4) In forming appropriately shaped wheels by piling up numerous compressed silk fibre plates or from silk castings, metallic reinforcing plates are provided on both sides of the wheels; and in
30 order to bind them together closely, tie rods are provided.

(5) Pulleys are formed by piling up numerous compressed silk fibre plates or from silk castings; on both sides of the pulleys thus formed, metallic reinforcing plates with diameters slightly smaller than those of the pulleys, are provided; to bind the pulley and plates together closely, tie rods are provided.

The accompanying drawings show the noiseless toothed wheels of the present invention:

Fig. 1 is a sectional side elevation of spur wheel.

Fig. 2 is its sectional elevation.

Fig. 3 is a sectional elevation of bevel wheel.

Fig. 4 is a sectional elevation of worm, for worm
45 gearing.

Fig. 5 is a sectional elevation of pulley.

Fig. 6 is a sectional elevation showing metal sheets inserted in the wheel.

Fig. 7 is a sectional elevation showing the annular reinforcements provided in the wheel.

Fig. 8 is a sectional elevation showing an example of a wheel formed of silk casting or made of silk solution.

Fig. 9 is a side elevation of the same.

The process of making wheels according to the present invention, is as follows:

Waste silk fibres or broken fibres obtained in the silk thread spinning operation are treated by roller type carding machine and lapped in thin
5 continuous layers, the grain of the fibres being arranged intercrossed; they are rolled on a drum and while they are being rolled, silk sericin solution obtained by mixing appropriate coagulating agents to a solution of boiled floss or cocoon hairs, is sprayed over the layers uniformly by an atom-
10 izer provided for the purpose; when they are lapped to a proper thickness, they are cut across and detached from the roller; while they are still wet, they are fully compressed, by a hydraulic
15 press or the like and at the same time heated properly until desired thickness is obtained; then they are cooled and compressed silk fibre plates are obtained:

As another process; unrefined, natural silk
20 fibrous materials are immersed in water or dilute ammonia solution and moistened to such an extent that sericin contained in silk does not dissolve off; then small amount of proteinaceous, coagulating agent like urea tri-oxy-methylen, is
25 added; the solution is placed in appropriate compressing moulds and heated; thus softened sericin is compressed and the fibres adhere together compactly; then they are taken off the moulds, cooled and dried, and silk castings are obtained. Another process is to put silk fibres reduced to solu-
30 tion into mould, compressed, cooled and dried and silk castings are obtained.

From the castings produced by any of the processes mentioned above, spur wheels 1 as
35 shown in Fig. 1 and Fig. 2 or bevel wheels 2 as shown in Fig. 3, or worm 3 as shown in Fig. 4, or pulleys 4 as shown in Fig. 5, are constructed. Further as shown in Fig. 6, in appropriate situations of compressed silk fibre plates 5, several
40 metallic sheets 6, 7 and 8 are inserted; they are formed into tight, compact bodies which lessen friction in gearing with other wheels.

As shown in Fig. 7, several reinforcing rings 9 are provided, closely surrounding the tie rods
45 for the purpose of reinforcement; or on both sides of the wheels, metallic reinforcing plates 11 are provided; and to unite and assemble these into one body, above mentioned tie rods 10 are provided; or as shown in Fig. 8 and Fig. 9, properly shaped wheels are formed of silk fibre
50 blocks 12.

In pulley shown in Fig. 5, reinforcing plates of diameters slightly smaller than those of the pulleys, are provided on both sides of the pulley; 55

this provision is for the purpose of reinforcement of the pulley and at the same time, the reinforcing plates 13 are prevented from coming into contact with other pulleys or belts; in this way, noise to be made by direct contact of metals, may be avoided.

Up to the present time, it has been usual to construct toothed wheels with phenol resin or leather with the object of preventing noise; in both of these cases, it has been quite expensive; in case of using phenol resin, teeth are liable to break and prevention of noise has been imperfect; while in case of using leather, teeth are easily disfigured, accompanying existence of water or oil; in other words, the permanence and durability of wheels are not sufficient.

Materials made of silk fibres possess strength equal to that of leather wheels and are oil proof at the same time; therefore toothed wheels constructed by these materials, are anti-frictional

oil-proof, waterproof, and do not generate high heat.

They are therefore suitable as substitutes of leather or metallic wheels and are highly advantageous on account of being noiseless.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States of America is:

A wheel comprising a plurality of plates arranged side by side and formed of compressed silk fibre, metallic reinforcing plates at the opposite sides of the first mentioned plates, tie rods connecting the metallic plates and passing through the first mentioned plates, and reinforcing rings engaging and surrounding the tie rods and embedded in the first mentioned plates at spaced points between said metallic plates within the periphery of the wheel.

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