Jan. 17, 1933. G. R. WATSON 1,894,432

WELL DRILLING MACHINE

Filed Nov. 4, 1931 3 Sheets-Sheet 1

Fig. 2.

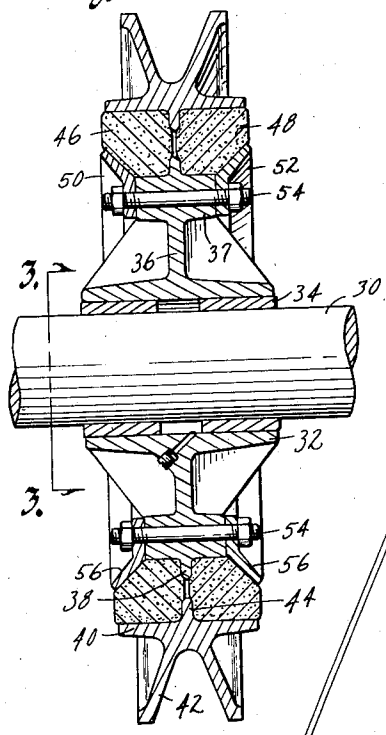

Fig. 1.

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Fig. 4.

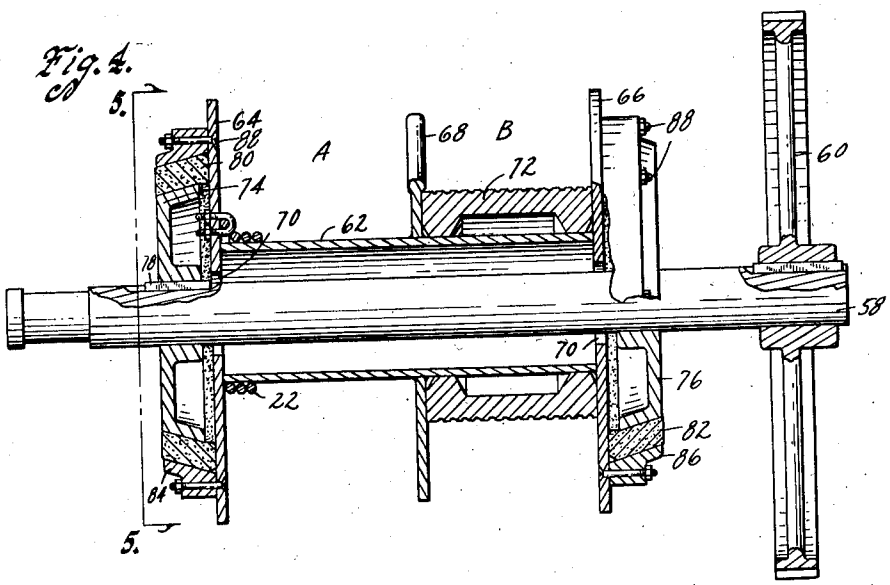


Fig. 5.

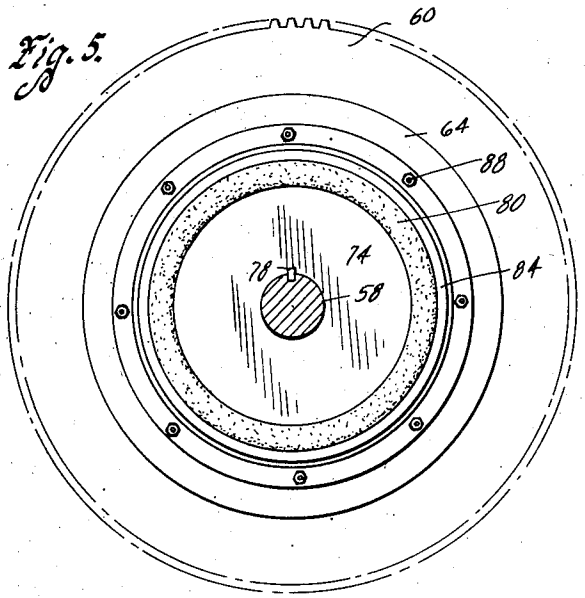
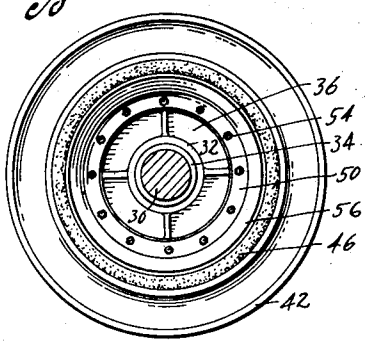


Fig. 3.



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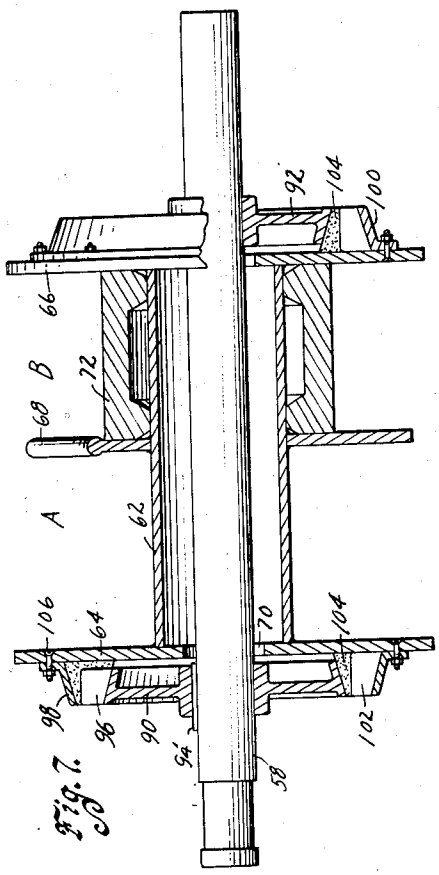

Fig. 7.

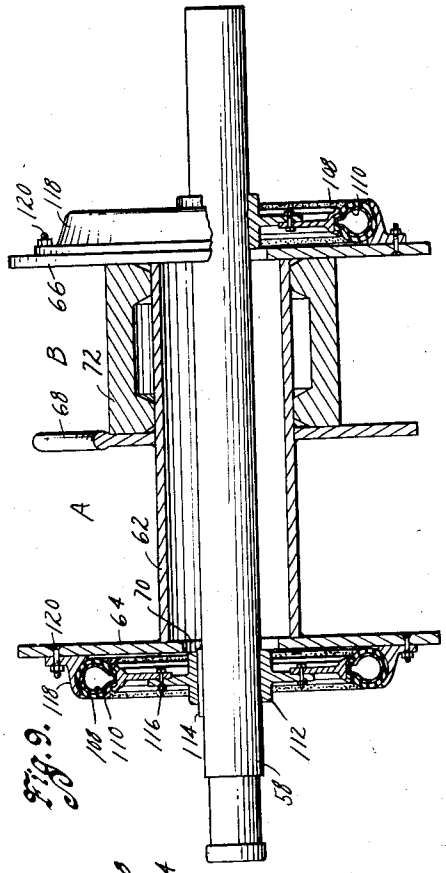

Fig. 9.

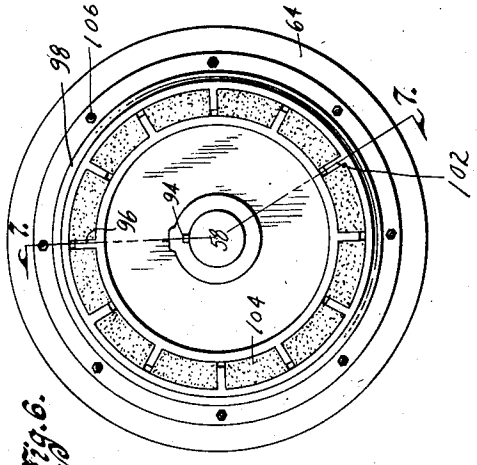

Fig. 6.

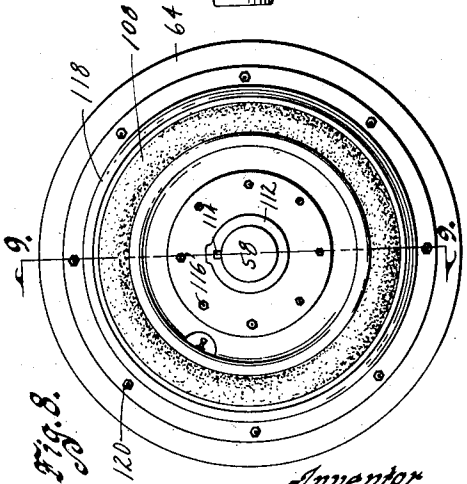

Fig. 8.

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UNITED STATES PATENT OFFICE

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WELL DRILLING MACHINE

Application filed November 4, 1931. Serial No. 572,888.

This invention relates to machines for drilling wells of various kinds and particularly to that type of drilling machine in which a steel cable is employed for lifting and dropping the drilling tool. The primary object of the present invention is to provide means for insulating the machine frame against vibration and shock which may be set up through percussion of the drilling tool and transmitted through the steel cable by which the tool is carried, such insulation being provided for the purpose of preventing injury and damage to the frame.

More specifically the object of the invention is to provide vibration insulation for all sheaves and drums carried by the frame and engaged by the steel cable, thereby preventing the sharp vibration waves which are set up by the impact of the drilling tool, particularly on rock, from being transmitted through the steel cable to the machine frame and thereby minimizing the crystallizing action of the metal parts of the frame. Another object of the invention is to provide vibration insulation for sheaves and cable drums used on excavating shovels and drag lines or other heavy machinery.

Still another object is to provide improved means for insulating the peripheral portion of a sheave or drum from its hub portion which has contact through a shaft or the like with a machine frame.

With these and other objects in view my invention consists in the construction, arrangement and combination of the various parts of my device, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which:

Figure 1 is a diagrammatic elevation of a well drilling machine embodying my improvements.

Figure 2 is a diametrical section through a sheave provided with vibration insulation.

Figure 3 is an elevation of the same on a reduced scale, partly in section, on the line 3—3 of Figure 2.

Figure 4 is a longitudinal section of a cable drum provided with one type of vibration insulation.

Figure 5 is an enlarged end elevation of the same, partly in section, on the line 5—5 of Figure 4.

Figure 6 is an end elevation of an insulated drum of modified form.

Figure 7 is a longitudinal section of the same on the line 7—7 of Figure 6.

Figure 8 is an end elevation of a further modified form of insulated drum employing a pneumatic insulating means; and

Figure 9 is a longitudinal section of the same on the line 9—9 of Figure 8.

In drilling machines of the type under consideration, it is customary to employ a drilling tool adapted for repeated impact with earth or rock, said tool being carried by a rope or cable, which extends over suitably arranged sheaves and is adapted to be wound upon a drum carried by a machine frame. The tool is alternately lifted and dropped by operation of suitable mechanism, and is advanced and retracted relative to the work by turning of the drum to unwind or wind a portion of the cable relative thereto.

For some time it has been known that it is more economical to employ a steel cable for carrying the drilling tool, because the initial cost is considerably less than that of a rope made of manila, hemp or the like, and because a steel cable will last much longer than a rope. There is another advantage in the use of a steel cable in securing more rapid action of the drilling tool and thereby increasing the drilling action because a faster motion is obtainable, particularly when the drilling tool is working in fluid where the natural buoyancy of a rope would somewhat retard the action.

However, there has heretofore been a vital

problem and difficulty when using a steel cable in that it tends to transmit the shock of the impact of the drilling tool, particularly when drilling rock, thereby setting up sharp vibration waves which are transmitted readily through the steel cable to the frame of the machine. This vibration results in injury and damage to the frame because of the crystallizing action on the metal. There have been some attempts to remedy this difficulty by using wooden frames for the machine or wooden parts for the frame, which expedient is not at all satisfactory for obvious reasons.

My present invention contemplates the use of vibration insulation in connection with all sheaves and drums carried by the machine frame and contacted by the drilling cable. The insulating means is interposed between the peripheral part of the sheave or drum which is contacted by the cable, and the hub portion which is in engagement with the machine frame through a shaft or the like.

All members which are engaged by the cable are thus insulated with suitable means for absorbing the shock and vibration, thus rendering it possible to use a steel cable and at the same time prevent the transmission of the vibration waves to the frame of the machine, thereby overcoming the difficulties hereinbefore mentioned.

In Figure 1 I have illustrated, more or less conventionally, a well drilling machine comprising a main frame 10 movably carried by any suitable means, such as a caterpillar truck 12. The frame 10 carries at one end, which is designated as the forward end, a super-structure or derrick 14 suitably supported and braced. The frame also carries a winding drum, designated generally by the numeral 16, and a wrist or crank wheel 18.

The drilling tool is represented at 20 and it is supported by a steel cable 22 which extends upwardly over a sheave 24 rotatably mounted at the top of the derrick 14. The cable then passes downwardly around a direction sheave 26, located at the upper forward portion of the frame, and carried by the free end of a so-called "spudding" beam 27, which is pivoted at its rear end to the main frame on the shaft 30 of the sheave 28. The cable then passes around the direction sheave 28 and thence to the drum 16 upon which a portion is wound. By rotary movements of the drum 16, the tool 20 is lifted to inoperative position, or lowered toward the work and gradually advanced as the work progresses.

The sheaves 24, 26 and 28 may be alike in construction, each being provided with suitable means for insulating against vibration. The construction of these sheaves is illustrated in detail in Figures 2 and 3 and will now be described.

The numeral 30 designates the shaft or spindle on which the sheave is mounted for rotation, said shaft being carried by the frame or by its super-structure 14, which really forms a part of the frame.

The pulley or sheaves includes a hub portion 32 surrounding the shaft and preferably having a bronze bushing 34 interposed therebetween. Extending outwardly from the center of the hub 32 is a web 36 which terminates in an annular enlargement or rim 37. The portion 37 preferably is formed with a central, outwardly projecting rib 38.

The peripheral portion of the sheave is formed separately from the hub and it includes an annular plate 40, having on its outer face a substantially V-shaped cable guide 42. The annular plate 40 may be formed on its inner periphery with an inwardly projecting rib 44 corresponding to the rib 38 on the rim 37 of the hub.

The annular plate 40 of the peripheral part of the hub is of materially greater diameter than the rim 37 of the hub portion and suitable vibration insulating means is interposed between these members. In the present instance, this insulating means consists of two rings of rubber, rubber composition or other suitable cushioning material. These two cushioning rings are designated by the numerals 46 and 48 and they are arranged on opposite sides of the median line of the sheave and are separated slightly by the ribs 38 and 44.

The cushioning rings 46 and 48 are clamped and held in place by means of a pair of clamping rings 50 and 52, one located on each side of the sheave, and held conjointly in place by means of a series of bolts or the like 54, passing through openings in said rings and in the rim portion 37 of the hub.

The cushioning rings 46 and 48 may be of any suitable shape in section and are here shown as being beveled on their outer faces and at their inner peripheries, these beveled portions being engaged by inclined parts 56 formed at the outer peripheries of the clamping rings.

The cushioning rings 46 and 48 preferably are placed under some tension or compression when the bolts 54 are drawn up tightly and said cushioning rings serve to provide an operative connection between the peripheral and hub portions of the sheave and at the same time to insulate one part from the other so that vibration and shock imparted to the periphery will not be transmitted to the hub.

It will be understood that other specific forms of vibration insulating means for the pulleys may be provided and the form herein illustrated and described is given only as an illustration of a suitable and effective means for preventing the transmission of shock from the steel cable to the frame of the ma-

chine at the points where the cable passes over the sheaves.

In Figures 4 and 5 I have illustrated a construction which may be employed for the winding drum or reel in order to accomplish the purposes of my invention.

In this form of the drum the numeral 58 is employed to designate the drum shaft which is suitably journaled in the frame and to which turning movement may be imparted from the jack shaft 59 by means of a gear 60 keyed to the drum shaft, through suitable clutch connections (not shown). The jack shaft 59 is operated by an engine located under the hood 61, by a drive belt enclosed in the housing 63.

The reel as here shown has two compartments, namely a storage space A upon which any surplus cable may be wound and a working space B which preferably carries not more than a single layer of the cable, and relative to which the cable is wound and unwound for raising and lowering the drilling tool.

The body of the reel is made up of a pipe or tube 62 which is arranged concentrically of, and spaced from, the drum shaft 58 and extends throughout the two compartments A and B of the reel or drum.

The outer end of the drum member A is defined by an annular head plate 64, and the outer end of the part B is defined by a similar member 66, while the two spaces are separated by an annular partition 68 fixed to and carried by the center portion of the tube 62. It will be observed that the head plates 64 and 66 are formed with central openings 70 which are of sufficient diameter to separate the inner peripheries of the head plates at all times from the shaft 58 and to prevent any contact therewith.

The working space B of the drum is provided with an enlarged body composed of a cylindrical member 72 surrounding that portion of the tube 62 between the head plate 66 and partition plate 68 and preferably having a corrugated outer surface for engagement by the cable.

At each end of the drum there is provided a hub member which is secured to the shaft 58, these hub members being designated respectively as 74 and 76 and the securing means being in the form of keys 78. The hub members 74 and 76 are of material thickness in a direction axially of the drum and preferably are frusto conical, or somewhat tapered, on their outer surfaces. The hub members 74 and 76 are definitely spaced at their inner ends from the adjacent head plates 64 and 66 so that there is no actual physical contact between said hub members and the reel portion of the drum.

Insulating or cushioning rings 80 and 82 are mounted in engagement with the sloping faces of the hub members 74 and 76 respectively and they have their inner ends in engagement with the outer faces of the head plates 64 and 66. The insulating rings 80 and 82 may be formed of rubber, rubber composition or other suitable cushioning material.

The cushioning rings 80 and 82 are engaged and held in place respectively by metallic clamping rings 84 and 86, which are secured to the head plates 64 and 66 respectively by means of a series of bolts 88.

The cushioning rings 80 and 82 preferably are formed with sloping inner faces to conform to the sloping sides of the hub members which they engage and also are formed with sloping outer sides which are engaged by corresponding sloping inner faces of the clamping rings. The parts are so formed that when the clamping rings are mounted in place and are drawn up tightly, by means of the bolts 88, the cushioning rings 80 and 82 are placed under compression and tension so that a snug driving fit is provided. Sufficient frictional engagement is thereby produced to insure that turning movement imparted to the shaft 58 will be passed on through the hub members 74 and 76, cushioning rings 80 and 82 and clamping rings 84 and 86 to the head plates 64 and 66 whereby the reel portion of the drum will be rotated. In other words, the cushioning rings 80 and 82 are employed as a means for absorbing torsional shock and strain as well as radial strain, and it will be observed that the reel portion of the drum is permitted to have some radial movement relative to the shaft 58 and without contacting therewith because of the central apertures 70 of the head plates and the complete spacing of all other members of the reel assembly from the shaft.

The only parts which have actual contact with the shaft 58 and are thereby capable of transmitting strain to the machine frame are the hub members 74 and 76 and these members are of course insulated from that portion of the drum engaged by the cable by means of the cushioning rings 80 and 82 and thus assurance is had that no vibration imparted to the cable will be transmitted to the frame of the machine.

In Figures 6 and 7 I have illustrated a modified form of insulated drum which has the same general characteristics. This form of the drum includes several members which are, or may be, identical with those previously described, including the shaft 58, tubular body 62, head plates 64 and 66, partition plate 68 and winding drum body 72.

The hub members, cushioning means and clamping rings of this particular drum are somewhat different and the hub members are designated generally by the numerals 90 and 92, each being keyed to the shaft by a key 94.

The hub members 90 and 92 are spaced from their respective head plates 64 and

66 and each of said hub members is formed with a series of outwardly projecting radial fins 96.

Clamping rings 98 and 100 are provided, one located outside of each hub member and suitably spaced therefrom. Each clamping ring is formed with a series of spaced inwardly projecting radial fins 102, which alternate with the fins of the respective hub members. The ends of the fins 96 are spaced at all times from the inner faces of the clamping rings and the ends of the fins 102 are spaced at all times from the outer faces of the hub members so that there is no physical contact between the metal parts thus involved.

Between the hub members 90 and 92 and the clamping rings 98 and 100 respectively are mounted a series of cushioning blocks 104 which are also interposed between and separated by the alternating fins 96 and 102 of the said members. The cushioning blocks may be made of any suitable insulating material as hereinbefore referred to and it is their function to cushion and insulate that portion of the drum which is engaged by the cable from the portion which engages the shaft and the machine frame.

The primary purpose of the alternating fins 96 and 102 on the two parts of the drum is to provide a positive driving means whereby rotary driving force from the shaft 58 is transmitted through the hub members and their fins 96 to the cushioning blocks 104 and thence to the fins 102 of the clamping rings 98 and 100, which are secured to the respective head plates 64 and 66 by means of a series of bolts 106.

Otherwise the functions of the cushioning blocks 104 are the same as previously stated with respect to absorbing vibration from the cable and preventing it from being transmitted through the drum to the shaft and machine frame.

The construction according to Figures 8 and 9 is in many respects the same as previously described and the parts which are alike are designated by similar reference numerals. According to this construction, I employ pneumatic cushioning means between the two parts of the drum as exemplified by a pair of casings 108 formed of rubber or a suitable composition of rubber and fabric, one of these members being located at each end of the drum and adjacent the outer face of the head plates. Each casing 108 contains an inner tube 110 which is capable of being inflated by ordinary means.

The hub members of this type of drum are designated by the numeral 112 and they are secured to the shaft 58 by keys 114. As here shown, the hub members are each made in two parts, the outer portion being secured to the inner portion by means of bolts 116 and being provided at their outer peripheries with portions adapted to engage the inner peripheries of the casings 108.

The clamping rings are designated by the numerals 118 and they are shaped to conform substantially to the outer peripheries of the casings 108, which they engage. The clamping rings 118 are secured to the respective head plates by means of bolts 120.

The functions of the pneumatic cushioning means are the same as previously set forth with respect to absorbing and minimizing vibration and also providing a frictional driving connection between the hub members which are secured to the shaft and the clamping rings which are secured to the reel portion of the drum.

In operation the drilling tool 20 is lowered to the work by permitting a portion of the cable 22 to be unwound from the reel and thereafter the tool is alternately lifted and dropped to cause repeated impact with the earth or rock to be drilled. This operation is accomplished by the wrist or crank wheel 18 which has a suitable clutch connection, not shown, with the jack shaft 59. The wrist wheel 18 is connected by a pitman or connecting rod 19 with the free end portion of the spudding beam 27 so that when the wheel 18 is rotated, the forward or free end portion of said beam, and with it the sheave 26, will be alternately raised and lowered. This action, slacking and retracting the forward portion of the cable 22, or in other words—the portion which extends over the upper sheave 24 and to the free end of which the tool is attached, will obviously cause an alternate dropping and lifting of the tool for the drilling operation.

By employing either of the vibration insulating means which I have shown and described with respect to the drum and sheaves, or insulating means of a similar character, I am enabled to effectively prevent the transmission of vibration from the drilling tool through the steel cable to the frame of the drilling machine and thereby obviate the difficulty which has heretofore been present in the use of steel cables for carrying the drilling tool.

In other words—by my present invention I make it possible and practicable to employ a steel cable, with all the attendant advantages of such use, without the disadvantages which I have previously outlined in this specification.

I claim as my invention:—

1. In a drilling machine, a drilling tool, a cable carrying the tool, a drum on which a portion of the cable is adapted to be wound, and non-metallic vibration insulating means interposed between the machine frame and that portion of the drum engaged by said cable, to permit such portion of the drum to move independently in any radial direction.

2. A machine, comprising a frame, a drum

thereon, a cable arranged to be wound and unwound relative to the drum, sheaves on said frame over which said cable is extended, and non-metallic cushioning means arranged between the machine frame and the peripheral parts of the drum and sheaves engaged by said cable, to permit such peripheral parts to move independently in any radial direction, for cushioning vibration and preventing transmission of such vibration to said frame.

3. A machine, comprising a frame, a drum thereon, a cable arranged to be wound and unwound relative to the drum, sheaves on said frame over which said cable is extended, and non-metallic vibration insulation means arranged between the hub and peripheral part of the drum as well as between the hub and peripheral part of each sheave engaged by said cable, thereby permitting said peripheral parts to yield bodily in any radial direction for cushioning vibration and preventing the transmission of such vibration to said frame.

4. A winding drum for a drilling machine employing a tool carried by a cable, comprising a shaft journaled in the frame of the machine, hub members fixed to said shaft, a reel portion concentric with and having all of its parts spaced from the shaft, and non-metallic cushioning members interposed between and forming a connecting means for the hub members and the reel portion to prevent transmission of vibration from the tool to the frame.

5. In a drilling machine having a frame and employing a drilling tool carried by a cable, a shaft journaled on the frame, a hub member fixed to said shaft, a peripheral portion engaged by said cable and having no direct contact with said shaft, and a non-metallic cushioning means interposed between the hub members and peripheral portion to form a non-metallic connection therebetween and to prevent transmission of vibration from one to the other.

6. In a drilling machine employing a cable for carrying a drilling tool, a sheave over which the cable is extended, said sheave being provided with non-metallic vibration insulating means interposed between its hub and its cable engaging peripheral portion, whereby vibration set up in the cable through impact of the tool is prevented from being transmitted through the hub of the sheave to the frame of the machine.

7. A winding drum for a drilling machine having a frame and employing a tool carried by a cable, comprising a shaft journaled in said frame, a cable-receiving reel including a pair of spaced head plates having central openings through which said shaft extends without contact, a pair of hub members fixed to the shaft adjacent but having no metallic contact with said head plates, and cushioning means interposed between said hub members and the respective head plates for forming a connection therebetween and for preventing the transmission of vibration from one part to the other.

8. A winding drum for a drilling machine having a frame and employing a tool carried by a cable, comprising a shaft journaled in said frame, a cable-receiving reel including a pair of spaced head plates having central openings through which said shaft extends without contact, a pair of hub members fixed to the shaft adjacent but having no metallic contact with said head plates, cushioning means arranged circumferentially and engaging the peripheries of said hub members, clamping rings engaging the radially outer surfaces of said cushioning means, and means for securing said clamping rings rigidly to the head plates of said reel.

9. A winding drum for a drilling machine having a frame and employing a tool carried by a cable, comprising a shaft journaled in said frame, a cable-receiving reel including a pair of spaced head plates having central openings through which said shaft extends without contact, a pair of hub members fixed to the shaft adjacent but having no metallic contact with said head plates, cushioning means arranged circumferentially and engaging the peripheries of said hub members, clamping rings engaging the radially outer surfaces of said cushioning means, means for securing said clamping rings rigidly to the head plates of said reel, said cushioning means being formed with radially arranged openings, and projections on said hub members and clamping rings for engaging in said openings.

10. A winding drum for a drilling machine having a frame and employing a tool carried by a cable, comprising a shaft journaled in said frame, a cable-receiving reel including a pair of spaced head plates having central openings through which said shaft extends without contact, a pair of hub members fixed to the shaft adjacent but having no metallic contact with said head plates, cushioning means arranged circumferentially and engaging the peripheries of said hub members, clamping rings engaging the radially outer surfaces of said cushioning means, means for securing said clamping rings rigidly to the head plates of said reel, said cushioning means being formed with radially arranged openings, and alternating projections on said hub members and clamping rings for engaging in said openings.

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