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ADHESIVE DRIVE FOR A TAPE-SHAPED SIGNAL CARRIER

Filed July 24, 1959

Fig.1

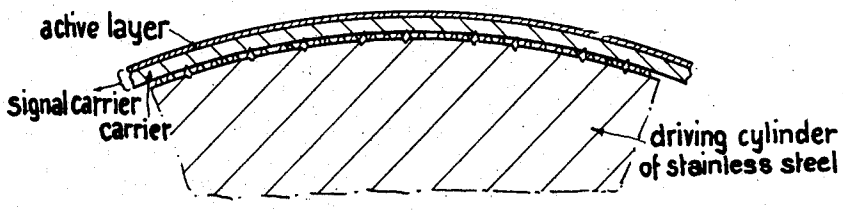


Fig.2

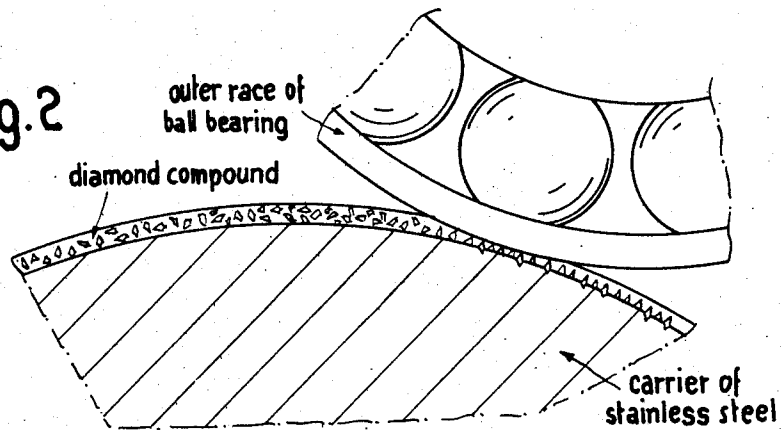
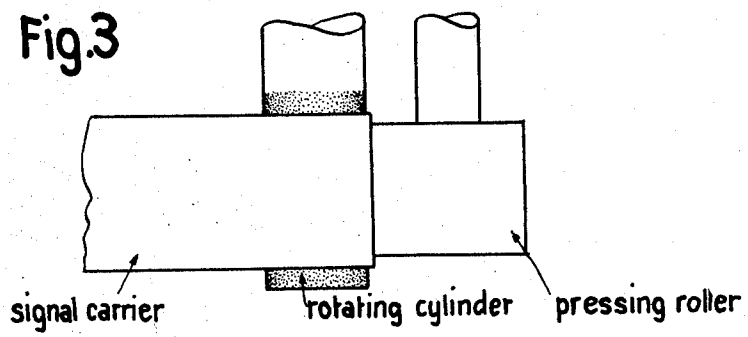


Fig.3



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ADHESIVE DRIVE FOR A TAPE-SHAPED SIGNAL CARRIER

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This invention relates to an adhesion drive for a tape-shaped signal carrier adapted to be fed through a signal recording or signal reproducing apparatus, such as a magnetic sound tape, a perforated tape or the like, wherein the speed of the signal carrier is controlled by contact thereof with a rotating cylinder.

The most important problem with adhesion drives of this kind, which has not been solved satisfactorily up to date, is the slip between the signal carrying tape and the said rotating cylinder which must be avoided to prevent fluctuations of the tape speed. It is well known that fluctuations of the speed of a magnetic sound recorder result in distortions of the high frequencies or in fluctuations of the sound reproduced from the tape, according to whether such speed fluctuations are of high or low frequency. Further when using sound recording tapes for recording the accompanying sound of films or television, the synchronism between the picture and the sound is gradually lost during reproduction due to the continuously occurring slip between the sound recording tape and its driving cylinder.

Attempts have been made for overcoming these difficulties by coating the driving cylinder with rubber, plastic material or the like for increasing the adhesion, but this measure has the drawback that the driving cylinder must be cleaned rather frequently and that the soft surface is subject to deformation after a relatively short time of operation. For avoiding these defects the use of a hardened and roughened steel cylinder was also proposed, whereby the tape is pressed against the cylinder by means of a roller of soft material such as nylon. To allow the use of a relatively thin steel, driving cylinder the active layer of the sound recording tape was fed through the machine in contact with the driving cylinder and the nylon roller applied with a very high pressure. However, it was found that the roughness of the hardened steel cylinder is rapidly ground off by the sound recording tape so that the adhesion between the cylinder and the tape decreases to values allowing undue slip between these elements. Therefore, extremely thick driving cylinders have been used for first class instruments. However, even this measure does not entirely avoid slip between the driving cylinder and the sound recording tape.

It is the main object of this invention to provide an adhesion drive which is simple in manufacture and by which slippage between the driving cylinder and the tape is completely avoided, said drive comprising a driving roller having a cylindrical surface to be contacted by the said tape-shaped signal carrier, or tape, the said surface being provided with hard projecting particles such as diamond particles.

The novel features that are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawings, and in which:

FIG. 1 is a fragmentary, enlarged sectional view showing a portion of the driving cylinder engaged by a tape;

FIG. 2 is a similar view illustrating the manufacturing process utilized to embed the diamond particles in the driving cylinder; and

FIG. 3 is a plan view illustrating a pressing roller urging the tape into contact with the rotating driving cylinder.

Referring now to the drawings, the driving cylinder, or roller, should be made of a relatively soft, stainless material such as unhardened stainless steel, copper, brass or a plastic material, diamond particles having a size in the order of 20 to 100μ for a cylinder diameter of 5 to 10 mm. being rolled into the surface of the driving cylinder in such a manner that approximately half the particles project from the surface of the cylinder. The size of the particles may increase with increasing diameter of the driving cylinder, and the size should be chosen in such a way that fluctuation of the driving speed is impossible due to inequalities in the engagement of the tape with the particles. Further, in order to obtain proper engagement of the tape with the projecting portions of the particles the distance between neighboring particles should substantially exceed the particle size, for instance this distance should be in the order of 3 to 4 times the particle size as shown in FIG. 1. Further, all particles should be of equal size and equal shape. When observing these conditions, excellent adhesion between the tape and the driving cylinder will be obtained. The pressure of a roller urging the tape against the driving cylinder may be decreased to a fifth or tenth of the pressure used in known apparatuses. A pressing roller should be used having an axial length not exceeding the width of the tape as shown in FIG. 3 in order that the roller contacts the tape only and not the driving roller. It was found that a roller contacting the tape and the driving cylinder often causes deviations of the tape speed from the circumferential speed of the driving cylinder because the tape is driven by the pressing roller. It is a particular advantage of this invention that the driving cylinder is practically not worn due to the absence of slip and due to the high hardness of the particles forming the driving surface. When using a synchronous motor for rotating the driving cylinder, an exactly synchronous running of the tape may be secured for considerable running periods of the apparatus. Due to the reduced radial pressure of the pressure roller, friction in the driving system may substantially be reduced so that smaller flywheels and smaller driving motors may be used, and the total dimensions, weight and cost of the apparatus may accordingly be reduced. If sufficient pull is set up in the tape and when the looping angle or angle of grip of the tape on the driving cylinder is relatively great, a pressing roller may be dispensed with. In this manner, an apparatus without any part of plastic or other soft material may be obtained. It is further possible to increase the adhesion between the driving cylinder and a sound recording tape of a sound recorder without solenoid-operated pressure roller for fast start, by passing the active layer of the tape in contact with the driving cylinder, whereby the size of the hard particles of the driving cylinder may preferably be equal to the size of the particles of the active tape layer. In this way some sort of gear-like engagement between the particles of the tape and of the cylinder will occur resulting in an absolutely slip-less drive.

Manufacture of the driving cylinder is relatively simple. However, some important indications mentioned hereafter should be followed. The surface of the cylinder is to be worked, for instance ground, to be very smooth. To the so smoothened surface a pasty substance containing the diamond particles is applied as indicated in FIG. 2. A suitable diamond compound of this kind is manufactured by "A.G. für Oberflächentechnik," at Lucerne, Switzerland. The driving cylinder is now rotated and a roller having a surface harder than the driving cylinder is

slowly approached to a distance in the order of 1/10 of a millimeter from the cylinder surface, whereby the pasty substance is first equally distributed on the cylinder surface without pressing the hard particles into the cylinder surface. When the desired distribution and thickness of the substance has been attained the roller is further approached substantially into contact with the surface of the driving cylinder whereby the particles are rolled into the relatively soft cylinder surface. As an example, the hardened outer race of a ball bearing may be used as a pressure roller, this ball bearing being fixed on a slightly resilient support. During this operation the speed of the cylinder surface should be relatively low and should not exceed 10 cm./sec. Smoothing the cylinder surface and providing it with the hard particles in the manner just described should be done before the cylinder is removed from its clamping in the lathe, or other machine used for fabricating the driving cylinder in order to first obtain an absolutely cylindrical driving surface in which all hard particles are thereafter inserted to an absolutely equal depth.

This invention may be used in all kinds of apparatus used in sound-picture production, in magnetic picture recording machines for television, and for automatic control of machines by means of perforated tapes or the like, wherein the higher precision and the longer lift-time of the drive are very important.

Of course the drive may also be used where the cylinder is not driven by a motor and does not drive the tape, but where the cylinder is driven by the tape. Such an arrangement is used when equalizing the speed of tapes fed by means of toothed rollers engaging perforations of the tape, such tapes being fed over an adhesion cylinder connected to a flywheel, the adhesion cylinder and flywheel equalizing fluctuations of the tape speed due to the drive thereof by means of toothed rollers.

The long life-time of the rough surface of the driving cylinder is of particular advantage for machines used for producing tape copies from an original, such machines having very high running times of up to 24 hours per day.

What I claim is:

1. An adhesion drive for a magnetic recording tape having an active layer comprising individual particles of magnetizable material at one side of said tape, comprising a rotating cylinder and means for maintaining the said tape in contact with the rotating cylinder in order to maintain the speed of the tape equal to the circumferential speed of the rotating cylinder, the said cylinder having a smooth cylindrical surface, hard particles being partially pressed and thus anchored in the said surface of the cylinder, the remaining portion of the particles projecting from the said surface and contacting the active layer of the said magnetic recording tape, the said hard particles having a size in the same order as the size of the individual particles of the said active layer.

2. An adhesion drive for a recording tape, comprising a rotating cylinder having a smooth cylindrical surface and means for maintaining the said tape in contact with the cylindrical surface of the rotating cylinder in order to maintain the speed of the tape equal to the circumferential speed of the rotating cylinder, hard particles being anchored in the said cylindrical surface of the rotating cylinder with portions of all particles being inserted into the cylindrical surface to an equal depth, the remaining portion of the particles projecting from the cylindrical surface and uniformly contacting the tape on the cylindrical driving surface.

3. An adhesion drive for a recording tape, comprising a rotating cylinder having a smooth cylindrical surface and means for maintaining the said tape in contact with the cylindrical surface of the rotating cylinder in order to maintain the speed of the tape equal to the circumferential speed of the rotating cylinder, hard particles having a size of less than 100μ being anchored in the said smooth cylindrical surface of the rotating cylinder with portions of such particles being inserted into the cylindrical surface of the rotating cylinder, the remaining portion of the particles projecting from the cylindrical surface and contacting the said recording tape, said particles being substantially uniformly distributed at random on said smooth cylindrical surface.

4. An adhesion drive according to claim 3, comprising particles of substantially equal size.

5. An adhesion drive according to claim 3, comprising a rotating cylinder of stainless steel.

6. An adhesion drive for recording tape, comprising a metallic rotating cylinder having a smooth cylindrical surface and means for maintaining the said tape in contact with the cylindrical surface of the rotating cylinder in order to maintain the speed of the tape equal to the circumferential speed of the rotating cylinder, the said cylindrical surface having a diameter in the order of 5–10 mm. and hard particles having a size in accordance with the said diameter of the cylindrical surface in the order of 20–100μ being anchored in the said cylindrical surface of the rotating cylinder with portions of such particles inserted into the cylindrical surface of the rotating cylinder, the remaining portion of the particles projecting from the cylindrical surface and contacting the said recording tape.

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