Sept. 6, 1949. M. CAMRAS 2,481,392

MEANS FOR BULK DEMAGNETIZATION

Filed March 2, 1945

Fig. 1

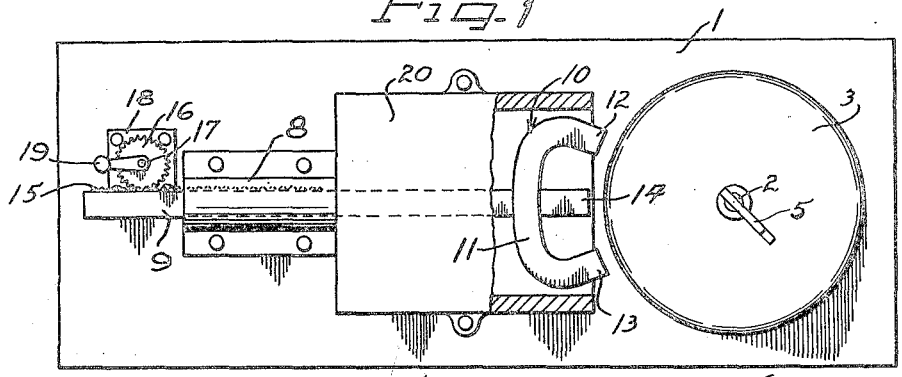


Fig. 2

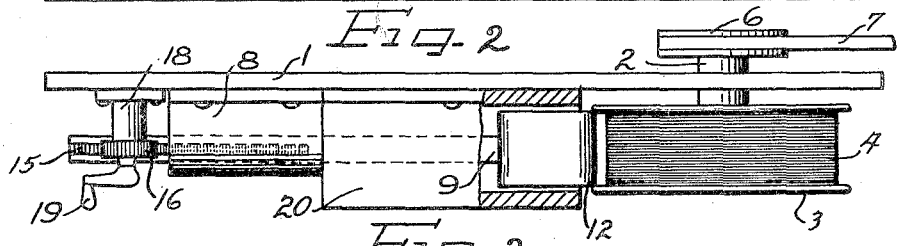


Fig. 3

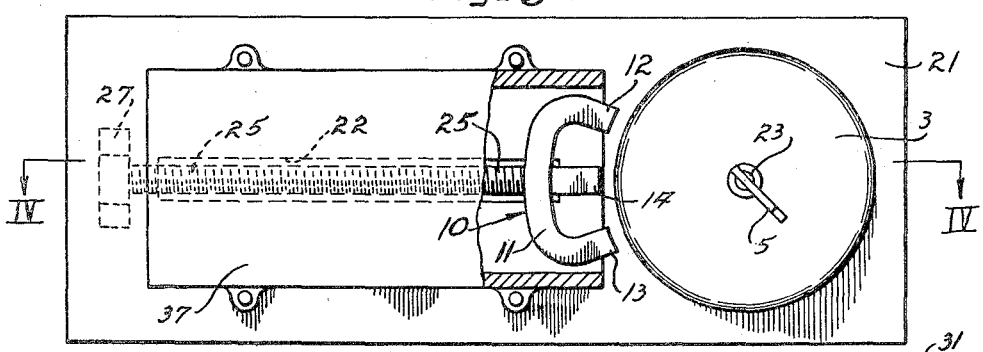
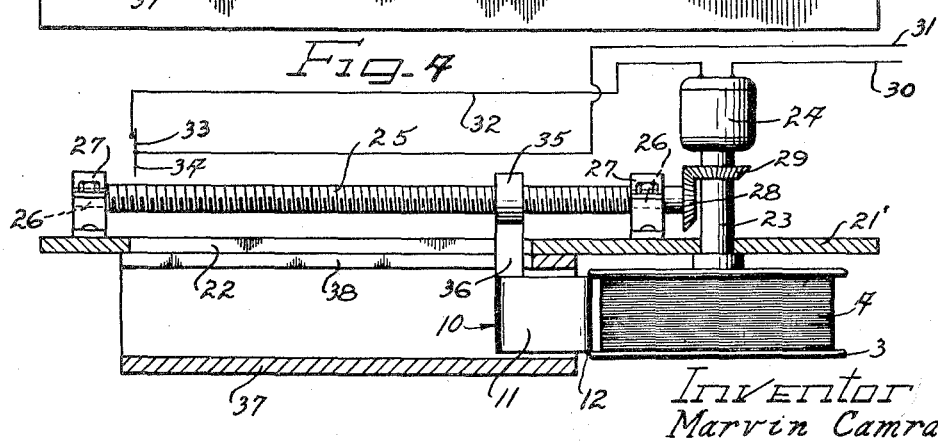


Fig. 4



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MEANS FOR BULK DEMAGNETIZATION

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1 Claim. (Cl. 175—181)

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This invention relates to improvements in a method of and means for bulk demagnetization, the invention being highly desirable for use in connection with the bulk demagnetization of a spool carrying a magnetized recording medium of the character used in magnetic recording devices, although the invention may have other uses and purposes as will be apparent to one skilled in the art.

In magnetic recording devices which are also equipped with reproduction means, and wherein a record is made by magnetizing an elongated recording medium such as a wire or tape, an erasing or wire cleaning head is frequently employed to remove a previous magnetization or recording from the wire just prior to the making of a new recording. However, in many cases it is desired to utilize a magnetic recording device that is not equipped with any erasing or cleaning head, and in such case it is necessary that the recording medium be in a clean state before being used on the recording device. By a clean state, is meant either that the medium is uniformly magnetized or demagnetized before it is used in the recording device. With such devices, and under other circumstances where it is desirable to separately demagnetize a recording medium, it is necessary in a separate operation to run the medium through a cleaning head. In the past, this required the complete rewinding of the medium, which frequently includes many thousands of feet of fine wire wound upon a spool or reel. Such rewinding operation requires an objectionable length of time.

With the foregoing in mind, it is an important object of this invention to provide a method of and means for bulk demagnetization of a magnetic recording medium; that is, the demagnetization of the medium while it is wound upon a spool, without necessitating the unwinding of the medium in order to effect the demagnetization thereof.

Another object of the instant invention is the provision of means for bulk demagnetization of a magnetic recording medium, which means are effective for the demagnetization of stainless steel and material equally difficult to demagnetize.

A further object of the instant invention is the provision of bulk demagnetization means for use in connection with magnetic recording media, which means may be either hand operated or mechanically driven, as may be most desired.

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Still a further feature of the instant invention resides in the provision of a bulk demagnetizer for magnetic recording media so constructed as to provide comparatively a high concentrated magnetic field so that relatively little movement of the apparatus is necessary in order to effect complete demagnetization of an entire supply or mass of magnetized recording medium.

It is also a feature of the instant invention to provide a bulk demagnetizer for magnetic recording media which is exceedingly rapid and positive in operation so that an entire spool of magnetized recording medium may be demagnetized in a very short interval of time and with little work on the part of an operator.

Another object of this invention is the provision of a bulk demagnetizer capable of giving the effect of a slowly alternating magnetic field which effect is gradually lessened as to the article being demagnetized.

Still another object of the instant invention is the provision of a bulk demagnetizer for magnetic recording media, which is capable of handling a relatively large mass or supply of magnetized recording medium in a single operation, the demagnetizer being very economical both in initial cost and to operate, and of a highly durable character.

Also an object of the instant invention is the provision of a new and novel method of bulk demagnetization, especially of a magnetized recording medium of the character used in magnetic recording devices.

While some of the more salient features, characteristics and advantages of the instant invention have been above pointed out, others will become apparent from the following disclosures, taken in conjunction with the accompanying drawing, in which:

Figure 1 is a front elevational view of a bulk demagnetizing device, embodying principles of the instant invention;

Figure 2 is a top plan view of the structure of Figure 1;

Figure 3 is a front elevational view of a bulk demagnetizing device embodying principles of the instant invention, but indicating a mechanically driven device of somewhat different construction than that of Figures 1 and 2; and

Figure 4 is a plan sectional view, with parts shown in elevation, of the structure of Figure 3 taken substantially as indicated by the line IV—IV

of Figure 3, looking in the direction of the arrows.

As shown on the drawings:

In that illustrated embodiment of the instant invention seen in Figures 1 and 2, there is shown a supporting structure or base 1 provided with suitable means to journal a shaft 2 near one end thereof. This shaft is provided with a split or otherwise deformed outer end and is designed to support a spool or reel 3 carrying a quantity 4 of wound recording medium thereon, and which spool may be locked to the deformed end of the shaft by any suitable means such as a pivoted lever 5 seen in Figure 1. In the illustrated instance, the recording medium 4 is in the form of a relatively great length of fine round wire wound upon the spool. For magnetic recording purposes, this wire need only be substantially of the diameter of a human hair, a wire approximately 0.004 inch in diameter being satisfactory. Insofar as the instant invention is concerned, this wire may be of stainless steel, iron, or any other suitable magnetizable material having sufficient tensile strength.

The shaft 2 together with the reel or spool carried thereon may be rotated at any desired time and preferably at a relatively slow speed by any suitable means, such, for example, as a pulley 6 and belt 7 as indicated in Figure 2.

Also carried on the base or frame 1 is a suitable bearing 8, spaced from the shaft 2. This bearing 8 slidably accommodates a shank or rod 9 which is preferably of polygonal cross-section, square in the illustrated instance, to prevent rotation. On its inner end, the shank preferably carries a magnet, generally indicated by numeral 10, and which in the illustrated instance is in the form of a permanent magnet. Also, in the illustrated instance, the magnet has substantially a yoke-shape as indicated at 11 providing a pair of spaced terminal poles 12 and 13. Another pole 14 projects centrally of the yoke arrangement. The pole 14 is of opposite polarity to the poles 12 and 13 which may be of like polarity. As a result of this construction, there is a concentrated magnetic field set up by the magnet 10.

As seen best in Figure 2, the magnet is preferably of a width substantially equal to the space between the flanges of the spool or reel 3, so that the magnet is of sufficient breadth to extend across the width of the wound recording medium 4. Preferably, the entire magnet is made of some highly magnetizable material having good retentivity, such, for example, as the commercial product known as "Alnico."

The magnet 10 is moved both toward and away from the spool or reel 3 by means of a rack and pinion arrangement. In the illustrated instance, the rear end of the rod or shank 9 is provided with a rack 15 which may be engaged by a pinion 16 carried on a shaft 17 journaled in a suitable bearing bracket 18 attached to the panel 1. A handle 19 is provided for manual rotation of the pinion 16 to cause movement of the rod or shank 9. Preferably, the rack and pinion have very fine teeth so that the movement of the magnet will be comparatively slow, and there will be no jerk of a sufficient degree to hinder proper demagnetization when the magnet initially moves away from the spool and wire thereon.

A metallic housing 20, open at both ends, is mounted on the panel 1 so as to substantially surround the magnet 10 at all times. The magnet projects without one end of the housing when in close proximity to the spool 3, as seen

in Figures 1 and 2, but the major portion of the magnet is always within the housing both during retraction and forward movement. This housing is preferably made of steel or other magnetizable metal, and functions as a shield around the magnet. In the illustrated showing, the housing is shown as extending on all four sides of the magnet. This is desirable in the event the panel 1 is made of a plastic material, some other non-metallic material, or of a non-magnetizable metal. In the event the panel 1 is of steel or some other magnetizable metal, it will be understood that the housing need only have three sides, the panel itself functioning as the fourth side.

In using the bulk demagnetizer above described, it is a simple expedient to mount a spool of magnetized recording medium upon the shaft 2, place the magnet 10 in the position seen in Figure 2, that is, with the pole pieces in close proximity to the recording medium, rotate the spool, and with the aid of the handle or crank 19 gradually retract or withdraw the magnet from the spool, thus progressively reducing the effect of the magnetic field, and leaving the recording medium demagnetized. The shield 20 causes the magnetic field to decrease more rapidly as the magnet is retracted; and this shield also functions as a protection against unintentionally demagnetizing or partially demagnetizing objects such as other spools of recording medium in the vicinity of the apparatus. With the magnet constructed to provide a reasonably concentrated field and with an alternating effect, a relatively short retraction of the magnet is sufficient to cause demagnetization of the recording medium. Thus, the apparatus need not be of large size, and requires very little manipulation on the part of an operator in order to effect at once a complete demagnetization of the entire bulk of recording medium.

It will be noted that with the particular pole arrangement, that is the three poles 12 and 13 on the ends, and 14 in the center, the effect of an alternating magnetic field is provided during the turning of the spool and the retraction of the magnet, and the effect of this field upon the wire on the spool is gradually lessened. Specifically, a point on the wire 4 is subjected first to a magnetic field in one direction, and then to a magnetic field in the other direction, and this repeatedly happens with a less and less effect of that alternating field upon the point on the wire. Thus, complete demagnetization of the wire will result, and wire or other substances may be effectively and positively demagnetized with the instant invention when they could not be demagnetized with the most powerful 60 cycle field.

From the foregoing, it will be apparent that my new method of bulk demagnetization includes broadly the steps of rotating the mass or supply of magnetized recording medium in a magnetic field, and then progressively lessening the effect of the field or separating the recording medium and the magnetic field.

It will be understood that the magnet may be retracted from proximity to the recording medium or the apparatus may be arranged to move the recording medium away from the magnet. Preferably, the movement of the magnet or the separation of the recording medium from the magnetic field is accomplished with reasonable slowness, and the shaft together with the spool carrying the recording medium is preferably

rotated at a relatively slow speed. Even with such relative slowness, it is possible to completely demagnetize a large bulk of recording medium in considerably less than one minute.

In Figures 3 and 4, I have illustrated a bulk demagnetizer in which all moving parts may be mechanically actuated. In this instance, a base or support 21 is provided with an elongated slot 22 therein. The support is suitably equipped to journal a shaft 23 integral with or drivingly connected with the armature of an electric motor 24. A reel 3 carrying a magnetized recording medium 4 may be attached to the shaft in the manner above described.

An elongated threaded shaft 25 having reduced smooth end portions 26—26 is carried in a pair of bearing members 27—27 mounted upon the base 21 in such position that the threaded portion of the shaft 25 is disposed opposite the slot 22 in the base. The reduced portions or journals 26—26 of the shaft 25 effectively prevent any movement of the shaft along its longitudinal axis, but permit the shaft to only rotate.

The shaft 25 is preferably actuated or driven from the shaft 23, and to this end the inner end of the shaft 25 is provided with a bevel gear 28 in mesh with a similar bevel gear 29 carried by the shaft 23. Consequently, when the motor 24 is in operation, both the shaft 23 and the shaft 25 are rotated. A simplified circuit for controlling the motor is provided and includes a pair of conductors 30 and 31 which may be connected to any suitable source of electrical energy. The conductor 30 is connected to one terminal of the motor, and a conductor 32 extends from the other terminal of the motor to one side of a pivot switch 33, the conductor 31 being connected to the blade of that pivot switch. For purposes that will later appear, the pivot switch is provided with a dependent handle 34 by means of which it may be automatically actuated.

Carried by the threaded portion of the shaft 25 is a carriage 35, the shaft engaging portion of which is also threaded. The body portion 36 of this carriage extends through the slot 22 in the base 21, and on its outer end carries a magnet which may be in the form of a permanent magnet of the same character as above described in connection with the showing in Figures 1 and 2.

A shielding housing 37 of some suitable magnetizable metal, such as steel, is provided around the path of the magnet 10. As seen clearly in Figure 4, this housing is provided with a slot 38 of substantially the same size and preferably in exact alignment with the slot 22 in the panel 21. As in the previous case above described in connection with Figures 1 and 2, the housing extends on all four sides of the path of the magnet. If, however, the panel 21 is of magnetizable metal, such as steel, then it would only be necessary to have the housing extend over three sides of the magnetic path, the panel itself functioning as the fourth side of the housing. The provision of the slot 38 in the housing does not affect the shielding function of the housing to any but a negligible degree.

In operation, the device of Figures 3 and 4 is even simpler than the device shown in Figures 1 and 2. Assuming that the parts are in the position seen in Figure 4, it is a simple expedient to start the motor by means of a switch not illustrated, or by plugging in the ends of the conductors 30 and 31 in a suitable convenience outlet. The motor will then drive the shaft 23, reel 3, and the shaft 25. Thus, the mass of magnetized recording medium turns within the field created by the magnet 10, and the magnet by virtue of the threaded shaft 25 is gradually retracted from the recording medium. In the event operation is permitted to continue until the carriage of the magnet approaches the opposite end of the slot 22, the portion 35 of this carriage will contact the handle 34 of the pivot switch 33, and thus open the motor circuit. The reel may then be removed, and the motor operated in the reverse direction until the magnet is brought back into original position for the demagnetization of a new reel. It is not essential that the new reel be off the shaft 23 when the magnet is moved toward the shaft 23 because the recording medium is preferably locked upon the reel so that no unwinding of the medium occurs during the demagnetizing operation.

As in the previously described embodiment, there is provided the effect of an alternating magnetic field upon the reel and the wire carried thereby. Preferably, the motor 24 rotates at a speed approximately 100 revolutions per minute or less, a relatively slow speed so that the full alternating field effect may be obtained. The threads upon the shaft 25 are preferably relatively fine so that there will be a correspondingly slow retraction of the magnet. Also, as in the previous case, effective and positive demagnetization even of stainless steel may be obtained, and a demagnetization of articles that cannot be cleaned even with a highly powerful alternating current field can also readily be obtained with the instant invention.

It will be obvious that the structure of Figures 3 and 4 practices the same method above described.

From the foregoing, it is apparent that I have provided a method of and means for simply and very rapidly demagnetizing a bulk of magnetized recording medium. It will further be understood that the device is simple in construction, very easy to manipulate, highly durable, and highly economical both in original cost and use.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claim.

I claim as my invention:

In a bulk demagnetizer for a magnetic record medium on a spool, support means, a shaft for holding a record bearing spool carried by said support means, drive means to rotate said shaft, a magnet movably mounted on said support means for movement toward and away from said spool, said magnet being in the form of a yoke having a center pole with the axis of the magnet through the center pole face substantially at right angles to the shaft, and end poles on said magnet spaced from and of different polarity than said center pole, said poles in general defining an arc in keeping with the curvature of a record spool and having faces positionable in close relation with and of approximately equal width with the record bearing portion of said spool, and tubular shielding means enclosing all sides of the path of the magnet.

MARVIN CAMRAS.

(References on following page)

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
204,141	Eaton	May 28, 1878
250,273	Maxim	Nov. 29, 1881
429,033	Ide	May 27, 1890
507,912	Boiteaux	Oct. 31, 1893

Number	Name	Date
1,628,618	Spencer	May 10, 1927
1,708,936	Cioffi	Apr. 16, 1929
1,916,352	Williams	July 4, 1933
2,053,177	Bower	Sept. 1, 1936
2,057,458	Tubbs	Oct. 13, 1936
2,248,272	Jurak	July 8, 1941
2,254,698	Hansen	Sept. 2, 1941
2,284,404	Martin	May 26, 1942
2,306,584	Zuschlag	Dec. 29, 1942