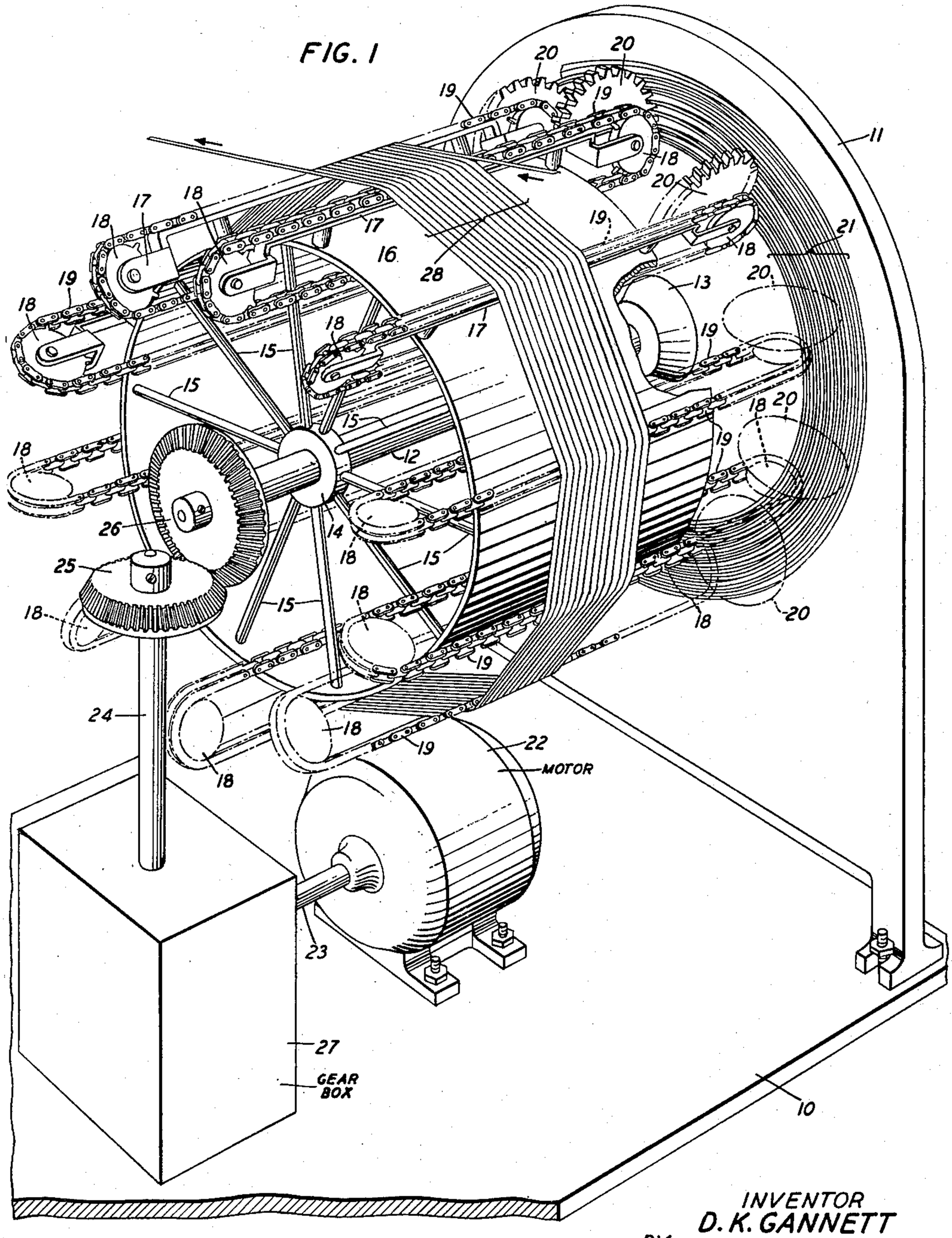
June 10, 1947. D. K. GANNETT 2,421,750

MAGNETIC WIRE STORAGE UNIT

Filed Dec. 20, 1944 2 Sheets-Sheet 1

FIG. 1



INVENTOR
D. K. GANNETT
BY J. W. Schmied
ATTORNEY

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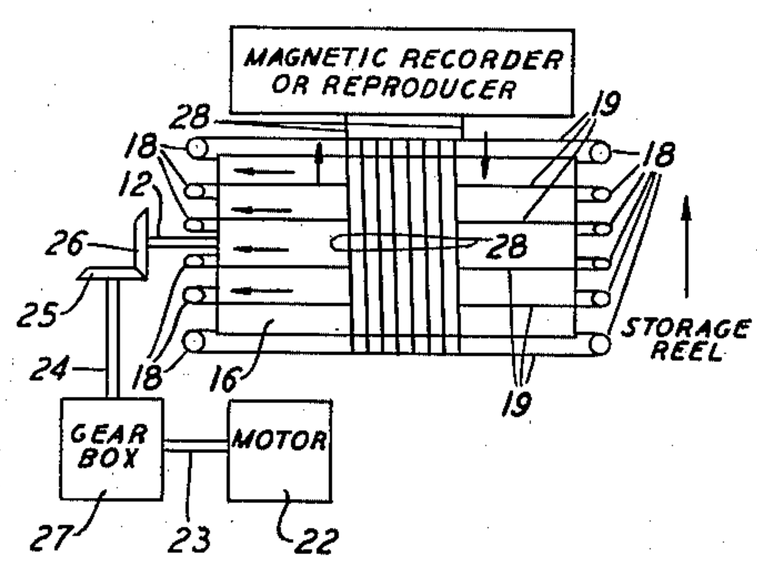

FIG. 2

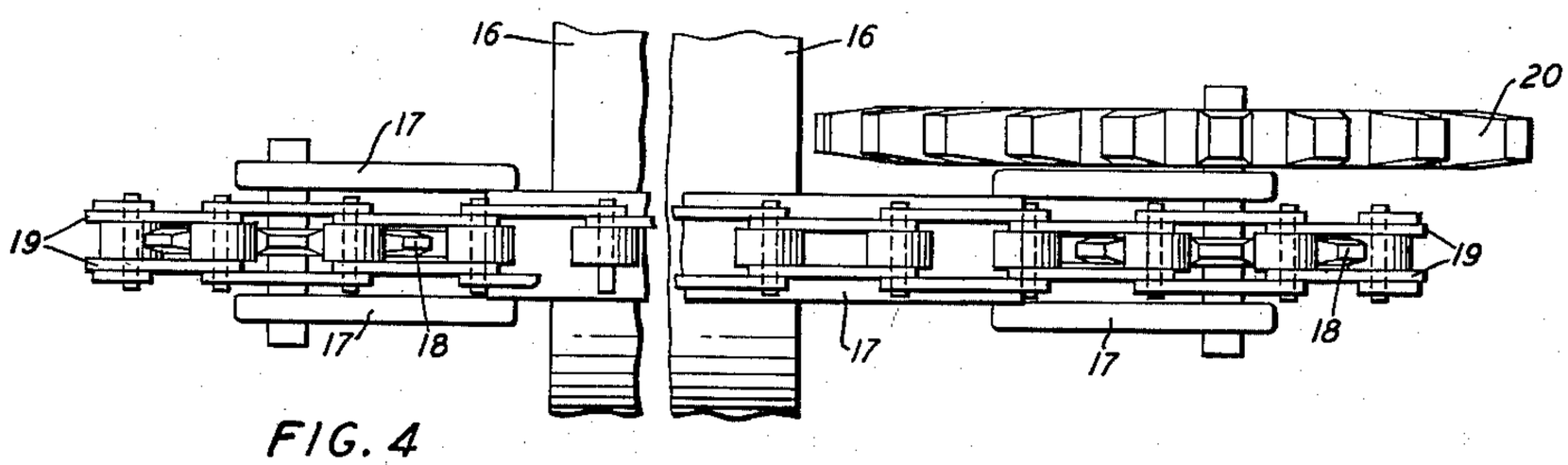

FIG. 4

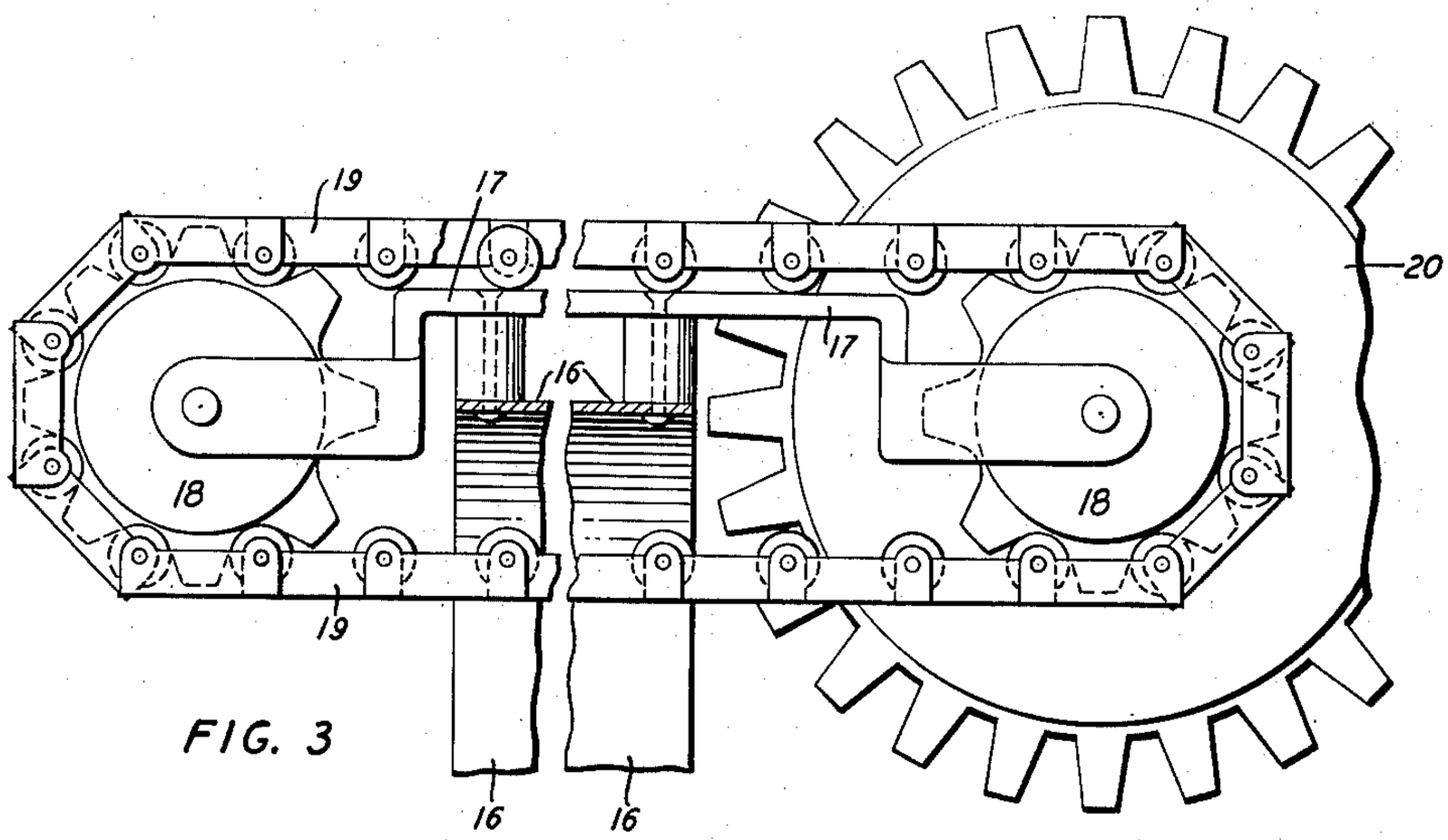

FIG. 3

INVENTOR
D. K. GANNETT
BY J. W. Schmied
ATTORNEY

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MAGNETIC WIRE STORAGE UNIT

Danforth K. Gannett, Mountain Lakes, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

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3 Claims. (Cl. 28—71.6)

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This invention relates to traveling flexible magnetic record mediums of great capacities such as tapes, wires and the like, adapted to record and reproduce electrical waves. More particularly, it relates to apparatus for storing such mediums from which repeated reproductions of magnetically impressed sound recordings on substantially long mediums, say of a half mile or more, may be made.

A specific object of the invention is to handle and/or store in a simple efficient and satisfactory manner, magnetic recording wire of great length so that such wire may be passed in either direction through one or more devices capable of recording speech, telegraph or other message waves or electrical disturbances on the wire or of reproducing from the wire previously recorded electrical disturbances.

Another object is to handle magnetic recording wire of great length in such a manner that it is effectively a very long continuous loop and may be run continuously through an exterior magnetic recorder or other device without the necessity of rewinding.

The present types of magnetic recorders fall into two classes. Some provide an endless repeating record on a continuous magnetic wire or tape but these are, in general, limited to fairly short lengths of record because of the difficulty of storing in a continuously accessible manner very long lengths of wire. Other types provide a very long record by unwinding the wire from one drum and rewinding it on another. Such devices do not provide a straightforwardly usable record and require that the wire be rewound between successive playings of the record. The invention described herein provides the features of both types simultaneously, making a very long record continuously available in repeating form.

According to an exemplary embodiment of the present invention, a single drum is employed in both the unwinding and the winding operations in feeding an endless magnetic wire of considerable length, for example, a half mile, more or less, to a recording or reproducing device. The invention comprises a rotating drum on which many turns of wire may be wound, the wire being continuously fed on the drum at one point and drawn off at another. The continuous operation is accomplished by effectively giving the winding surface of the drum a slow motion parallel to its axis so that the turns of wire remain in a fixed longitudinal position, each turn of wire being spaced on the drum a uniform distance from its adjacent turns at all times. The effective space surface of the drum on which the wire is wound consists of a series of conveyor belts or chains which pass over pulleys or sprocket wheels at the ends of the drum and return on the inside of the drum. The pulleys, or the like, at one end of the drum are respectively fastened to gears that engage a spiral track on a fixed support at one end of the drum so that they are slowly turned as the drum rotates. The resulting movement of the conveyor belts or chains carries the turns of wire in a direction parallel to the axis at a rate slightly greater than a distance equal to the thickness of the wire for each revolution of the drum. The positions at which the wire is fed on and drawn off, therefore, remain fixed with respect to the axis.

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A feature of the invention resides in moving belts or chains which form the effective surface of the drum.

Another feature resides in the movement of the winding supported by the belts or chains in a direction parallel to the axis of the drum.

Another feature resides in the provision of the feeding on and drawing off the wire at points on the drum which are fixed with respect to the axis and which permit of a single drum supporting an endless traveling record medium.

Another feature is the avoidance of the requirement for synchronism in arrangements where two or more drums are employed for the winding and unwinding operations.

Other objects and features of the invention will be apparent from a study of the specification read in connection with the accompanying drawings wherein is disclosed an embodiment of the invention particularly adapted for winding and unwinding in a single operation on a single drum, an endless traveling steel wire of substantially great length and great capacity for the purpose of recording or reproducing sound waves. It will be understood, however, by those skilled in the art that the invention may be successfully and advantageously employed for recording electrical disturbances for many other uses.

In the embodiment of the invention, specifically illustrated and described herein, Fig. 1 of the drawing represents a perspective view of the drum rotatably mounted on a fixed support and a motor for driving the drum by means of a set of gears enclosed in the gear box, the fixed support, motor and gear box being fixedly mounted on a base plate.

Fig. 2 represents a graphic view of the endless traveling magnetic steel wire continuously feeding to and from a magntic recorder or repro-

ducer at two points, respectively, which do not vary in location with respect to the ends of the drum because of the slowly rotating conveyer belts or chains on which the turns of wire are supported and which are shown as passing over pulleys or wheels at the ends of the drum and returning on the inside.

Fig. 3 shows, in detail, a side elevation view of a roller type conveyor chain supported for its full length on the outside of the drum by a rib, or girder-like member, to reduce friction and to prevent sagging of the chain under the pressure exerted by the windings of the magnetic steel wire.

Fig. 4 shows, in detail, a plan view of the conveyor chain shown in Fig. 3.

Referring now more in detail to the drawings and with specific reference to Fig. 1, thereof, the base plate 10 has fixedly mounted thereon in a suitable manner, support 11 which in turn rotatably supports shaft 12 by means of a bearing 13. Fixedly supported by the shaft 12 are two hub collars 14 and 14' (the latter not shown but arranged on shaft 12 like collar 14). On each of the hub collars 14 and 14' extends a group of spokes 15 at the other ends of which are supported a drum shaped or hollow cylinder 16. Fixedly mounted on the outside of drum 16 at points midway between spokes and extending in parallel to the axis of the drum are ribs, or girder-like members, 17 for supporting sprocket wheels 18, the ribs being fastened to the drum by means of countersunk rivets or bolts. Other obvious means for suitably supporting cylinder 16 on shaft 12 may be employed in place of spokes 15. The sprocket wheels 18 are pivotally mounted on the ends of ribs 17 and each pair of sprocket wheels 18 is arranged in a line parallel to the axis of shaft 12 which serves for mounting endless elements such as bicycle-like chains 19. Fastened to each of the sprocket wheels 18 at the right-hand end of the cylinder is a gear 20, the teeth of which engage a spiral track 21 fixedly mounted on support 11. Shaft 15 and drum 16 are slowly rotated by motor 22, through a system of shafts 23 and 24 and several beveled gears such as gears 25 and 26 and other gears not shown but enclosed in gear box 27. As drum 16 rotates under the influence of motor 22 or any other suitable driving power, gears 20 in engagement with track 21 are slowly rotated to cause a similar rotation of the sprocket wheels 18 respectively attached thereto. The sprocket wheels 18 which are securely fastened to gears 20, upon turning, respectively cause a movement of chains 19 at a uniform rate of motion, each chain 19 in turn driven by sprocket wheel attached to a gear causing the sprocket wheel at the other end to turn likewise. The chains 19, in motion around their respective pairs of sprocket wheels and along their respective rib supports 17, provide for rotating cylinder 16 an outer moving surface on which an endless traveling magnetic wire 28 is wound and unwound, simultaneously, for making a record or a reproduction of sound waves or electrical disturbances in an exterior device not shown. The return movement of the chains is on the inside of cylinder 16. The movement of the chains carries the turns of wire 28 in a direction parallel to the axis of the cylinder at a rate slightly greater than a distance equal to the thickness of the wire for each revolution of the drum. Each turn of wire, in its relative position, on the drum due to the movement of the chains remains in a fixed longitudinal position. The positions of the respective points at which the wire is fed on and drawn off, therefore, remain fixed with respect to the axis.

With a 4 mil wire, about 200 turns per inch can readily be placed on the drum. An 8 inch drum, 6 inches long, will, therefore, carry a total of 1200 turns or about 2400 feet of wire, which is nearly a half mile. If used in a recorder at the rate of 2 feet per second, the recording will last 1200 seconds or about 20 minutes before repeating.

The total pressure on a belt or chain will be

$$P = nT \sin\frac{\pi}{N}$$

Where

P=pressure on one chain or belt
T=tension of wire
n=number of turns
N=number of chains or belts around drum.

If N is a large quantity P approaches

$$P \doteq \frac{\pi n T}{N}$$

If T=2 ounces, n=1200, and N=12, P=about 40 pounds. While fairly large, this pressure can be handled by proper design. In the case where chains similar to those used in bicycles are employed as supporting conveyors for the steel wire turns, a suitable design, as hereinbefore referred to, is to fixedly mount along the outside of drum 16 in lines parallel to the drum axis and at points midway between spokes 15, ribs 17 for supporting chains 19 for their entire lengths on the outside of the drum, the supporting ribs being fastened at points near their extremities to the ends of the drum. The continuous loops on which the wire turns are wound, which form the moving surface of the drum and are preferably of a non-magnetic material, such as non-ferrous metals, leather, fiber, fabric, a plastic material or the like. These continuous loops may preferably be roller chains, such as used on bicycles and designed with their tops of the links on which the wire rests forming a straight surface. The invention, while described as an adjunct to a magnetic recorder, is obviously applicable to any use where it is desired to store a long moving wire or other flexible element such as tape, string, thread, strand, cable or the like.

The arrangement described, therefore, permits storage of a long record medium in a relatively small space so that it may be stored conveniently and without damage to the medium or impairment of the record thereupon. In the case wherein the making of the record and its reproduction are simultaneous the stored portion is equivalent to introduction of a large time lag between the recorded and reproduced sounds and this lag may be controlled or adjusted as desired by initially selecting a suitable number of turns of record to be constantly upon the reel, this number of turns may be any number from a single turn to a very large number. The record passes or may be caused to pass from the record producer to the reel at a constant angle thereby avoiding any tendency to twisting or distortion of the magnetic tape or wire.

However, the device may be used to store a whole or partial reel of material prior to its use for recording. In such case the leading end of the record may be secured by a screw or spring clamp or otherwise to a suitable point upon one of the chains 19; the reel may then be turned at

a speed suitable to store the record; after storage the leading end may be threaded through a suitable recorder, the trailing end separated from the reel and the record led off through a reproducer to which it will also move at a constant angle without twisting or distortion. Between storage and use, with this method of operation, the reel may be transported together with the stored record with or without its supporting and driving mechanism to any desired location whereat it is desired to accomplish the reproduction. Also, because the progress of the record is always straightforward, storage upon a succession of similar reels in tandem may be accomplished.

The reel may be caused to run at a speed appropriate to the speed of the recorder or reproducer or both by means known in the art, such for example, as a rheostat for adjusting the speed of the motor 22 or an automatic speed regulator such as are used in controlling and regulating the speeds of drive shafts of teletypewriter instruments or other devices of similar nature.

What is claimed is:

1. In a strand storing device for storing a strand having message material impressed thereon and required to be delivered from storage in the same directional sense in which it is received in storage, a rotatable shaft, means for driving said shaft, a cylindrical drum carried by said shaft for rotation therewith to receive and deliver strand material, a plurality of endless conveyers carried by said drum in radial planes with respect to said drum and having their outer and inner runs disposed exteriorly and interiorly respectively of said drum and parallel to the axis thereof, a pair of sprockets for supporting each of said conveyers, a guide channel for the outer run of each of said conveyers carried by said drum, a plurality of anti-friction rolls carried by said conveyer and adapted to engage said guide channel for free movement of said conveyers with respect to said channels while supporting strand material under tension, a pinion gear secured to each of the sprockets at one end of said drum, and a stationarily mounted helical track engageable in common by said pinions for imparting continuous rotation thereto during rotation of said drum whereby to shift turns of strand material received on said drum axially thereof from a strand receiving plane.

2. In a portable strand receiving, storing and delivering device for receiving, storing and delivering a strand having message material impressed thereon and required to be delivered from storage in the same directional sense in which it is received in storage, a portable foundation structure, a rotatable shaft supported by said foundation structure, driving means for said shaft including a motor and reduction gearing also supported by said foundation structure, a cylindrical drum carried by said shaft for rotation therewith to receive, store and deliver a strand, a plurality of endless conveyers carried by said drum in radial planes with respect to said drum and

having their outer and inner runs exposed exteriorly and interiorly respectively of said drum and parallel to the axis thereof, a pair of sprockets for supporting each of said conveyers, a guide channel for the outer run of each of said conveyers carried by said drum, a plurality of anti-friction rolls carried by said conveyers and adapted to engage said guide channels for free movement of said conveyers with respect thereto, a pinion gear secured to each of the sprockets at one end of said drum, and a helical track stationarily secured to said foundation structure and engageable in common by said pinions for imparting continuous rotation thereto during rotation of said drum whereby to continuously shift turns of a strand received on said drum away from a strand receiving plane in an axial direction with respect to said drum.

3. A strand receiving, storing and delivering device adapted to store a quantity of magnetizable strand material in excess of the length passing to and from a signal recorder and/or reproducer comprising a rotatable shaft, means for driving said shaft, a single drum of cylinder shape carried by said shaft for rotation therewith to receive, store and deliver said excess of magnetizable strand material, a plurality of endless conveyors carried by said drum in radial planes with respect to said drum and having their outer and inner runs parallel to the axis of said single drum, a pair of sprockets for supporting each of said conveyors, a guide channel for the outer run of each of said conveyors, a plurality of uniformly spaced anti-friction rolls carried by each of said conveyors and adapted to engage said guide channel for free movement of said conveyors with respect thereto under the load of said strand material, a pinion gear secured to each of said sprockets at one end of said single drum, and a stationarily mounted helical track engageable in common by said pinion gears for imparting thereto continuous rotation at a uniform speed during rotation of said single drum whereby to uniformly shift, during successive revolutions of said single drum, the turns of said magnetizable strand material received on said drum axially thereto from a strand receiving plane.

DANFORTH K. GANNETT.

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