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<th>(71) Applicant: and</th>
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<td>BUGLEWICZ, Neal, J. [US/US]; 12 Empty Saddle Road, Rolling Hills Estates, CA 90274 (US).</td>
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| (72) Inventor: FINKELSTEIN, Don, B.; Finkelstein, McGuire & Thut, 700 South Flower Street, Suite 904, Los Angeles, CA 90017 (US). |

| (74) Agent:                           |                                                   |

| (54) Title: MULTI-TRACK TAPE DRIVE WITH REEL END OF TAPE SENSING AND REWIND |                                                   |
(57) Abstract

A telephone answering device of the reel-to-reel type, in which a pre-recorded broadcast message is on a first portion (184) of at least a first track (1) of a multitrack recording tape (30), and incoming messages are recorded on a second portion (186) of other tracks (2-13) of the multitrack recording tape (30). A sensor (188), such as a foil, a coded recorded interval, a predetermined tone, or the like, is on the recording tape (30) between the first portion (184) and second portion (186). A supply reel (14) and take-up reel (44) are provided, and in the start position, that is, when the device is awaiting the receipt of an incoming call, at least a portion of the tape is wound on the supply reel (14) in a first section thereof. The first section of the supply reel (14) has a pawl (46) mounted thereon, which is restrained to a retracted position by the tape wound thereon. When a call is received, a drive motor (96) engages the take-up reel and moves the tape (30) adjacent both a broadcast head (134), which first transmits the broadcast message to the incoming caller, and also past a recording head (136) which records the message which the incoming caller wishes to leave. When the tape has unwound from the supply reel (14) so that the first section is free of the reel, the pawl (46) mounted on the supply reel (14) extends outwardly and engages an arm (56). Further rotation of the supply reel (14) causes the pawl (46) to move the arm (56). The arm (56) engages ratchet teeth (160) on a multi-level cam (148) and rotates the multi-level cam (148) to position the recording head (136) which bears against the multi-level cam (148) adjacent the next available track for recording an incoming message. Further movement of the arm (56) disengages the drive motor (96) from the take-up reel (44). The arm (56) is resiliently biased to its initial position and resists the movement caused by the pawl (46). The foil sensor (188), which is between the first portion (184) and the second portion (186) of the multi-track recording tape (30) is utilized to activate appropriate electronic circuitry during playback, so that the drive motor (96) may be reengaged each time the foil sensor (188) is detected, thereby allowing rapid listening of all of the recorded messages, without listening to the outgoing broadcast message. Further, manual operation for positioning the record head (136) during playback allows selective positioning thereof adjacent any desired track. The electronic controls also switch the record head (136) to the playback mode during the playback operation.

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MULTI-TRACK TAPE DRIVE WITH REEL END
OF TAPE SENSING AND REWIND

FIELD OF THE INVENTION

This invention relates to the telephone
answering machine art, and, more particularly, to an
improved, inexpensive, reel-to-reel telephone answering
device.

DESCRIPTION OF THE PRIOR ART

Automatic telephone answering and playback
mechanisms are now widely utilized in many different
commercial and private applications. Such telephone
answering devices generally have the capability of
broadcasting to an incoming caller a pre-recorded
message and then, after an appropriate tone signal,
allowing the incoming caller to record a message.
Conventional multi-track magnetic tapes are utilized for
both the broadcast message, and the incoming messages.
Some prior art telephone answering devices have
utilized, essentially, two separate tape decks, one for
pre-recording the broadcast message thereon, and the
other for receiving and recording the incoming messages.
Such a duplication of structural parts increases the
cost of such devices.

In other prior art telephone answering devices
utilizing a single tape, the broadcast message was repe-
titatively recorded in spaced apart locations on the
single tape. The incoming messages were sequentially
recorded between each of the pre-recorded broadcast
messages. On playback, when it was desired to listen to
the incoming messages that had been recorded, in
general, in such devices, it was generally necessary to
listen to the broadcast message repetitively between
each of the incoming recorded messages. In still other
telephone answering devices which have heretofore been
utilized, a single head was utilized for both playing
the broadcast message, as well as recording each
incoming message. Such devices often utilized a single
tape and one or more tracks thereon were utilized for
the pre-recording of one or more broadcast messages and
the remaining tracks were utilized for recording the
incoming messages. The single tape head, in such
devices, was moved from one of the broadcast tape loca-
tions to the next available incoming recorded message
tracks on the tape during each cycle of operation.
Appropriate switching was required to switch the single
record head from the playback mode when the broadcast
message was broadcast to the incoming caller, and the
record mode when the caller recorded his incoming
message. Such devices generally incorporated com-
paratively complex mechanisms to carry out the above
mentioned operation and, additionally, in many devices
it was still necessary to listen to the pre-recorded
broadcast message before being able to listen to each of
the recorded incoming messages.

In the prior art devices which have utilized
two separate heads, that is, one for playing the broad-
cast message to the incoming caller, and another head
for recording the incoming message from the caller, it
was often found that there was an interference between
the head utilized for playing the broadcast message and
the head utilized for recording the incoming messages,
so that some or all of the broadcast message would
actually be recorded on the tracks of the tape in the
position where it was desired to record the incoming
messages.

Accordingly, it has long been desirable to
provide a telephone answering device utilizing a single
tape, which is provided with a plurality of tracks, and
in which a broadcast message may be recorded on one
track and incoming messages recorded on the other
tracks, and in which, on playback, it would not be
necessary to listen to the broadcast message before
listening to each recorded message, or an equivalent
time delay therebetween, and in which interference bet-
 tween the head utilized for playing the broadcast message
and the head utilized for recording the incoming mes-
ges does not adversely affect operation of the telephone
answering device.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present
invention to provide an improved telephone answering
mechanism.

It is another object of the present invention
to provide an improved telephone answering mechanism
utilizing a reel-to-reel multi-track tape with separate
heads for playing the broadcast message to incoming
callers and recording the incoming messages.

It is yet another object of the present inven-
tion to provide an improved telephone answering
mechanism in which, on playback, the incoming messages
may be heard without listening to the pre-recorded
broadcast message interspersed between each of them,
and/or without listening to the unused portions of the
incoming call recording tape when the caller does not
use the entire time available, and without utilizing
"fast forward" or similar control means.

It is yet another object of the present inven-
tion to provide an improved telephone answering
mechanism that is free of comparatively complex
mechanisms, does not require precision parts or delicate
adjustments, and may be comparatively economically
manufactured.

The above, and other objects of the present
invention are provided, in a preferred embodiment
thereof, by providing a case means, upon which there is
rotatably mounted a supply reel and a take-up reel. A
multi-track recording tape, of a predetermined length,
has a first end connected to the supply reel, and a
second end connected to the take-up reel, and in the
start condition, that is, when the mechanism is awaiting
the receipt of the first incoming call, at least a por-
tion of the tape is wound on a section of the supply
reel. In that section of the supply reel, there is pro-
vided an "end-of-tape" sensor which comprises a pawl
means that is movably, for example, pivotally,
reciprocatingly, or the like, mounted on the supply
reel. The pawl means is retained in the retracted posi-
tion by the portion of the tape that is wound on the
supply reel.

The multi-track recording tape is divided into
a first portion and a second portion and is provided
with a metallic strip which acts with a signaling or
sensing section between the first portion and the second
portion. A first track of the multi-track recording
tape in the first portion, is utilized for pre-recording
the broadcast message. The other tracks of the multi-
track recording tape are utilized to record the incoming
messages and the first portion of the other tracks are
not utilized. The incoming messages are sequentially
recorded on the second portion of the other tracks of
the multi-track recording tape. The second portion of
the first track is not utilized.

A broadcast head is mounted on the case means
and is positioned adjacent the first track which con-
tains the pre-recorded broadcast message. The broadcast
head need not be movable, and may be fixed in location
with respect to the first track of the multi-track
recording tape. A record head is movably mounted on the
case means and is sequentially moved to the other tracks
on the multi-track recording head to record the incoming
messages. Appropriate electronic circuitry of conven-
tional design is utilized to allow the broadcast head to
first act as a recording head to record the pre-recorded
broadcast message on the first track, and then to play
the broadcast message to each incoming caller. In such
an embodiment, the broadcast head also incorporates
erase capabilities, so that any previously recorded
broadcast message is erased as the new one is recorded.

In another embodiment of the present
invention, the record head is positionable at the first
track and the first portion thereof to allow recording
of the broadcast message thereon. In such an
embodiment, the broadcast head need not have record and
or erase capability and only the record head need have
the erase capability. The conventional electronic cir-
cuity also provides for the recording head to record
incoming messages and, during playback operation, when
it is desired to listen to the incoming messages, to
switch to the playback mode so that each recorded
message may be heard. A first motion producing means,
which, for example, may be a multi-level cam, engages
the record head for providing the sequential positioning
of the record head to the other tracks of the multi-
track recording tape to allow both the recording of the
incoming messages thereon, as well as during the
playback mode, the listening to the incoming messages
which have been recorded. A plurality of ratchet teeth
are coupled to the multi-track cam and the number of
ratchet teeth correspond to the number of cam surfaces
in the multi-level cam. The number of available tracks
on the multi-track recording tape available for
recording incoming messages corresponds to the number of
surfaces on the multi-level cam.

A drive means is provided for rim drive of the
take-up reel. The drive means is movable, for example,
by a solenoid, clutch means, centrifugal means, or the
like, upon receipt of an incoming call into a drive condi-
tion where it rotates the take-up reel, thereby
caus[ing] the multi-track tape to be wound upon the take-
up reel and unwound from the supply reel. Conventional
circuitry is utilized to energize the solenoid and allow
the drive means to move away from engagement with the
take-up reel. A resilient means is operatively con-
ected to the supply reel and resists the rotation
thereof when the tape is unwound from the supply reel
and wound onto the take-up reel. When the motor is
disengaged from the take-up reel, the resilient means
causes the supply reel to rotate in the opposite
direction, thereby rewinding the tape upon the supply
reel.

An arm means is movably mounted on the case
means, and, for example, may be mounted for linear
reciprocating motion. The arm means has first walls
which engage the pawl means of the supply reel when the
pawl means is allowed to move outwardly from the supply
reel for the condition of the multi-track recording tape
being unwound from the first section of the supply reel
where the pawl means is mounted. Continued movement of
the supply reel causes the pawl means to engage the arm
means and move the arm means. The arm means also has
second walls that engage the ratchet teeth on the multi-
level cam. The movement of the arm means is controlled,
so that the multi-level cam means is moved by the arm
means the equivalent of one ratchet tooth, which thereby
positions the recording head at the next available track
for recording incoming messages. Another resilient
means, such as a spring, may be utilized for biasing the
arm means into its first position, that is, when it is awaiting engagement with the pawl means, so that the arm means automatically returns to its first position after each movement thereof caused by the pawl means.

For example, if the multi-track tape is a conventional half-inch width, it is divided into thirteen equally spaced tracks. The lowermost track, for example, may be the track upon which the broadcast message is pre-recorded on the first portion thereof. The remaining tracks, that is, tracks two through thirteen, or a total of twelve available tracks, are utilized for sequentially recording the incoming calls.

The total length of the multi-track recording tape, from the first end to the second end, may be selected to provide, for example, fifteen seconds of broadcast message time, which comprises the first portion of the multi-track recording tape, and thirty seconds of incoming calls recording time on the second portion of the tape. In this embodiment of the present invention, a foil is positioned between the first portion and second portion, and may, for example, correspond to one second of time to provide an appropriate signal for indicating to the caller that the caller may commence dictating the message which is to be recorded. In such an embodiment, with twelve available tracks for recording incoming messages, there are twelve ratchet teeth on the multi-level cam, and, correspondingly, twelve cam faces. In this embodiment, wherein the multi-level cam is rotatably mounted to sequentially position each face of the cam into engagement with the recording head, each ratchet tooth and each cam face is thirty degrees of angular measurement.

A switch is provided, and the switch is also engaged by the arm means when the arm means has reached the extent of its travel. The switch is utilized to operate the appropriate electronic functions of the
machine, such as disengaging the drive means from the
take-up reel and the like.

In the start position, that is, when the
device is awaiting the receipt of the first call, the
tape is wound onto the supply reel and retained in that
position by the resilient means. The multi-level cam
means is positioned, for example, manually, into the
position corresponding to the location of the recording
head at the first available track for recording incoming
calls. When a call is received by the telephone
answering machine, the drive means, which may, for
example, be a motor, is energized, and the solenoid is
energized to move the drive means into engagement with
the take-up reel. Rotation of the take-up reel causes
the tape to move across both the broadcast head and the
record head as it is unwound from the supply reel. The
broadcast message is played by the broadcast head on the
telephone line to the caller. At the end of the fifteen
seconds of the broadcast message time, the foil divider
is sensed and an appropriate signal is generated by con-
ventional circuitry, to indicate to the caller that he
may commence recording of his message. The record head
may be left in a record mode during the time of playing
the broadcast message. Even though interference may
occur, so that the broadcast message may be recorded on
the first portion of the other tracks, according to the
principles of the present invention, this has no inter-
ference with the normal operation of the device, since
the first portion of the other tracks is not utilized
during playback, or at all.

After hearing the signal caused by the detec-
tion of the foil, the incoming message may be recorded
as the tape continues to run for an additional thirty
seconds, during which the incoming message is recorded.
At the end of the thirty seconds, the tape has been
unwound from the supply reel, allowing a resilient means
such as a light spring to urge the pawl outwardly from the supply reel as it engages the arm. The arm is moved to reposition the recording head to the next available track and, at the end of the movement, to engage the switch for deenergizing the motor and the solenoid. Deenergizing the solenoid allows the motor to rotate away from engagement with the take-up reel and the rewind means connected to the supply reel causes rotation of the supply reel in the opposite direction, thereby rewinding the tape onto the supply reel and depressing the pawl back to its retracted position.

If desired, there may also be provided a predetermined resistance to rotation in the take-up reel, to resist the rotation thereof caused by the rewind means during rewind. This may be desired, in some embodiments of the present invention, to provide sufficient tension on the tape to insure that the pawl is forced back into its retracted position.

After the tape has been rewound onto the supply reel, the device is then in its start position, and is available for repeating the cycle upon receipt of the next incoming call.

When it is desired to listen to the messages which have been recorded, the multi-level cam means may be manually rotated to position the record head adjacent the first track upon which incoming messages have been recorded. An appropriate switch may be energized to change the record head to a playback mode wherein it will play the messages recorded. This switch also engages appropriate electronic circuitry coupled to the detection means utilized to detect the foil on the multi-track recording tape.

Thus, on the initial playback of the telephone answering device according to this embodiment, there is a fifteen second delay as the drive means rotates the take-up reel and the multi-track recording tape is wound
thereon. This corresponds to the initial broadcast
message time. At this time, if desired, the pre-recorded
broadcast message may be monitored by the user to pro-
vide a check thereof. At the end of the thirty seconds
of record time, the mechanical operation of the pawl
engaging the arm occurs and the drive means is
disengaged from the take-up reel and rewind on the
supply reel occurs. However, the detector means detects
the presence of the foil strip on the tape during the
rewind operation and when the foil strip is thus sensed,
the drive means is controlled to move into the engaged
position with the take-up reel and the playback head,
having been moved to the next track upon which an
incoming message has been recorded, commences to play
the next message.

It will be appreciated that, in some instances
of operation, the incoming recorded message may not
occupy the full thirty seconds of time available on the
multi-track recording tape. Consequently, a manual
control for the arm may be provided so that, for
example, if the incoming message only occupies fifteen
seconds of the total thirty seconds, at the end of that
particular incoming message, the arm means may be
manually moved from its first position to its second
position, which causes both movement of the playback
head to the next available track, as well as causing
disengagement of the drive means from the take-up reel
to allow rewinding on the supply reel to commence.

Thus, according to the principles of the pre-
sent invention, on playback of the incoming recorded
messages, the user does not have to listen to repetitive
broadcast of the pre-recorded broadcast message, nor is
there any delay between listening to the recorded
incoming messages, except that associated with the com-
paratively short time of the rewind cycle.

According to another aspect of the present
invention, a specially designed multi-track recording
tape may be advantageously utilized according to the
principles of the present invention. Such a tape would
have a predetermined length and, as noted above, would
be divided into a first portion and a second portion.
Since only the first track of the pre-recorded tape is
utilized in the first portion and the other tracks are
utilized only in the second portion, the tape may be
provided so that there is no message recording capabi-
ity on the other tracks, that is, the record tracks, in
the first portion, and, if desired, there is no message
record capability on the first track in the second
portion. The advantages of such a special tape when
utilized in the telephone answering device of the pre-
sent invention are apparent. Thus, certain on-off
switching of the record head and/or playback head may be
eliminated, since the presence of unwanted sounds
emanating from the device; during the first cycle of
playback when the record head is traversed by the first
portion of the first track available for, no unwanted or
unpleasant sounds, will be generated.

In another embodiment of the present
invention, more than one track of the multi-track tape
is utilized for recording different broadcast messages,
one such message on the first portion of each track so
utilized. In this embodiment, the broadcast head is
selectively positionable adjacent each of the tracks
utilized for the broadcast messages.
BRIEF DESCRIPTION OF THE DRAWING

The above and other objects and aspects of the present invention may be more fully understood from the following description taken together with the accompanying drawings, wherein similar reference numbers are used to refer to similar elements throughout, and in which:

Figure 1 illustrates a preferred embodiment of the present invention;
Figure 2 illustrates a motion producing means useful in the practice of the present invention;
Figure 3 illustrates a multi-track recording tape useful in the practice of the present invention; and
Figure 4 illustrates another embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawing, and, in particular, to Figure 1, there is shown one embodiment generally designated 10 of the present invention. It will be appreciated that the embodiment shown in Figure 1 is utilized as an example of a preferred embodiment of the present invention, and many variations and adaptations thereof may be incorporated. Consequently, the present invention is limited only by the claims appended hereto. As shown in Figure 1, the embodiment 10 generally comprises a case means 12, in which all of the structure and controls for the present invention are mounted. A recording tape supply reel 14 is rotatably mounted on shaft 16, for rotation about a first axis 18 in a supply direction as indicated by the
arrow 20 and in a rewind direction as indicated by the
arrow 22. The recording tape supply reel 14 has a bot-
tom flange 24, an upper flange 26, and a rim 28. A
multi-track recording tape 30 may be wound on the rim 28
a predetermined number of turns, and this is indicated
on Figure 1 by the area generally designated 32.

The rim 28 of the supply reel 14 is omitted
from a first section generally designated 34. Figure 1
illustrates the embodiment 10 at the start condition,
wherein at least one winding of the recording tape 30 is
on the rim 28 of the supply reel 14. It will be appreci-
ciated that the size of the supply reel 14, and/or the
diameter of the rim 28 as compared with the overall
length of the tape 30 from its first end 36, which is
connected to mounting 38 affixed to the supply reel 14,
to its second end 40, which is coupled to a mounting
bracket 42 on a take-up reel generally designated 44,
will determine the number of turns of the multi-track
recording tape 30 which is wound on the supply reel 14
in the start position. The take-up reel 44 is described
below in greater detail.

Movably, for example, pivotally, mounted in
the first section 34 of the supply reel 14 is a pawl
means 46, for pivotal movement in the direction indi-
cated by the double ended arrow 48 about a pivot
axis 50. The pawl means acts as an end-of-tape sensor.
A resilient means generally designated 52 may be coupled
to the pawl means 46 and the supply reel 14 for
yieldingly urging the pawl means 46 outwardly in the
direction of the arrow 54. Thus, as shown on Figure 1,


at least one winding of the multi-track recording
tape 30 in the rim 28 of the supply reel 14 retains the
pawl means 46 in a first or retracted position to pre-
vent movement of the pawl means 46 outwardly in the
direction of the arrow 54 under the urging of spring
means 52 to a second or engagement position when the
first section 34 of the supply reel 14 is free of any winding of the multi-track recording tape 30.

The pawl means 46 may, if desired, be mounted on the supply reel 14 for movement other than pivotal. Figure 4 illustrates another embodiment of the present invention, generally designated 200, in which a pawl means 46' is slidingly mounted for reciprocating movement in the directions of the double ended arrow 202 within upstanding walls 204 on supply reel 14' and is urged outwardly into an engagement condition by spring means 206. At least one winding of the tape means 30 on the rim means 28' of supply reel 14, retains the pawl means 46' in the first or retracted position as illustrated in Figure 4. Lip 207 of walls 204 engages shoulder 208 at pawl 46' to limit the outward movement thereof.

An arm means, generally designated 56, is movably mounted on the case means 12, and, in the embodiment 10, the movement is a linear reciprocating movement in the directions indicated by the arrows 58 and 60. The arm means 56 has first walls 62 on a tab means 64. The tab means 64 is positioned to be engaged by the pawl means 46, when the pawl means 46 has moved outwardly in the direction of the arrow 54 from its position shown in Figure 1 to an engagement position. The arm means 56 is constrained to move in the linear reciprocating direction indicated by the arrows 58 and 60 by slots 66 and 68, therein, engaging pins 70 and 72, which are coupled to the case means 12.

A resilient means 74, such as a spring, may be coupled between the case means 12 and the arm means 56, for yieldingly urging the arm means 56 into the position shown in Figure 1 to provide movement thereof in the direction of the arrow 60. After the arm means 56 has been moved in the direction of the arrow 54 by engagement with the pawl means 46. Thus, in Figure 1, the arm...
means 56 is shown in a first position, and the pawl means 46 moves the arm means 56 from its first position as illustrated in Figure 1 to a second position as described below in greater detail.

A lever means 80 may be coupled to the arm means 56 and accessible in regions external to case means 12, to allow manual actuation of the arm means 56 in the directions of the arrows 58, and, if desired, 60. As shown on Figure 1, the slot 66 is larger than the pin 72 to allow pivotal movement of the arm means 56 in the direction of the arrow 82, for purposes hereinafter described.

The take-up reel 44, in the embodiment 10, is spaced from the supply reel 14 and is mounted on a spindle 86 of case means 12 for rotational movement in the directions indicated by the arrows 88 and 90, about second axis 92. As noted above, the second end 40 of the multi-track recording tape 30 is coupled at 42 to the take-up reel 44. Thus, as the take-up reel 44 rotates in the direction of the arrow 88, the multi-track recording tape 30 is wound onto the rim 94 of take-up reel 44 and unwound from the rim 29 of the supply reel 14.

In other embodiments of the present invention, the supply reel and take-up reel may be coaxially mounted for rotation about a common axis, though at different rotational rates. Thus, those skilled in the art, with the teachings of the present invention, may vary the geometrical relationship between the supply reel and the take-up reel as may be desired for particular applications.

The take-up reel 44 is rotated in the direction of the arrow 88 by a drive means 96, which may be a motor, having a drive wheel 98 engaging the rim 100 of the take-up reel 44 in a drive condition of the drive means 96. Thus, as the drive wheel 98, on the drive
means 96 rotates in the direction indicated by the arrow 102, the take-up reel 44 is rotated in the direction of the arrow 88. The drive means 96 is mounted on a bracket 104, which is pivotally mounted on the case means 12 for pivotal movement in the direction of the double ended arrow 106, about the pivot axis 108. A spring means 110, connected between the case means 12 and the bracket means 104, may be utilized to yieldingly urge the drive means 96 out of the drive condition thereof illustrated in Figure 1.

Means 112 may be mounted on the case 12 and connected to the bracket means 104 for moving the drive means 96 into engagement with the take-up reel 44. The means 112 may, for example, be a solenoid, which is appropriately actuated to move the drive means 96 into the drive position thereof, and deenergized to allow the spring means 110 to move the drive means 96 out of the drive condition thereof.

Instead of a solenoid, the means 112 may be a clutch or any other type of structure which provides the movement of the drive means 96 as required.

A rewind means, generally designated 114, is utilized to rewind the multi-track recording tape 30 upon the supply reel 14 after it has been wound in whole or in part upon the take-up reel 44. The rewind means 114 comprises a spring means 116 having a first end 118 coupled to the case means 12 at 120. A second end 122, of the spring 116 is coupled to a flexible cord-like member 124 at its first end 126. The second end 128 of the flexible cord 124 is coupled at aperture 130 in the supply reel 14 and is adapted to be wound around the supply reel spindle 16. The aperture 130 is spaced from the spindle 16. The spring means 116 exerts a force on the supply wheel 14 to cause it to rotate in the direction indicated by the arrow 22. The force exerted on the supply reel 14 by the spring means 116 is less than
the force exerted on the supply reel 14 by the multi-track recording tape 30 when the multi-track recording tape 30 is being rotated by the drive means 96. Thus, the drive means 96 has sufficient force to overcome the resistance of the spring means 116 and allow the supply reel 14 to rotate in the direction of the arrow 20.

However, when the drive means 96 is moved out of the drive condition thereof by the spring 110, the spring means 116 causes the rotation of the supply reel 14 in the direction of the arrow 22. In order to insure that the multi-track recording tape 30 is properly wound onto the supply reel 14 during the rewind operation thereof, under the influence of spring 116, a light resistance pad 132 is positioned adjacent the take-up reel 44 and applies a light resistance against rotation thereof. This insures that there is tension on the multi-track recording tape 30 while it is being wound onto the supply reel 14, as well as when it is being wound on the take-up reel 44. The frictional force supplied by the resistance pad 132 is less than the force applied by spring 116 to the supply reel 14 during the rewind operation and is less than the force applied to the take-up reel 44 by the drive means 96 to allow winding of the multi-track recording tape 30 on the take-up reel 44.

As noted above, the aperture 130 is spaced from the spindle 16. Such an arrangement is preferred, since, at the start position, shown in Figure 1, there is a greater moment arm due to the offset position of aperture 130 and thus the spring force of spring 116 causes a greater torque than if the flexible member were connected directly to the spindle 16. Such greater torque tends to minimize overrun and damps out oscillation when the tape 30 is rewound on the reel 14.

Alternatively, in other embodiments, the rewind means 114 may comprise a resilient means such as
a coiled spring wound around the spindle 16 and having a
first end coupled to the case means 12 and the second
end coupled to the spindle 16. It will be appreciated
that many other resilient type rewind means may be uti-
lized in the practice of the present invention.

A broadcast head 134 is mounted on the case
means 12 adjacent the multi-track recording tape 30.
The broadcast head 134, in this embodiment of the pre-
sent invention, is fixedly positioned with respect to a
first track of the multi-track recording tape 30. The
broadcast head, as described below in greater detail,
provides for transmittal of a pre-recorded message which
is recorded on the first track of the multi-track
recording tape to an incoming caller.

It will be appreciated that as noted above,
more than the first track may be utilized to allow
recording of a plurality of broadcast messages, one on
each track so utilized. In such an embodiment, the
broadcast head 134 is not fixedly mounted on the case
means 12, but is movable to allow selective positioning
adjacent each track of the multi-track tape 20 utilized
for broadcast message recordation. Thus, for example,
if three tracks of the multi-track recording tape 30 are
utilized for recordation of different broadcast
messages, the broadcast head 134 is selectively
positionable, for example, manually, adjacent each of
the three tracks. In some applications, it may be
desired to provide a "tape full" broadcast message which
is broadcast to each incoming caller when all tracks on
the multi-track recording tape 30, available for recor-
dation of incoming messages, have been utilized. In
such an application, the broadcast head 134 is
automatically moved from the original broadcast message
track to the track having the "tape full" message when
all available tracks have been utilized for recorded
incoming messages.
A record head 136 is movably mounted on the case means 12, for movement into and out of the plane of the paper on shaft means 138. The record head 136 is movable between the other tracks on the multi-track recording tape 30, that is, all of the other recording tracks except the first track, which is utilized for the recording of the broadcast message thereon. In these embodiments of the present invention, wherein more than the first track is utilized for the recording of a plurality of broadcast messages, the record head 136 is movable for selective positioning relative to the tracks available for recordation of incoming messages. The record head 136 records the incoming message on the other tracks of the multi-track recording tape in a sequential operation, that is, the first incoming message is recorded on the first available track, the second message is recorded on the second available track, and similarly, through the total number of tracks available on the multi-track recording tape for recording incoming messages. Roller type capstans 140 are provided adjacent the broadcast head 134 and record head 136 to insure proper positioning of the multi-track recording tape 30 thereagainst.

Movement of the record head 136 from track to track with respect to the multi-track recording tape 30 is controlled by a first motion producing means generally designated 142, and is illustrated in greater detail on Figure 2 hereof.

As shown in Figure 2, the first motion producing means 142 generally comprises a body member 146, having a multi-level cam surface 148. The record head 136 is mounted on a bracket 150 for movement in the direction indicated by the double ended arrow 152 to allow positioning of the record head 136 adjacent the plurality of tracks available for recording incoming messages on the multi-track recording tape 30. The
bracket 150 has a cam follower 154 which engages the cam surface 148 of the body means 146 and spring means 156 yieldingly urges the bracket 150, upon which the record head 136 is mounted, into engagement with the multi-level cam surface 148. The multi-level cam surface has a plurality of surface levels corresponding to the number of tracks available on the multi-track recording tape 30 for recording incoming messages. For example, there may be twelve such levels in the multi-level cam surface 148. Each level discretely positions the record head 136 adjacent one track of the multi-track recording tape 30.

A plurality of ratchet teeth 160 are coupled to the body member 146. In the embodiment shown in Figures 1 and 2, the body means 146 is a generally annular, cylindrical member, and the upper end 162 is provided with the multi-level cam surface 148 and the ratchet teeth 160 are coupled to the body member 146 adjacent the second end 164. The body means 146 is further provided with a sleeve means 166, mounted over a spindle 168, to allow rotation of the body means 146 in the direction indicated by the double ended arrow 170. A manually operable knob 172, which is accessible in regions external the case means 12, is mounted on the sleeve 166 to allow manual operation, that is, manual rotation, of the body means 146 in the directions indicated by double ended arrow 170. This allows manual positioning of the record head 136 adjacent to any of the desired record tracks on the multi-track recording tape 30. The knob means 172 may provide appropriate indicia thereon (not shown) for indicating which particular track is adjacent the record head 136. In other embodiments of the present invention, the record head is selectively positionable, for example, manually, adjacent each track utilized for recordation of a broadcast message. In such embodiments, the record head 136 is
utilized to record the broadcast message or messages in
the appropriate track or tracks. Such an embodiment
eliminates the requirement that the broadcast head 134
also have record and erase capabilities.

It will be appreciated that both the record
head 136 and the broadcast head 134, are of conventional
design.

The arm means 56 has second walls 171 for
engaging the ratchet teeth 160. The arm means 56 may,
if desired, be further restrained to its reciprocating
movement in a plane by washers 70' and 72'.

If desired, a predetermined frictional force
may be provided between the spindle 168 and the
sleeve 166 to prevent undesired rotation of the body
means 146.

The number of ratchet teeth 160, as noted
above, corresponds to the number of levels in the multi-
level cam surface 148, which, in turn, corresponds to
the number of tracks on the multi-track recording
tape 30 available for recording incoming messages.

Thus, for example, with twelve tracks available for
recording incoming messages on the multi-track recording
tape 30, there are a total of twelve levels in the
multi-level cam surface 148, and there are twelve

 corresponding ratchet teeth 160. Each ratchet tooth,
and, correspondingly, each level of the multi-level cam
surface 148, occupies 30° of arc of the axis of the
spindle 168. Consequently, movement of the arm means 56
in the direction of the arrow 58, rotates the body
means 146 30° of arc and thus causes the next cam level
of the multi-level cam 148, to be positioned beneath the
cam follower 154 of the bracket means 150. When the arm
means 56 moves in the direction of the arrow 60, the
ratchet engaging portion 170, engages the ratchet
teeth 160, but, because of the larger dimension of the
slot 66 in comparison with the size of the pin 70, is
allowed to move outwardly to the position shown in
Figures 1 and 2 without rotation of the body means 146.
The predetermined resistance between the spindle 168 and
the sleeve 166 is sufficient to prevent rotation of the
body means 146 during the return of the arm 56 in the
direction of the arrow 60.

The manually operable tab 80 on the arm
means 56 may be engaged manually to move the arm 56 out
of engagement with the ratchet teeth 160 and thus allow
free rotation of the body means 146 in either direction
indicated by the double ended arrow 170 by manual opera-
tion thereof. Thus, the tab 80 allows movement of the
arm means 56 manually both in the directions indicated
by the arrows 58 and 60, as well as into and out of
ratchet tooth engagement as indicated by the double
ended arrow 82.

Figure 3 illustrates the multi-track recording
tape 30 useful in the practice of the present invention.
By way of illustration, the multi-track recording
tape 30 may have thirteen separate tracks, one through
13, inclusive. Track number 1 is utilized for recor-
dation of the broadcast message which is transmitted to
each incoming caller by the broadcast head 134. Thus,
broadcast head 134 may be fixedly positioned adjacent
track number 1 on the multi-track recording tape 30. The
other tracks, that is, 2 through 13, or a total of
twelve tracks, are utilized for recording incoming
messages. The record head 136 sequentially records each
incoming message on tracks 2 through 13, inclusive. It
will be appreciated, of course, that the record head 136
has both the functions of recording messages on the
multi-track tape 30 as well as having the capability of
playing back messages which have been recorded on, for
example, tracks 2 through 13. Similarly, it is pre-
ferred that the broadcast head 134 also has the capabi-
ality of both recording a message on track 1, as well as
playing back the message which is on track 1, so that the user of the telephone answering machine of the present invention may listen to the message which he has recorded and change the message as desired. As noted above, in other embodiments, the record head 136 is utilized to record the broadcast message and thus the record and erase capabilities of the broadcast head 134 are eliminated. The multi-track recording tape 30 has, as noted above, its first end 36 coupled to the supply reel 14, and its second end 40 coupled to the take-up reel 44. The section 40' of the multi-track recording tape 30, between the second end 40 and the line 180, corresponds to that portion of the multi-track tape 30 extending between the connection at 42 to the take-up reel 44 and the broadcast head 134 when the embodiment 10 is in the start position as shown in Figure 1. The portion 36' between the first end 36 and the line 182, corresponds to that portion between the supply reel 14 and the record head 136 when the tape 30 has been fully wound upon the take-up reel 44. Consequently, the sections 40' and 36' are not utilized for the recodation of messages thereon, and, if desired, may be free of the multi-tracks.

The multi-track tape 30 has a first portion 184, corresponding to a first time indicated on Figure 3 at t1. The multi-track recording tape 30 also has a second portion indicated at 186, separated by a sensing means 188, which, for example, may be a strip of foil. According to the principles of the present invention, the broadcast message is recorded on track number 1 which is in the first portion 184 of the multi-track recording tape 30. The section of track number 1 that is in the second portion 186 of the multi-track recording tape 30, is not utilized. Similarly, according to the principles of the present invention, the incoming messages are recorded sequentially on
tracks 2 through 13, which are in the second portion 186
of the multi-track recording tape 30, and the sections
of tracks 2 through 13, inclusive, which are in the
first portion 184, are not utilized. Consequently, the
unutilized portions of the multi-track recording
tape 30, as described above, may be free of recording
message capability. Alternatively, if desired, the
tracks 1 through 13, inclusive, on the multi-track
recording tape 30 may extend completely between the
first end 36 and second end 40 thereof, even though por-
tions of them are not utilized.

The length of the second portion 186 of the
multi-track recording tape 30 may correspond to a time
indicated by $t^2$ on Figure 3. For example, the time
$t^1$ may be 15 seconds, and the time $t^2$ may be 30 seconds.
The width of the foil strip 188 may, for example, be on
the order of 1 second.

Operation of the embodiment 10 described in
connection with Figures 1, 2, and 3, commences with the
telephone answering device in the position indicated in
Figure 1. An incoming call signal is generated by the
connection between the embodiment 10 and a telephone
(not shown), and the incoming call signal is supplied to
an appropriate control 190, to initiate operation of the
telephone answering device. The solenoid 112 is
actuated upon receipt of the incoming call signal and
moves the drive means 96 into the engaged condition with
the take-up reel 44. The broadcast head 134 is in the
play mode. As the drive means 96 rotates the take-up
reel 44, the multi-track recording tape 30 is moved past
the broadcast head 134 in a direction indicated by the
arrow 192, and the pre-recorded message on track
number 1 in the first portion 184 of the multi-track 20
recording tape 30 is broadcast to the incoming caller.
At the end of first portion 184, the sensing means 180
is senses by an appropriate detector (not shown), and an
appropriate tone signal of conventional design, is
generated to indicate to the incoming caller that he may
record his message following the tone signal. After the
sensing means 188 has passed the detector, the record
head is in the record mode and positioned adjacent
track 2 by the first motion producing means 142.
Continual movement of the multi-track recording tape 30
in the direction of the arrow 192 continues until the
end of the time period indicated by the second
portion 186. The overall length of the multi-track
recording tape 30 is selected so that when the end of
the time period t² is reached, the tape has unwound from
at least the first section 34 of the supply reel 14,
allowing the pawl means 46 to move outwardly therefrom
under the influence of the spring 52. Continued rotation
of the supply reel 14 causes the pawl means 46 to
engage the first wall 62 of the tab 64 on arm 56, and
moves the arm 56 in the direction of the arrow 58. This
causes the second walls 170 of the arm means 56 in enga-
gement with one of the plurality of ratchet teeth 160 to
rotate the body means 146 of the first motion producing
means 142 in the direction indicated by the arrow 194
30° for the particular embodiment described above.
Continued movement of the arm means 56 in the direction
of the arrow 58 if the body means 146 have been so
rotated causes the end 56a of the arm means 56 to engage
the switch means 198 and switch means 198 is opened and
sends an appropriate signal to the control 190. Upon
receipt of the signal from the switch means 198 by the
control 190, the solenoid 112 is deenergized. This
allows the bracket 104, upon which the drive means 96 is
mounted, to move out of the drive engagement condition
with the take-up reel 44. With the drive means 196 no
longer driving the take-up reel 44, the spring means
116, which had been stretched during the winding of the
tape 30 on the take-up reel 44, to rotate the supply
1 reel 14 in the direction of the arrow 22 to rewind the
2 multi-track recording tape 30 on the supply reel 14.
3 The first level or layer of the multi-track tape 30 on
4 the supply reel 14 causes the pawl means 46 to move from
5 its outward engaged position to its retracted position shown on Figure 1, and continued rotation of the
6 supply reel 14 under the influence of the spring 116,
7 winds the remainder of the tape 30 thereon. The
8 spring 74 has caused the return of the arm means 56 to
9 the position shown in Figure 1 in the direction of the
10 arrow 60. The rewinding of the tape 30 on the supply
11 reel 14 continues until the tape 30 is once again in the
12 position shown in Figure 1 and as described above. The
13 first motion producing means 142, having moved the
14 record head to the next available track for recording
15 the next incoming message, the embodiment 10 of the present invention is now ready to receive the next incoming
16 call. Upon receipt of the next incoming call, the above
17 described cycle of operation is repeated until the last
18 message has been recorded or until the last track
19 available for recording of an incoming message has
20 been utilized. Further rotation of the body means 146,
21 after track 13 has been utilized, is prevented by the
22 surface 146' engaging the mounting bracket 150.
23 When it is desired by the user of the
24 telephone answering device of embodiment 10 to listen to
25 the messages recorded on tracks 2 through 13, the record
26 head 136 is switched to the playback mode by an
27 appropriate control (no shown), and, preferably, the
28 broadcast head 134 is deenergized so as not to allow
29 playback of the pre-recorded message. An appropriate
30 signal is generated to simulate the incoming call signal
31 and the above described cycle of operation commences.
32 However, since the broadcast head 134 has been
33 deenergized, during the first time period $t_1$, there is
34 no broadcast of the pre-recorded message. When the
record head 136, which is now in playback mode, has been
placed in the position corresponding to track 2 by
manual rotation of the knob 172, in a direction opposite
to the arrow 194, which is permitted by manual operation
of the tab 180 on arm 56 to move the arm 56 out of
ratchet engaging condition, and then released after the
rotation of the knob 172 has been completed, the record
head 136 commences playing back the messages recorded on
track 2 until the end of time t2. The above described
cycle of operation then repeats itself, associated with
the recording of incoming messages, then is repeated,
except that, in preferred embodiments of the present
invention, the detection means utilized to sense the
presence of the foil strip 188, is controlled to detect
the presence of the sensing means 188 during the rewind
operation of the tape 30 on the supply reel 14 under the
influence of spring 116. When the detection means thus
detects the sending means 188, the solenoid 112 is
energized and the drive means 96 is energized to cause
the take-up reel 44 to rotate in the direction of the
arrow 88. The record head 136, which is in the playback
mode, having been moved to the next track, for example,
track 3, then plays back the message recorded on
track 3.

If the above described automatic operation is
not desired during the playback, for example, if the
message left is short or no message has been left at
all, manual actuation of the arm 56 by the tab 80,
causes both activation of the switch 198 as well as
rotation of the body member 146, the first motion pro-
ducing means 142, and the above described playback
cycle, commencing with the foil strip 188 at the
beginning of the time period t2 is initiated with the
record head 136, still in the playback mode, now posi-
tioned at the next track.

If a particular message or a particular track
is desired to be heard again, the arm means 56 may be
moved out of engagement with the ratchet teeth 160, and
the knob 172 rotated to rotate the body means 146 to
position the record head 136 at any desired track.

It will be appreciated, of course, that the
above described operations of embodiment 10, the drive
means 96 is also energized when the drive means 96 is in
the drive condition thereof, to rotate the take-up reel
44. When the drive means 96 is not in the drive posi-
tion thereof, the drive means 96 may be deenergized.

In other embodiments of the present invention,
variations from the structure illustrated in Figures 1,
2, and 3 may be made. For example, the take-up reel 44
may be coaxially mounted with the supply reel 14. Such
a configuration, of course, may allow a reduction in the
size of the case means 12. Further, if desired, in
another embodiment of the present invention, take-up
reel 44 and body means 146 of the first motion producing
means 142 may both be coaxially mounted with respect to
the supply reel 14. In such an embodiment, the pawl
means 46 may directly engage the ratchet teeth 160 as
well as the switch 198, thereby eliminating the arm 56.

From the above, it can be seen that there has
been provided an improved telephone answering machine.
Those skilled in the art may find many variations and
adaptations thereof, and all such variations and adap-
tations falling within the scope and spirit of the
appended claims are intended to be covered thereby.
1. In an improved telephone answering device of
the type having a supply reel, a take-up reel, and a
tape selectively wound and unwound from the supply reel
and take-up reel, the improvement comprising, in
combination:
an end of tape sensor on said supply
reel, and said end of tape sensor comprising:
a pawl means movably mounted on said
supply reel for pivotal motion between a retracted posi-
tion and an engagement position, and said pawl means
restrained by said tape in said retracted position and
said pawl means extending outwardly from said supply
reel to said engagement position thereof for the con-
dition of said pawl means free of contact with said tape
means; and
resilient means between said supply
reel and said pawl means for yieldingly urging said pawl
means into said engagement position thereof.

2. The arrangement defined in claim 1, and
further comprising:
a drive means operatively engaging said
take-up reel in a drive condition for rotating said
take-up reel to unwind said tape from said supply reel
and wind said tape on said take-up reel, and said drive
means free of operative engagement with said take-up
reel for said drive means in a disengaged condition; and
rewind means coupled to said supply reel
and said rewind means comprising a resilient means for
yieldingly resisting rotation of said supply reel as
said tape is unwound therefrom and rotating said supply
reel to rewind said tape means thereon for said drive
means in said disengaged condition.
3. The arrangement defined in claim 2, wherein
said rewind means further comprises:
a flexible member having:
a first end coupled to said supply
reel, and said flexible member wound onto said supply
reel during the unwinding of said tape therefrom; and
a second end; and
a spring means coupled to said second end
of said flexible member.

4. The arrangement defined in claim 1 wherein:
said tape is a multi-track recording tape
and each track thereof has a first portion extending
from one end of said tape to a sensor and a second por-
tion extending from said sensor to the other end of said
tape;
a broadcast message recordable on said
first portion of at least a first track of said multi-
track tape; and
incoming messages recordable on said
second portions of other tracks of said multi-track
recording tape.

5. The arrangement defined in claim 4, and
further comprising:
a record head selectively and sequen-
tially positionable adjacent said second portions of
said other tracks for sequentially recording incoming
messages thereon; and
a broadcast head positionable adjacent
said first portion of at least said first track for
broadcasting said broadcast message to incoming callers.
6. The arrangement defined in claim 5, wherein:
   said record head is selectively positionable adjacent said first portion of at least said first track for recording said broadcast message thereon.

7. The arrangement defined in claim 5, and further comprising:
   a drive means operatively engaging said take-up reel in a drive condition for rotating said take-up reel to unwind said tape from said supply reel and wind said tape on said take-up reel, and said drive means free of operative engagement with said take-up reel for said drive means in a disengaged condition; and
   rewind means coupled to said supply reel and said rewind means comprising a resilient means for yieldingly resisting rotation of said supply reel as said tape is unwound therefrom and rotating said supply reel to rewind said tape means thereon for said drive means in said disengaged condition.

8. The arrangement defined in claim 7, wherein said rewind means further comprises:
   a flexible member having:
   a first end coupled to said supply reel, and said flexible member wound onto a spindle concentric with said supply reel during the unwinding of said tape therefrom; and
   a second end;
   a spring means coupled to said second end of said flexible member.
9. In an improved telephone answering device of the type having a rotatably mounted supply reel, a rotatably mounted take-up reel, and a tape having a first end coupled to said supply reel and a second end coupled to said take-up reel, and said tape wound on said supply reel at a start condition and wound on said take-up reel at an end condition, the improvement comprising, in combination:

- a drive means operatively engaging said take-up reel in a drive condition for rotating said take-up reel to unwind said tape from said supply reel and wind said tape on said take-up reel, and said drive means free of operative engagement with said take-up reel for said drive means in a disengaged condition; and
- a rewind means coupled to said supply reel and said rewind means comprising a resilient means for yieldingly resisting rotation of said supply reel as said tape is unwound therefrom and rotating said supply reel to rewind said tape means thereon for said drive means in said disengaged condition.

10. The arrangement defined in claim 9, wherein said rewind means further comprises:

- a flexible member having:
  - a first end coupled to said supply reel, and said flexible member wound onto said supply reel during the unwinding of said tape therefrom; and
  - a second end;
- a spring means coupled to said second end of said flexible member.
11. The arrangement defined in claim 10, wherein:
said tape is a multi-track recording tape
and each track thereof has a first portion extending
from one end of said tape to a sensor and a second port-
ion extending from said sensor to the other end of said
tape;
    a broadcast message recordable on said
first portion of at least a first track of said multi-
track tape; and
    incoming messages recordable on said
second portions of other tracks of said multi-track
recording tape.

12. The arrangement defined in claim 11, and
further comprising:
    a record head selectively and sequen-
tially positionable adjacent said second portions of
said other tracks for sequentially recording incoming
messages thereon; and
    a broadcast head positionable adjacent
said first portion of at least said first track for
broadcasting said broadcast message to incoming callers.

13. The arrangement defined in claim 12, wherein:
said record head is selectively posi-
tionable adjacent said first portion of at least said
first track for recording said broadcast message
thereon.
14. An improved telephone answering device of the type transmitting a pre-recorded broadcast message in response to an incoming call, and recording incoming messages after the broadcast message has been completed, comprising, in combination:

- a case means;
- a recording tape supply reel, rotatably mounted on said case means for rotation about a first axis;
- a recording tape take-up reel rotatable mounted on said case means for rotation about a second axis;
- a multi-track recording tape, having a first end coupled to said supply reel and a second end coupled to said take-up reel, and said multi-track recording tape having a plurality of tracks thereon, and said multi-track recording tape having a first section thereof wound on said supply reel in a start condition, and a second section thereof wound on said take-up reel in an end condition;

- at least a first section of said supply reel having said first section of said multi-track recording tape wound thereon in said start condition and free of said multi-track recording tape wound thereon in said end condition;
- a pawl means, movably mounted on said supply reel in regions adjacent said first section thereof, and restrained in a first, retracted, position thereon, by said first section of said multitrack recording tape, in said start condition, and said pawl movable from said retracted position to a second, engagement, position, for said first section free of said first section of said multi-track recording tape;
- arm means, movably mounted on said case means and having first walls for engaging said pawl means for said pawl means in said engagement position
thereof, and said first walls of said arm means free of
engagement with said pawl means for said pawl means in
said retracted position thereof, and said arm means
moved by said pawl means from a first position to a
second position;

first resilient means for resiliently
urging said arm means into said first position thereof;

rewind means for rotating said supply
reel to wind said multi-track recording tape thereon
from said end condition of said tape to said start con-
dition of said tape:

drive means, mounted on said case means,
and operatively engaging said take-up reel in a drive
condition for rotating said take-up reel to move said
tape from said start condition thereof to said end con-
dition thereof, and free of said operative engagement
for said drive means in a disengaged condition;
at least one pre-recorded broadcast
message recordable on at least said first track of said
multi-track recording tape, and other tracks of said
multi-track recording tape for recording said incoming
messages thereon;

a broadcast head, mounted on said case
means and positionable adjacent at least said first
track of said multi-track recording tape to transmit
said at least one pre-recorded broadcast message to
incoming callers;
a record head, movably mounted on said
case means for sequential positioning adjacent at least
said other tracks of said multi-track recording tape to
sequentially record incoming messages selectively on
each of said other tracks of said multi-track recording
tape; and

first motion producing means, movably
mounted on said case means and operatively engaging said
record head for sequentially positioning said record
head adjacent said other tracks of said multi-track recording tape.

15. The arrangement defined in claim 14, wherein:
   said rewind means comprises a second resilient means.

16. The arrangement defined in claim 14, and further comprising:
   means for selectively moving said drive means between said drive condition thereof and said engaged condition thereof.

17. The arrangement defined in claim 14, and further comprising:
   third resilient means operatively connected between said supply reel and said pawl means for resiliently urging said pawl means into said engagement position thereof.
18. The arrangement defined in claim 14, wherein:
   said first motion producing means
   comprises:
   a body member having a multi-level
   cam surface;
   fourth resilient means for urging
   said recording head into engagement with said multi-
   level cam surface; and
   said arm means having second walls for
   engaging said ratchet teeth of said body member, to move
   said body member a predetermined distance during each
   movement of said arm means from said first position to
   said second position thereof.

19. The arrangement defined in claim 18, wherein:
   said body means is a cylindrical annulus,
   having a first end, a second end axially spaced from
   said first end, and peripheral walls;
   said multi-level cam surface is on said
   first end of said body member;
   said ratchet teeth are on said peripheral
   walls adjacent said second end of said body member, and
   extend radially outwardly therefrom; and
   said body means rotatably mounted on said
   case means for rotational movement about a predetermined
   axis.

20. The arrangement defined in claim 19, and
   further comprising:
   manually operable means coupled to said body
   member for manually rotating said body member for selec-
   tively positioning said recording head.
21. The arrangement defined in claim 14, wherein:
    each track of said multi-track recording
tape has a first position and a second portion;
    a sensing means on said multi-track
recording tape between said first portion and said
second portion thereof;
    said pre-recorded broadcast message on
said first portion of at least said first track; and
    said incoming messages on said second
portion of other tracks.

22. The arrangement defined in claim 14, wherein
    said first axis of said supply reel and said second axis
of said take-up reel are parallel and in a spaced apart
location.

23. The arrangement defined in claim 14, wherein:
    said arm means is movably mounted for
linear, reciprocating movement.

24. The arrangement defined in claim 23, and
    further comprising:
    said rewind means comprises a second
resilient means;
    third resilient means operatively con-
connected between said supply reel and said pawl means for
resiliently urging said pawl means into said engagement
position thereof.
25. The arrangement defined in claim 24 and further comprising:
    said first axis of said supply reel and said second axis of said take-up reel are parallel and in a spaced apart location.

26. The arrangement defined in claim 25, and further comprising:
    said first motion producing means comprising:
    a body member having a multi-level cam surface;
    fourth resilient means for urging said recording head into engagement with said multi-level cam surface; and
    a plurality of ratchet teeth on said body member;
    said arm means having second walls for engaging said ratchet teeth of said body member, to move said body member a predetermined distance during each movement of said arm means from said first position to said second position thereof;
    said body means is a cylindrical annulus, having a first end, a second end axially spaced from said first end, and peripheral walls;
    said multi-level cam surface is on said first end of said body member;
    said ratchet teeth are on said peripheral walls adjacent said second end of said body member and extend radially outwardly therefrom; and
    said body means rotatably mounted on said case means for rotational movement about a predetermined axis.
27. The arrangement defined in claim 26 and further comprising:

manually operable means coupled to said body member for manually rotating said body member for selectively positioning said recording head;

each track of said multi-track recording tape has a first portion and a second portion;

a sensing means on said multi-track recording tape between said first portion and said second portion thereof;

said pre-recorded broadcast message on said first portion of at least said first track; and

said incoming messages on said second portion of said other tracks.

28. The arrangement defined in claim 27 and further comprising:

means for selectively moving said drive means between said drive condition thereof and said engaged condition thereof.

29. The arrangement defined in claim 14, wherein:

said first axis of said supply reel and said second axis of said take-up reel are colinear.
30. An improved telephone answering device of the type transmitting a pre-recorded broadcast message in response to an incoming call, and recording incoming messages after the broadcast message has been completed, comprising, in combination:

- a case means;
- a recording tape supply reel, rotatably mounted on said case means for rotation about a first axis;
- a recording tape take-up reel rotatable mounted on said case means for rotation about a second axis;
- a multi-track recording tape, having a first end coupled to said supply reel and a second end coupled to said take-up reel, and said multi-track recording tape having a plurality of tracks thereon, and said multi-track recording tape having a first section thereof wound on said supply reel in a start condition, and a second section thereof wound on said take-up reel in an end condition;

at least a first section of said supply reel having said first section of said multi-track recording tape wound thereon in said start condition and free of said multi-track recording tape wound thereon in said end condition;

- a pawl means, movably mounted on said supply reel in regions adjacent said first section thereof, and restrained in a first, retracted, position thereof, by said first section of said multi-track recording tape, in said start condition, and said pawl movable from said retracted position to a second, engagement, position, for said first section free of said first section of said multi-track recording tape;

- a record head selectively positionable adjacent a preselected number of said plurality of tracks of said multi-track tape;
means operatively connected to said
record head and moved by said pawl means for said pawl
means in said engagement condition thereof for selec-
tively positioning said record head.

31. The arrangement defined in claim 30, and
further comprising:
wind means for winding said multi-track
recording tape in said supply reel, and said rewind
means comprising:
resilient means for yieldingly
resisting rotation of said supply reel in a first direc-
tion as said tape is unwound therefrom and rotating said
supply reel in a second direction to rewind said tape
thereon.

32. The arrangement defined in claim 1, wherein
said pawl means is pivotally mounted on said supply
reel.

33. The arrangement defined in claim 1, wherein
said pawl means is mounted for reciprocating movement on
said supply reel.

34. The arrangement defined in claim 2, wherein
said rewind means comprises a coiled spring connected to
said supply reel.
35. The arrangement defined in claim 18 and further comprising:
   a manually operable knob means,
   operatively coupled to said first motion producing means to allow selective manual rotation thereof.
# INTERNATIONAL SEARCH REPORT

**International Application No**: PCT/US81/00372

## I. CLASSIFICATION OF SUBJECT MATTER

(according to International Patent Classification (IPC) or to both National Classification and IPC)

<table>
<thead>
<tr>
<th>INT. CL.</th>
<th>U.S. CL.</th>
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<td>3 G11B 15/18, 19/44</td>
<td>360/90</td>
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## II. FIELDS SEARCHED

### Minimum Documentation Searched

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<tr>
<th>Classification System</th>
<th>Classification Symbols</th>
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<tbody>
<tr>
<td>US</td>
<td>360/78,90,96,106,242/186,197,199,201</td>
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</table>

Documentation Searched other than Minimum Documentation to the extent that such Documents are Included in the Fields Searched

## III. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of Document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to Claim No.</th>
</tr>
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<tbody>
<tr>
<td>X</td>
<td>US, A, 3,154,308, Published 27 October 1964, See 115 of Fig 3, Faulkner</td>
<td>1-8,32,34</td>
</tr>
<tr>
<td>X</td>
<td>US, A, 3,285,612, Published 15 November 1965, See Figs 1-4 and 8-9, Hallamore</td>
<td>2-3,7,13,34</td>
</tr>
<tr>
<td>X</td>
<td>US, A, 3,865,987, Published 11 February 1975, See 1 of Fig 1, Yamamoto et al</td>
<td>4-8,11-13</td>
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<tr>
<td>A</td>
<td>US, A, 3,386,294, Published 4 June 1968, See col. 1, lines 30-47, Waldenburger et al</td>
<td>1-8,32,34</td>
</tr>
<tr>
<td>A</td>
<td>US, A, 3,606,345, Published 20 September 1971, See Fig. 2, Cranor et al</td>
<td>1-13,32,34</td>
</tr>
</tbody>
</table>

*Special categories of cited documents:

- **"A"** document defining the general state of the art
- **"E"** earlier document but published on or after the international filing date
- **"L"** document cited for special reason other than those referred to in the other categories
- **"O"** document referring to an oral disclosure, use, exhibition or other means
- **"P"** document published prior to the international filing date but on or after the priority date claimed
- **"T"** later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention
- **"X"** document of particular relevance

## IV. CERTIFICATION

- **Date of the Actual Completion of the International Search**: 7 July 1981
- **Date of Mailing of this International Search Report**: 21 JUL 1981

**International Searching Authority**: ISA/US

**Signature of Authorized Officer**:

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**EXAMINER**

See notes ---

**GROUP ART UNIT 235**
FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

VI. OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSERACHABLE 10

This International search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. □ Claim numbers __________, because they relate to subject matter not required to be searched by this Authority, namely:

2. □ Claim numbers __________, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful International search can be carried out, specifically:

   Claim 33 depends on claim 1 which calls for a Pawl to pivot yet claim 33 calls for the pawl to reciprocate. One or the other is possible, not both at the same time.

VI. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING 11

This International Searching Authority found multiple inventions in this international application as follows:

I. Tape drive subcombination: 1-13, 32 and 34
   II. Telephone Answering Device Combination: 14-31 and 35

1. □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. □ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. □ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers: 1-13, 32 and 34

Remark on Protest

□ The additional search fees were accompanied by applicant's protest.
□ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (supplemental sheet 2) (October 1977)