E.P. 0042870

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 3:	A1	(11) International Publication Number: WO 81/01902
G11B 5/09, 15/18, 15/48		(43) International Publication Date: 9 July 1981 (09.07.81)

(21) International Application Number: PCT/US80/01754

(22) International Filing Date: 30 December 1980 (30.12.80)

(31) Priority Application Number: 109,745

(32) Priority Date: 31 December 1979 (31.12.79)

(33) Priority Country: US

(71) Applicants; and
(72) Inventors: ADAMS, Robert, M. [US/US]; 6705 Robin Road, Dallas, TX 75209 (US). CAVE, Ellis, K. [US/US]; 5106 Durango Drive, Garland, TX 75040 (US).

(74) Agents: MANZO, Edward, D. et al.; Cook, Wetzel & Egan, Ltd., 135 South LaSalle Street, Chicago, IL 60603 (US).

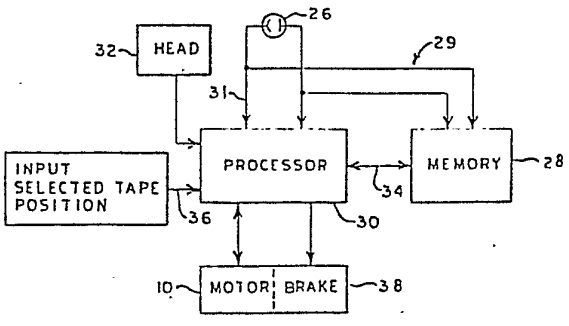
(81) Designated States: AT (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), LU (European patent), NL (European patent), SE (European patent).

Published
With international search report

(54) Title: TAPE TRANSPORT SYSTEM

(57) Abstract

Improved magnetic tape transport arrangement allows rapid and accurate access to selected tape positions. The tape includes at least one track containing a recording of an index. The transport has associated with it a means for indicating tape transport movement, illustratively an aperture (20) in the tape flywheel (14) for permitting passage of light (22, 24) to a photosensor (26) from time to time in accordance with flywheel movement. A processor (30) and associated memory (28) are connected (31, 29) to the optical system so that the memory (28) registers the apparent position of the tape based on the number of times the light beam (22) passes through the aperture (20). From time to time as the tape is played the tape head (32) reads digital data and this is inputted to the processor (30) which corrects the memory (28) count, if necessary, of the tape position. To move the tape to a desired location, the intended position is applied by appropriate means (36) to the processor. The processor (30) calculates the number of increments needed to reach the intended position based on the data in memory (28) and commands a motor (10) and brake (38) system to move the tape in that direction. The processor monitors the memory count which changes each time the aperture (20) permits the light beam (22) to pass, and causes brake (38) application prior to reaching the intended position. The processor thereafter continues monitoring the memory (28) and controlling the motor (10) and brake (38) until the desired tape location is reached. With the disclosed system, inexpensive tape transport can be used for accurate and quick tape positioning.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**KP**	Democratic People's Republic of Korea
AU	Australia	**LI**	Liechtenstein
BR	Brazil	**LU**	Luxembourg
CF	Central African Republic	**MC**	Monaco
CG	Congo	**MG**	Madagascar
CH	Switzerland	**MW**	Malawi
CM	Cameroon	**NL**	Netherlands
DE	Germany, Federal Republic of	**NO**	Norway
DK	Denmark	**RO**	Romania
FI	Finland	**SE**	Sweden
FR	France	**SN**	Senegal
GA	Gabon	**SU**	Soviet Union
GB	United Kingdom	**TD**	Chad
HU	Hungary	**TG**	Togo
JP	Japan	**US**	United States of America

TAPE TRANSPORT SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to improvements in a tape transport system and in a method for decoding digital data stored on audio tape by an audio tape recorder. This discloure hereby incorporates by reference the entire disclosure of the patent application of Ellis K. Cave, one of the co-inventors hereof, entitled "Automated Conversation System," having serial no. _____ and being filed concurrently herewith.

One of the features of the "Automated Conversation System" is a processor controlled system having two tape recorders, one of the tape recorders having prerecorded on one of its tracks a set of vocalizations on the particular subject about which the conversation system is to converse, and on a parallel track having prerecorded thereon digital data corresponding to the vocalizations. The Automated Conversation System accesses various vocalizations using the digital track for guidance. After a vocalization (or even during the vocalization), the second tape recorder records all information from the person carrying on the conversation. Such information may be in the form of vocalizations or can be data transmitted via a telephone line in the same manner by which a telephone is placed, i.e. by dialing the telephone for example.

The present invention in one of its aspects relates to a method and apparatus by which the digital data stored on the track of the first tape recorder is decoded for use by a microprocessor.

Another aspect of the invention relates to achieving a two-way conversation without undue gaps on behalf of the system. Such gaps would be introduced when the system is moving the tape on the first tape recorder to a selected position at which a vocalization is to be replayed. Unless the tape recorder can move both

BUREAU OMPI WIPO INTERNATIONAL

quickly and accurately to such a select position, part of the vocalization will be lost or time will be wasted while the tape recorder zeros in on the selected tape position.

It is therefore an object of the present invention to provide an improved method and apparatus by which a tape can moved to a selected position.

It is another object to provide a method and apparatus for moving a tape to a selected tape position in a relatively low-cost audio tape recorder.

Another object of the present invention is to provide an improved braking system for a tape transport.

Still a further object of the present invention is to provide a braking system for the tape transport in a relatively low-cost audio tape recorder.

BRIEF DESCRIPTION OF THE DRAWINGS

In describing various aspects of the present invention, reference is made the accompanying drawings wherein:

Figure 1A is a sketch representing a view of means on a portion of a tape transport for generating signals as the tape transport moves;

Figure 1B is a sketch representing a side view of the means of Figure 1 as well as other representative portions of a tape deck; and

Figure 2 is a block diagram of a system according to various aspects of the present invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

According to one aspect of the invention, a magnetic recording tape may be prerecorded with digital data on one of two or more parallel tracks. Each digital datum identifies its own position on the tape. On the other track, audio vocalizations may be prerecorded. Such prerecording can be done on a tape recorder equipped

BUREAU CIPI ... TIONAL

with means on a tape transport for generating signals based on movement of the transport. For example, referring to Figure 1A and 1B, a tape recorder having a motor 10 with a axle 12 can rotate a flywheel 14 via a rubber belt 16 to rotate the flywheel about an axis 18. The flywheel may include an aperture 20 through which light passes along an optical path 22 from a light source 24 to a photocell 26. Each time aperture 20 passes through the optical path, the electrical signal outputted by photocell 26 changes.

Such electrical signals will represent the position of the tape in the tape transport. Accordingly, during the prerecording stage, a catalog can be made to associate the number of counts of changes in the electrical signal outputted by photocell 26 with the various vocalizations on one track of the magnetic recording tape. This catalog can be prerecorded along the tape, advantageously at the beginning. Advantagiously, the digital data is also correlated to the vocalizations.

When the tape is placed in a tape deck equipped with the means previously described for generating signals based on movement of the tape transport, the apparant position of the tape can be monitored by apparatus shown in Figure 2. Signals from photocell 26 can increment the count in a storage device such as a memory 28 directly via lines 29 or via control means such as a microprocessor 30 via leads 31. The count in memory 28 represents the number of occasions that optical path 22 has been intercepted, and therefore represents the apparant position of the tape.

When the tape moves in a "read" or playback position, a playback head 32 will read the audio vocalizations on one track and the digital signals on the other track. The digital signals will be applied to processor 30 which communicates with memory 28 via a lead or bus 34. Processor 30 updates memory 28 to correctly reflect the actual position tape which will be read directly from the tape without any error such as

BUREAU OMPI WIPO INTERNATIONAL

tape slippage or the like which could cause a miscorrelation of the position of the tape transport mechanism with the actual position of the tape.

A command may be given to move the tape to a particular location. Such a command can be inputted on an input lead 36 from a command authority such as a system user or a central processing unit at a remote location. Alternatively, the command to go to a particular tape location can be generated by processor 30 of its own accord, depending on system organization. When the command is given, processsor 30 determines which direction the tape must be moved to reach the selected position and activates motor 10 accordingly. The motor may illustratively be put into a rewind position. Normally the playback head 32 is not engaged with the tape during a rewind operation, so the movement of the tape is monitored by pulses generated by photocell 26.

This method and apparatus will result in a more accurate manner than exhibited by prior art devices because memory 28 will have been recently updated with the actual tape position which, it will be recalled, was read directly from the tape by head 32. It is to be understood that the updating can occur at various times and with various frequency, although highly accurate results will be obtained when the updating is done after each digital indication of tape position is read.

Another aspect of the present invention relates to the braking of the tape transport when going to a selected position. Referring again to Figure 2, when a command is generated or inputted to move the tape to a selected position, processor 30 activates motor 10 to move the tape toward the selected position. Processor 30 monitors the count of memory 28 and when the count approaches the selected position count, processor 30 activates a brake 38. Illustratively, brake 38 may be activated when the number of counts corresponding to the sensed or determined tape location differs from the

BUREAU OMPI OMPI INTERNATIONAL

number of counts corresponding to the selected tape location by some predetermined number of counts such as twenty.

Sometime after the braking application, processor 30 determines the position of the tape by reading memory 28 or by itself monitoring the number of counts generated by photocell 26. Processor 30 then determines whether the tape is at the selected tape position, and if not, then the processor calculates the difference between the tape position and the selected tape position and from this difference selects a subsequent tape position. Processor 30 then causes motor 10 to move the tape toward the selected tape position and at the subsequent tape position again engaging brake 38. After the tape stops, the processor determines whether the tape is at the selected tape position. If it is not, the processor 30 reiterates the tape position adjustment by determining the new difference in position, calculating a new subsequent tape position, restarting motor 10 and rebraking at the new subsequent position.

It will be appreciated that the methods and apparatus described herein will facilitate the use of relatively inexpensive tape transports such as may be found in low-cost audio tape recorders or decks for highly accurate and quick tape positioning, such as may be required in telephone banking or other applications where a machine must communicate with a person. Other applications of the present invention will be apparent. Moreover, it will be clear to those who are skilled in the art that various modifications and alterations can be made to the preferred embodiment hereof. It is therefore intended that the scope of protection afforded be determined by the appended claims.

BUREAU OMPI VEO INTERNATIONAL

I CLAIM:

1. A method for decoding modulated digital data recorded by an audio recorder on audio tape comprising:

playing the tape to generate signals corresponding to the data as stored on tape; then

detecting transitions in the levels of the corresponding signals; then

determining the time between the detected transitions; and then

identifying the digital data from the time between said detected transitions.

2. The method of claim 1 further comprising the step of first filtering the corresponding signals to remove noise therefrom.

3. Apparatus for decoding modulated digital date stored on audio tape by an audio tape recorder comprising:

a transition detector coupled to receive playback signals outputted by the audio tape recorder and to signal transitions in said playback signals;

a period counter coupled to said transition detector for counting the time between transitions and outputting a count signal;

processor means responsive to said count signals for comparing the time between transitions against a reference time.

4. The apparatus of claim 3 further comprising a hysteresis comparator receiving playback signals from said tape redcorder and having its output coupled to said transition detector.

5. A method for accurately moving tape to a tape transport to a selected position comprising:

first, prerecording a set of marker signals along a track of the tape, each signal

BUREAU OMPI INTERNATIONAL

identifying its respective position on the tape; then

storing in a storage device the relative position of the tape in the tape transport by generating sensed position signals based on occurrences of the tape transport and counting said sensed poisition signals; then

moving the tape from its current position to the selected position based on the number by which the count in said storage device must be incremented to reach the selected position;

determining the actual tape position by reading a marker signal when the tape is moved; then

adjusting the storage device count in accordance with the marker signal read in the step last recited.

6. The method of claim 5 wherein said storing step comprises moving an apertured device associated with the tape transport to intercept and then clear an optical path in response to movement of the tape transport and incrementing the count of said storage device with the occurrence of a selected one of said interception and clearance of said optical path.

7. The method of claim 5 further comprising storing a catalog associating projected sensed position signals with said set of marker signals.

8. The method of claim 7 wherein said storing comprises prerecording said catalog on said tape, reading said catalog, and storing said catalog in a memory position.

9. The method of claim 7 wherein said moving step comprises determining the number and direction by which said count in said storage device must be incremented to reach the marker signal for the selected

BUREAU OMPI WIPO INTERNATIONAL

position as indicated by said catalog.

10. The method of claim 5 or 9 wherein said determining step and said adjusting step precede said moving step.

11. The method of claim 5 or 9 wherein said determining step and said adjusting step follow said moving step.

12. A system for accurately moving recording tape to a selected position comprising:

a magnetic recording tape having a set of market signals recorded on one track thereof, each of said marker signals identifying its respective position on said tape;

a tape transport engaging said tape;

means associated with said tape transport for generating signals based on movement thereof;

a storage device coupled to receive and count said signals based on movement;

reading means for reading said market signals;

controller means coupled to said first storage device and to tape transport, said controller means receiving an indication of the selected position and determining how said storage device must be incremented by movement of the tape from its apparent position as indicated by the count stored in said first storage device;

said tape transport being controlling coupled to said controller means;

said controller means receiving signals from said reading means which correspond to said marker signals;

said controller means being coupled to adjust the count of said storage device whereby the count of said storage device is

BUREAU OMPI INTERNATIONAL

updated by said controller means to accurately represent the position of said magnetic recording tape despite inaccuracies introduced into said count by prior movements of said tape by said tape transport.

13. The system of claim 12 wherein said magnetic recording tape also has recorded thereon a catalog associating marker signals with anticipated signals based on movement, and wherein said storage device is also coupled to receive and store said catalog, whereby the selected position may be expressed in terms of a marker signal correlated to the selected position to which said tape is to be moved.

14. A machine implemented method for braking a tape transport when moving tape from an initial tape position to a selected tape position so that the tape stops at the selected position comprising:

a) electronically sensing the position of said tape as it moves in the tape transport;

b) electronically directing the tape transport to begin braking at a tape position related to said selected tape position, said first tape position being intermediate the initial top position and selected tape position; then

c) determining the position to the tape; then

d) electronically comparing the determined tape position against the selected tape position to generate a subsequent tape position representation intermediate the determined tape position and the selected tape position; then

e) transporting said tape toward the selected tape position;

f) braking at said subsequent tape position;

BUREAU OMPI O INTERNATIONAL

then

g) determining the tape position; and

h) if the determined tape position is not substantially the same as the selected position, then reiterating the method steps (e) through (h).

15. The method of claim 14 wherein said first tape position differs from the selected tape position by an absolute value constant in the system for sensing tape position.

16. The method of claim 14 wherein step (a) includes moving an apertured device associated with the tape transport to intercept and then clear an optical path in response to movement of the tape transport and incrementing the count of a storage device with the occurrence of a selected one of said interception and clearance of said optical path.

17. The method of claim 16 wherein said first tape position corresponds to a count in said storage device which differs from a count corresponding to the selected tape position by a predetermined number of counts.

18. The method of claim 14 wherein each of said subsequent tape positions has a predetermined relationship to the selected tape position and the relavant determined tape position.

19. The method of claim 14 wherein said subsequent tape positions is the average of the determined tape position and the selected tape position.

20. A system for accurately braking a tape moving from an initial tape position to a selected tape position in a tape transport comprising:

means associated with the tape transport for generating signals based on movement of the tape transport;

a storage device coupled to receive and count said signals based on movement of the

BUREAU ... INTERNATIONAL

tape transport;

a brake associated with the tape transport;

a controller means for controlling the activation of said brake and being coupled to said storage device to receive the count stored therein, said controller means also having an input for receiving a signal correspongint to the selected tape position;

said controller means activating said brake in response to the count of said storage device reaching a first count corresponding to a first tape position intermediate the initial tape position and the selected tape position, said controller means then determining whether the count of said storage device corresponds to the selected tape position, and if not, then generating subsequent tape position intermediate the court of said storage device and the selected tape position, activating the tape transport, and activating said brake at said subsequent position, and reiterating such controlling until the count in said storage device corresponds to the selected tape position.

BUREAU OMPI INTERNATIONAL

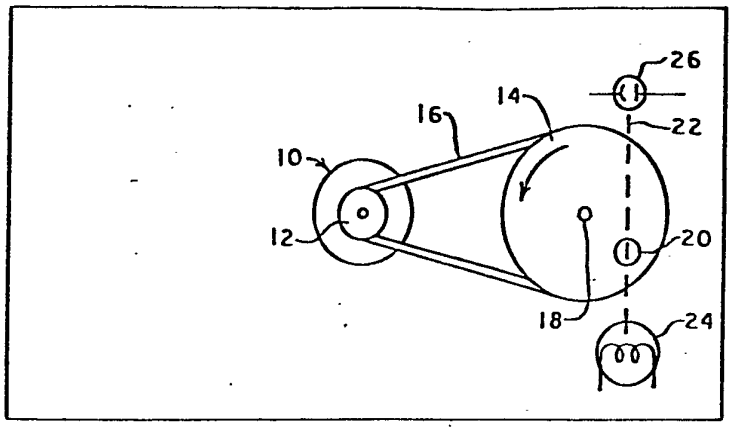


FIG. 1A

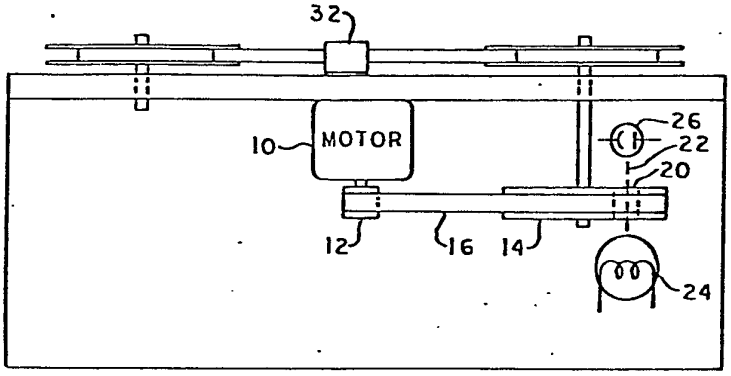


FIG. 1B

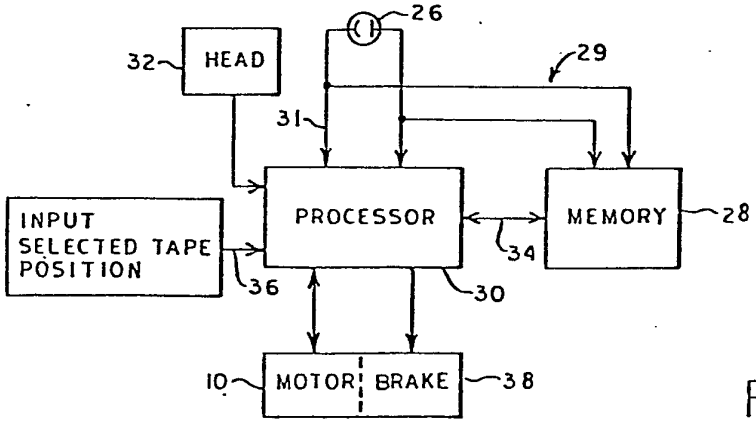


FIG. 2

BUREAU OMPI INTERNATIONAL

INTERNATIONAL SEARCH REPORT

International Application No PCT/US80/01754

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

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

IPC.[3] G11B 5/09, 15/18, 15/48
U.S. 360/44, 72.2, 72.3, 74.2

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	360/44, 72.2, 72.3, 74.2

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	US, A, 3,959,816, Published 25 May 1976, Spiecens	1-4
X	US, A, 3,804,993, Published 16 April 1974, Honnold et al	5-13
X	US, A, 4,172,231, Published 23 October 1979, D'Alayer de Costenire d'arc et al	5-14
X,P	US, A, 4,215,378, Published 29 July 1980, Sato et al	14-20

* Special categories of cited documents: [15]

"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 [2]	Date of Mailing of this International Search Report [2]
18 March 1981	07 APR 1981
International Searching Authority [1]	**Signature of Authorized Officer [20]**
ISA/US	

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [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 [12] 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 [13], specifically:

VI. ☒ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [11]

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

I. Claims 1-4
II. Claims 5-13
III. Claims 14-20

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:

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.