United States Patent

Camras

[15] **3,686,433**

[45] **Aug. 22, 1972**

[54] **TRANSDUCER SYSTEM ADAPTABLE FOR AUDIO OR VIDEO RECORDING OR REPRODUCTION**

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[73] Assignee: **IIT Research Institute,** Chicago, Ill.

[22] Filed: **June 9, 1969**

[21] Appl. No.: **831,352**

Related U.S. Application Data

[60] Continuation-in-part of Ser. No. 456,192, May 17, 1965, Pat. No. 3,449,528, and a continuation-in-part of Ser. No. 813,359, Feb. 7, 1969, Pat. No. 3,595,584, which is a division of Ser. No. 456,192, May 17, 1965, Pat. No. 3,449,528.

[52] **U.S. Cl.**.....**178/6.6 A,** 179/100.2 CA, 179/100.2 MD

[51] **Int. Cl.**.....**G11b 15/60,** G11b 21/12, H04n 5/78

[58] **Field of Search**.....179/100.2 Z, 100.2 CA, 100.2 C, 179/100.2 CR, 100.2 MD; 178/6.6 A, 100.2 MI, 100.2 CA

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Primary Examiner—Bernard Konick

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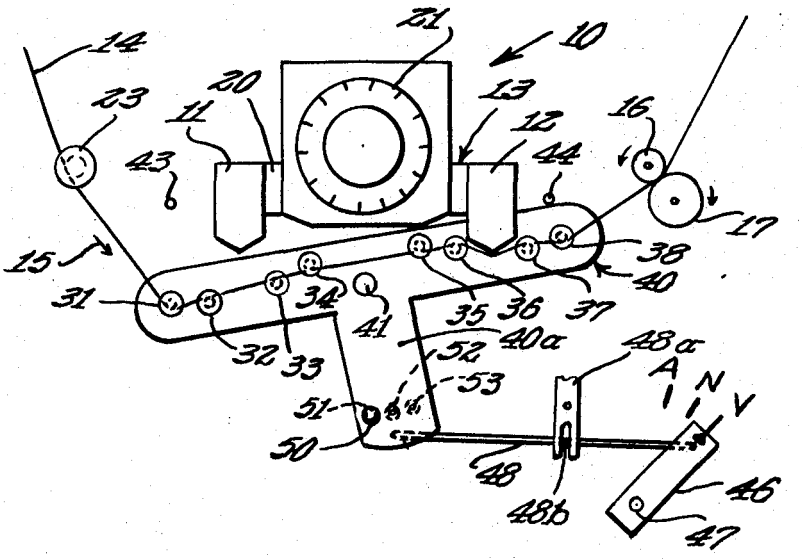
[57] **ABSTRACT**

A magnetic transducer system for selective audio or video operation with movable guides for shifting the tape path between audio, video, and rewind positions, or with fixed guides defining both an audio and video tape path, the audio tape path being clear of the video head, for example. A video transducer with a receptacle removably receiving and providing external energization for a battery powered audio transducer unit. An audio/video cartridge transducer arrangement for selective operation with audio and video cartridges of different configuration, preferably using a common capstan element.

11 Claims, 12 Drawing Figures



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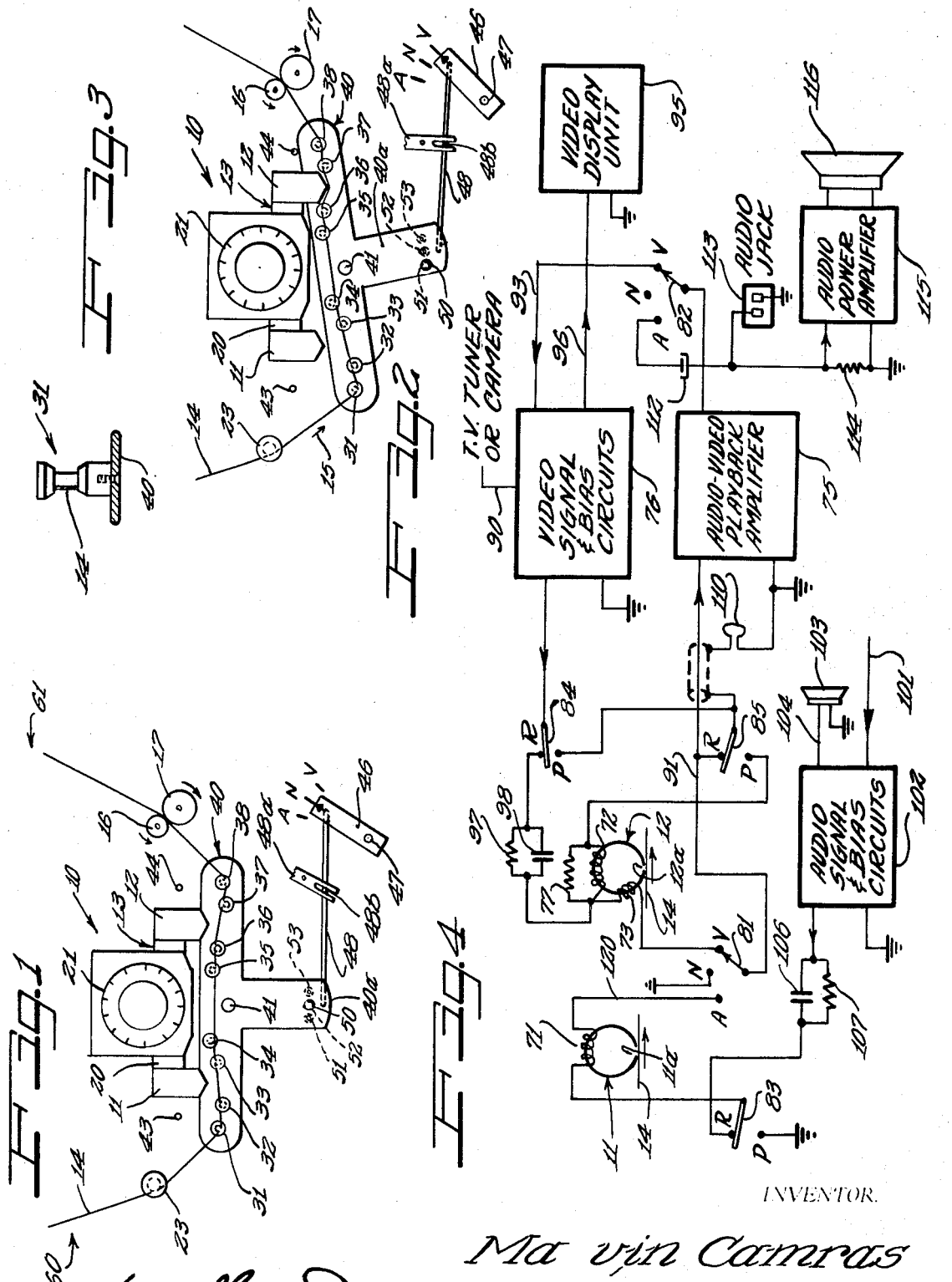

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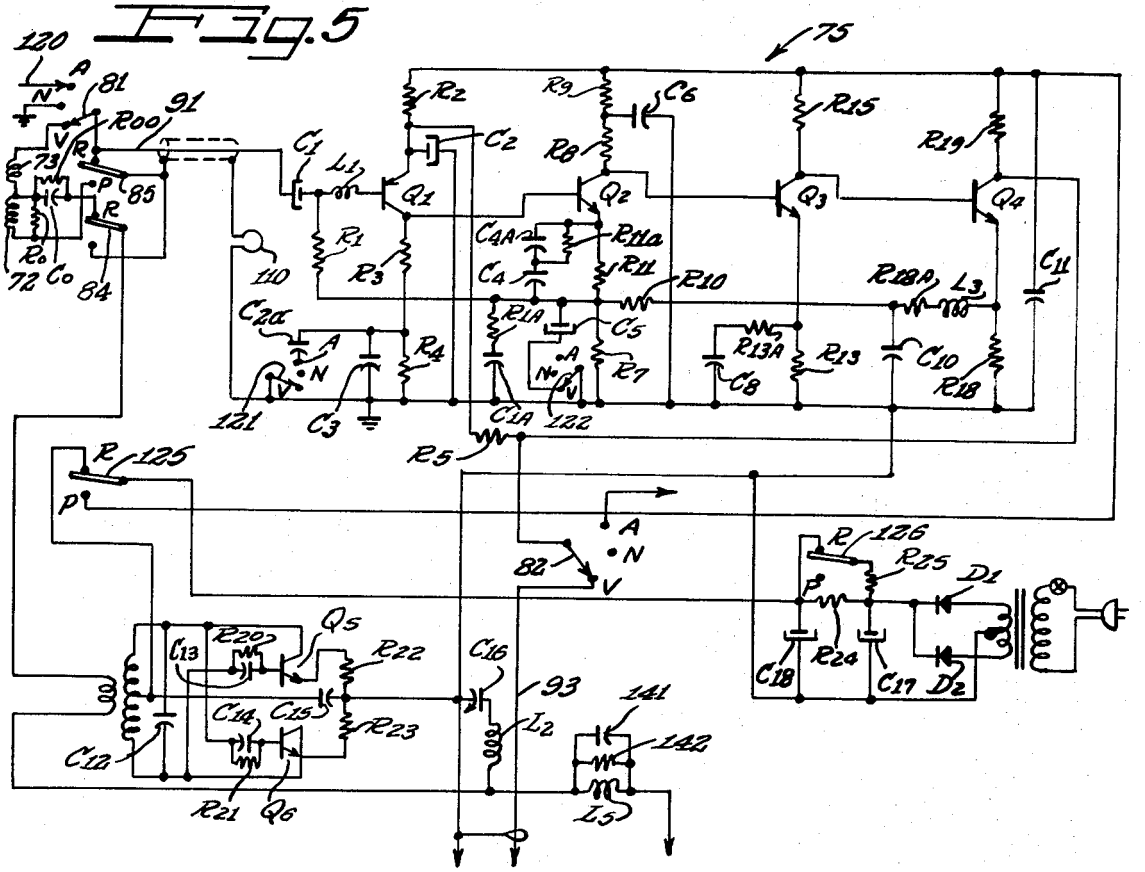
Fig. 5



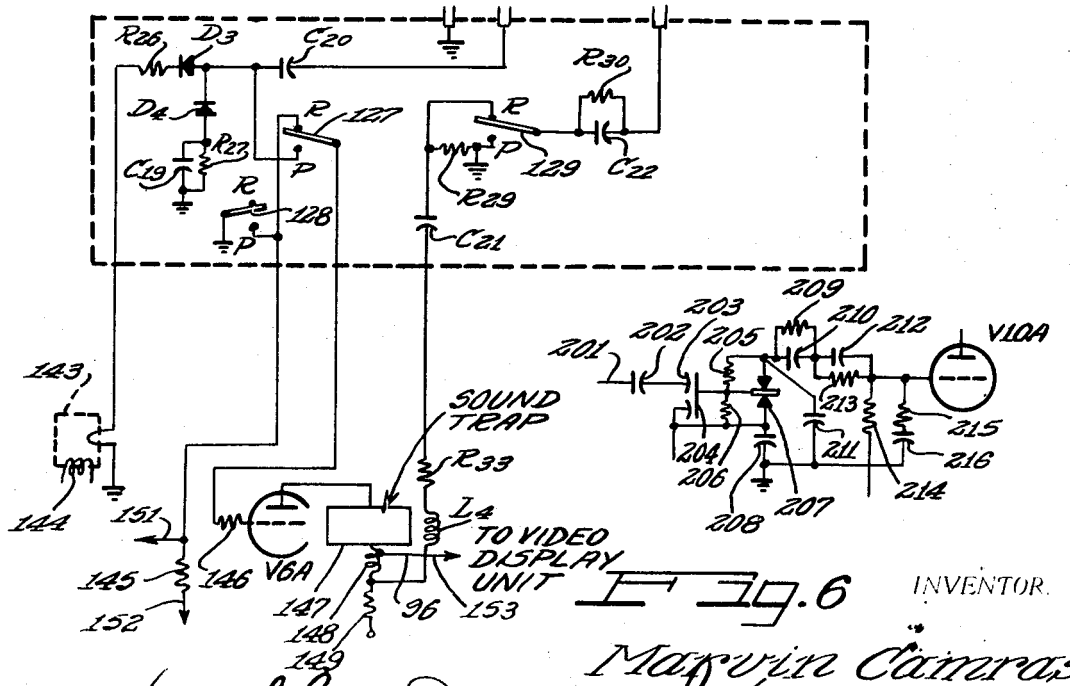


Fig. 6

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Fig. 7

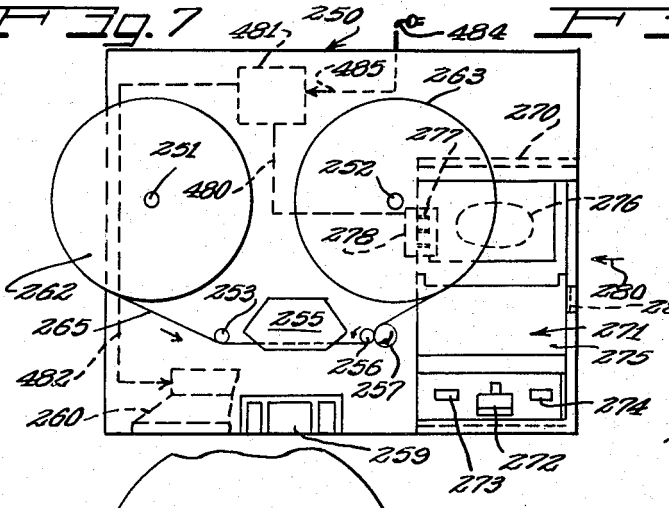
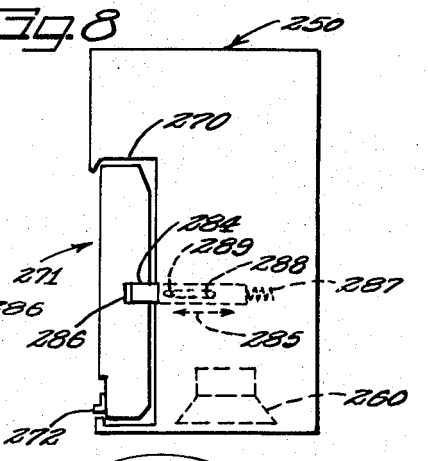


Fig. 8



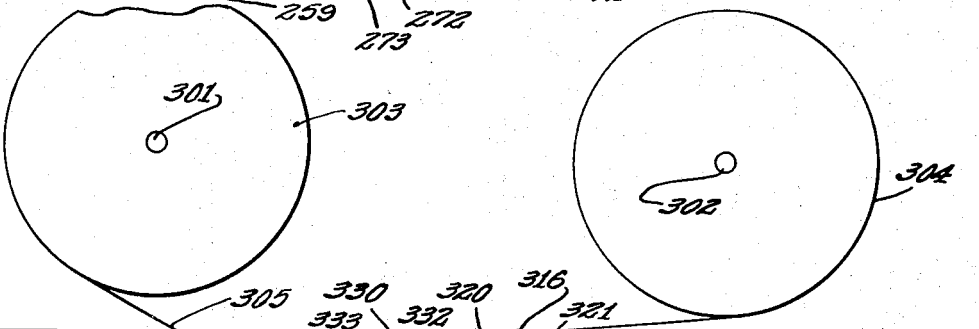


Fig. 9

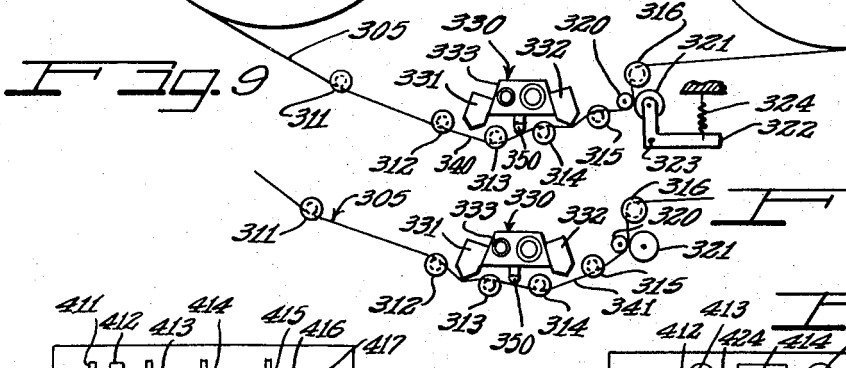


Fig. 10

Fig. 11

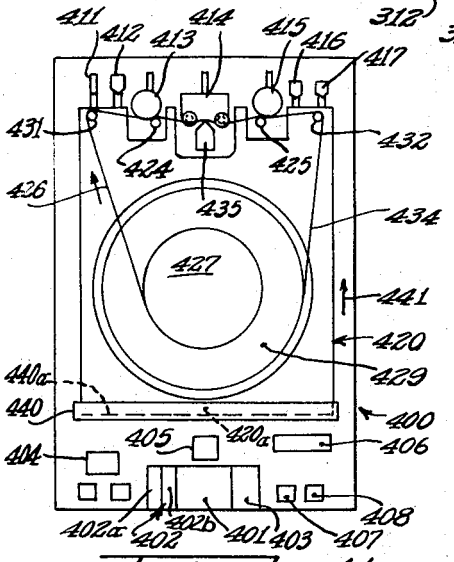
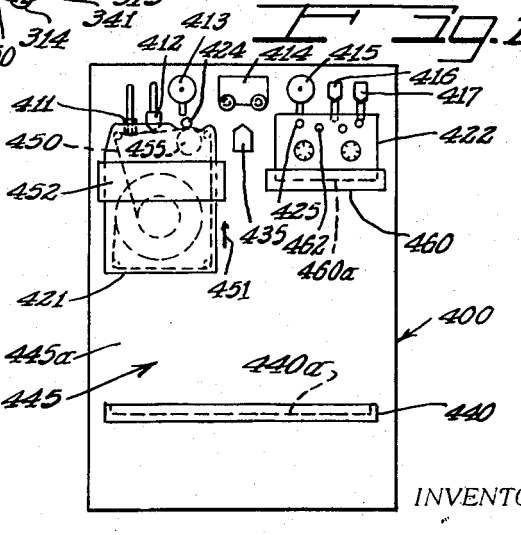


Fig. 12



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TRANSDUCER SYSTEM ADAPTABLE FOR AUDIO OR VIDEO RECORDING OR REPRODUCTION

CROSS REFERENCES TO RELATED APPLICATIONS

The present application is a continuation-in-part of my copending application Ser. No. 456,192 filed May 17, 1965 and issuing as U.S. Pat. No. 3,449,528 on June 10, 1969. The present application is also a continuation-in-part of my copending application Ser. No. 813,359 filed Feb. 7, 1969, now U.S. Pat. No. 3,595,584, which in turn is a division of said application Ser. No. 456,192.

The disclosure of said copending applications Ser. No. 456,192 and Ser. No. 813,359 is incorporated herein by reference in its entirety.

SUMMARY OF THE INVENTION

The present application relates to audio/video transducing systems and to electric circuitry therefor.

It is an object of the present invention to provide a compact and economical audio/video transducer system.

Another object is to provide an audio/video transducer system wherein during audio operation, the record medium travels clear of the video transducer head to avoid detrimental effects thereon during audio operation.

Another and further object is to provide a video transducer device having a flexible system for transducing audio records independently of the video transducer head.

Still another and further object is to provide a compact and efficient audio/video transducer device for transducing both audio and video record cartridges.

A further object is to provide a transducer device in accordance with the foregoing object which is capable of playing audio cartridges of different configuration within the video cartridge receiving region of the device.

A still further object is to provide an audio/video transducer system capable of efficient utilization of common components, such as common drive and electric circuit components.

Yet a further object is to provide a universal audio transducing machine capable of transducing reel to reel and cartridge type record configurations.

It is also an object of the present invention to provide a playback amplifier circuit for selective amplification of reproduced audio and video signals; and/or to provide playback stabilizing circuitry for more stable reproduction especially of video signals from a simple tape deck (wherein tape motion is subject to substantial flutter).

A feature of the invention resides in the provision of shiftable tape guides for selectively defining audio, video and rewind record paths, the audio path being clear of the video head, for example, and the rewind path being clear of both the audio and video heads, for example.

A further feature of the invention resides in the provision of common fixed record guides threadable at different sides thereof for audio and video transducing operation with the audio path being clear of the video head and/or the video path being clear of the audio head.

Another feature resides in an audio/video transducer device with a video record cartridge receptacle also accommodating one of more smaller size audio record cartridges.

Still another feature resides in an audio/video transducer system wherein a battery powered audio unit is detachably connected with the transducer device to receive external power therefrom and/or to utilize the power amplifier and loudspeaker of the transducer device.

Other objects, features and advantages of the invention will be readily apparent from the following description of certain preferred embodiments thereof, taken in conjunction with the accompanying drawings, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a somewhat diagrammatic partial plan view illustrating an audio/video transducing system utilizing shiftable record medium guides, with the guides being shown in an intermediate or "rewind" position;

FIG. **2** is a somewhat diagrammatic plan view similar to FIG. **1**, but showing the shiftable guides in a "video transducing" position;

FIG. **3** is partial side elevational view of a record medium guide for the system of FIGS. **1** and **2**;

FIG. **4** is a schematic electric circuit diagram for the transducer system of FIGS. **1–3**;

FIG. **5** shows a detailed electric circuit in conformity with the diagram of FIG. **4**;

FIG. **6** illustrates a further portion of the electric circuit of FIG. **5** which functions to compensate for flutter conditions during video transducing operation of the circuit;

FIG. **7** is a somewhat diagrammatic plan view showing a video transducing device with a receptacle for removably receiving an audio transducing unit;

FIG. **8** is a somewhat diagrammatic end elevational view of the device of FIG. **7** and illustrating certain details of the audio transducer receptacle;

FIG. **9** is a somewhat diagrammatic partial plan view of an audio/video transducer device utilizing fixed guides, and showing the guides threaded for video transducing operation;

FIG. **10** is a partial diagrammatic view similar to FIG. **9** but showing the fixed guides threaded for audio transducing operation;

FIG. **11** is a somewhat diagrammatic plan view showing an audio/video cartridge transducing machine with a video cartridge diagrammatically indicated in the cartridge receiving region; and

FIG. **12** is a somewhat diagrammatic plan view of the machine of FIG. **11**, but showing two different types of audio record cartridges both assembled in the cartridge receiving region of the machine for simultaneous or selective operation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. **1–3** illustrate an audio/video transducer system **10** including an audio transducer head **11** and a video transducer **12** forming parts of a transducer head assembly **13** for selective scanning cooperation with a

magnetic record medium **14** which may be driven in the direction of arrow **15** (FIG. **2**) by means of a suitable drive arrangement including a capstan drive element **16** and a capstan pressure roller **17**. By way of example, heads **11** and **12** may be carried on a common mounting member **20**, which may be vertically movable so that the head assembly **13** may be indexed to selectively scan successive channels on the record medium by means of a manually operated knob indicated at **21**.

In the illustrated arrangement, the tape passes about a fixed guide **23**, and then passes about a series of jointly movable tape guide elements **31–38** carried on a shiftable frame member **40** which is shown as being movable in respective opposite directions from the position shown in FIG. **1** about a pivot **41**. The frame member **40** thus has three positions of adjustment a neutral position "N" as illustrated in FIG. **1**, an audio transducing position "A" with the frame member **40** engaging a stop **43**, and a video transducing position "V" as indicated in FIG. **3** with the frame member **40** engaging stop **44**.

For actuating the frame member **40** between the respective positions, a manual control knob **46** is provided which is pivotal at **47**, the knob **46** having a pivotal connection with a link **48** which in turn is pivotally connected with an extension **40***a* of frame member **40**. A spring pressed ball detent is indicated at **50** for cooperating with sockets **51–53** of the extension **40***a* for retaining the frame member **40** in the selected position.

In the audio transducing position, the tape record medium **14** may move in the longitudinal direction indicated by arrow **15** in sliding contact with the confronting longitudinally spaced poles of audio head **11**, while moving in spaced relation to the poles of the video head **12**. In the neutral position shown in FIG. **1**, the record medium may be rewound onto a supply reel (not shown) at relatively high speed, or may be moved at relatively high speed in the direction of arrow **15** and wound onto a takeup reel (not shown).

Each of the tape guide elements **31–38** may be of identical configuration and may have the configuration of the guide element **31** which is shown in detail in FIG. **3**. While the record medium **14** has a common tape path relative to the guides **31–38** in each position of adjustment, the tape paths during audio and video operation have a different location relative to the heads **11** and **12**. Thus, the path of the record medium **14** shown in FIG. **2** may be termed a video transducing record path, while in the other extreme position of adjustment of the frame member **40**, the record path may be termed an audio transducing record path.

Referring to FIG. **1**, a supply region is indicated at **60** and a takeup region is indicated at **61**, such regions, being suitable for mounting a supply reel and a takeup reel, for example, in a conventional manner. By way of example, the capstan drive element **16** may be driven by means of a motor 98 as shown in the eighth figure of the copending application Ser. No. 456,192. (Reference numerals shown in parenthesis herein refer to the reference numerals of the copending application Ser. No. 456,192, and not to the reference numerals of the present drawings.) The switching means of this eighth figure is controlled by the selector knob **46**, FIGS. **1** and **2**, so that the motor 98 is energized with a relatively high frequency electric current during video transducing mode, but is energized with a relatively lower frequency electric current during audio transducing mode, the motor being deenergized in the neutral (N) position of selector **46**. Further, by way of example, the capstan **16** may be provided with a relatively massive flywheel 96 which is an integral part of the capstan **16** and is secured to an output shaft 97 of the motor 98. Actuation of selector **46** serves to shift an audio linkage 390 to place components such as 392, 395 in the position shown in the eighth figure of the copending application. In this condition, the inertia of the auxiliary flywheel 392 is such as to provide stable movement of the record medium at the audio transducing speed. Shifting of the selector **46** to the neutral position shown in FIG. **1** causes the flywheel assembly 392, 395 to pivot about the axis 398 and out of driven relation to the capstan flywheel 96 against the action of the tension spring 393. In the audio transducing mode, switch contact 386 which is actuated to closed condition by moving selector **46** to the audio transducing position "A," adds a capacitor 401 in parallel with the capacitor 402 so as to provide the proper phase shift for the relatively low output from the low frequency oscillator component 405 which drives the motor 98 at the audio speed. The reversing switch 384 is operated to engage the lower junction points (as viewed in the eighth figure) to reverse the direction of rotation of the motor 98 in the audio mode or in the video mode. By way of example, the audio transducing speed of the record medium **14** may be 3¾ or 7½ inches per second, while the video transducing speed of the record medium may be 60 inches per second, or 30 inches per second.

The motor 117 may be utilized to index the head assembly **20** automatically in the same manner as described in the copending application, and the disclosure of the copending application is incorporated herein by reference in this respect with the understanding that there may be two pairs of vertical guide rails such as 80 and 81 to engage and guide each side of each of the heads **11** and **12**, and with the understanding that the heads **11** and **12** need not be disengaged from the record medium **14** during head indexing movements.

As a further alternative, the audio/video system of the twelfth figure of the copending applications may utilized to drive the capstan **16** which would then correspond to the capstan 212*a* integral with flywheel 212 on the shaft of the high speed capstan motor 187. In this event, the linkage 195 would be suitably coupled to the selector **46** so as to provide for engagement of idler wheel portion 210 in the audio "A" position of selector **46**. This is indicated by motor shift lever **48***a* coupled to linkage **48** in FIG. **2** by pin **48***b* on the linkage **48**.

FIG. **4** illustrates an electric circuit arrangement for the embodiments of FIG. **1–3** wherein the ring configuration of the audio and video heads **11** and **12** has been diagrammatically indicated, the record medium **14** travelling successively across the poles of the heads at the scanning regions **11***a* and **12***a* which may be formed by means of a non-magnetic gap in the magnetic circuits of the heads. Because of the relatively long wavelengths recorded in the record medium during audio transducing, the length dimension of gap **11***a*

may be relatively great in comparison to the dimension of the video scanning gap **12***a*. The larger gapped audio transducer head **11** has more turns on its winding and exhibits substantially greater playback voltage under these circumstances than would be the case if the video head **12** were also used for transducing of audio recorded signals. Further, during audio transducing operation, an audio grade magnetic tape may be utilized, even though such grade of record medium would not be desirable during a video transducing operation, because some grades of audio tape are abrasive enough to injure the video head. Since the video head **12** does not engage the tape during audio transducing operation, it is protected from undesirable abrasion.

The audio head **11** is shown as being provided with an audio transducing winding **71** having the optimum number of turns for the audio transducing operation, while the video transducer head **12** is provided with a high impedance winding **72** having a relatively large number of turns and a low impedance winding **73** having a relatively lower number of turns. By way of example, the windings **72** and **73** may be connected in series relation with respect to the input to the amplifier component **75** during playback operation, while the video signal and bias circuits component **76** is essentially connected only with the winding **73** during video recording operation, a resistor **77** being shown permanently connected across the high impedance winding **72** to damp any resonance effects.

In the embodiment of FIG. **4**, it is contemplated that the selector switch arms **81** and **82** are mechanically coupled for actuation by the selector **46**, the arms **81** and **82** being shown in the position corresponding to the position of the selector **46** in FIG. **2**, i.e., the video transducing mode. Record/playback selector arms **83–85** are shown in the record "R" position. For conditioning the circuit for video playback, the selector arms **83–85** would be placed in their lower playback positions "P." For video mode, component **76** is shown as receiving a video signal from a television tuner or a television camera device which may transmit a conventional television broadcast signal to input line **90**. In this case, component **76** may include a conventional television broadcast receiver. Various television camera and signal processing arrangements are disclosed in my copending application Ser. No. 545,050 filed Apr. 25, 1966, now U.S. Pat. No. 3,484,546, and the disclosure of this copending application is incorporated herein by reference in its entirety, and particularly for the purpose of illustrating suitable signal processing and camera circuitry which may be substituted in FIG. **4**. During video playback mode, the output from the video head windings **72** and **73** is supplied via shielded conductor **91** to the input of the playback amplifier component **75**, whose output is supplied via conductor **93** to an input of the component **76**. The component **76** thus also includes suitable playback circuitry, for example such as found at the bottom of FIG. **5** or in my copending application Ser. No. 545,050, so that the reproduced video signal may be displayed at the video display unit **95** which is coupled with the component **76** via suitable conductors such as indicated at **96**. Resistor **97** and capacitor **98** provide an equalizing network during video recording operation corresponding to Roo and Co, FIG. **5**.

During audio operation, input signals may be supplied, for example to input line **101** of audio signal and bias circuits component **102** from a broadcast receiver or the like. Alternatively, input may be taken from a microphone **103** via an input line **104**. The output audio and bias current is supplied via capacitor **106** and resistor **107** forming an equalizing network and via selector arm **83** to audio winding **71**. Hum bucking loop **110** provides relatively negligible impedance at the audio or video frequencies. During audio playback operation, the reproduced signal is supplied via shielded cable **91** to the input of playback amplifier component **75**, and the output of component **75** is supplied via a capacitor **112** to an audio jack **113** and to a resistance **114** across the input of audio power amplifier **115**. The output of amplifier **115** is shown driving a loudspeaker **116**.

In accordance with the concepts of the present invention, the apparatus of FIGS. **1–4** may be supplied in a modular form, so that a purchaser could initially acquire only the components such as **11**, **75**, **102**, **103**, **115** and **116** necessary for audio recording operation. At a later date, specifically video components such as head **12**, and the processing circuits such as **76** and **95** could be added to the equipment to adapt it to selective audio/video operation.

Other signal processing arrangements which are adaptable to the circuitry of FIG. **4** are found in my copending application Ser. No. 393,282 filed Aug. 31, 1964, now U.S. Pat. No. 3,506,780 and the disclosure of this application is also incorporated by reference herein in its entirety.

Referring to FIG. **5**, which is a preferred electric circuit in accordance with FIG. **4**, corresponding reference numerals have been applied to similar parts in the diagram of FIG. **4** and in the detailed electric circuit of FIG. **5**. Reference numeral **120** has been applied to the conductor leading to the audio head **11**, FIG. **4**, and to the corresponding conductor extending from the audio "A" terminal at the upper left in FIG. **5** to indicate the correlation of the two views. FIG. **5** illustrates additional selector arms **121** and **122** which are also preferably mechanically coupled with the selector **46** so as to be shiftable therewith between the video position "V," the neutral position "N" and the audio position "A" in accordance with the corresponding position of the selector **46**. Record-playback selector arms **125–129** are shown in FIG. **5** having upper record positions "R" and lower playback positions "P." These selector arms **125–129** may be coupled to a common manual actuator with selector arms **83–85** so as to be all jointly movable between the record and playback positions.

The circuit of FIG. **5** is generally comparable to the circuits of my copending application Ser. No. 649,256, now U.S. Pat. No. 3,596,008, the disclosure of which is incorporated herein by reference in its entirety for the purpose of providing a clear understanding of the circuitry of FIG. **5** and also for the purpose of illustrating alternative, but not preferred, video/audio circuits which may be utilized as the component **75**, FIG. **4** and as illustrating additional signal processing circuits which may be utilized for component **76**, FIG. **4**. Most of the circuit elements in FIG. **5** have been given reference characters comparable to those of the first

figure of the copending application Ser. No. 649,256. Additional components in FIG. 5 have been given reference numerals **141–149**, and presently preferred values for the various circuit elements are tabulated in the following table.

Conductors **151** and **152** in FIG. 5 correspond to conductors 61 and 62 in the first figure of the copending application, and conductor **153** in FIG. 5 corresponds to conductor 65 of the copending application Ser. No. 649,256.

Components **201–216** of FIG. 6 are also similar to circuit elements of the circuit of the first figure of the copending application Ser. No. 649,256, so that the function of these elements in compensating for flutter in the reproduced signal during playback operation will be apparent.

Earlier versions of the circuits of FIGS. 5 and 6 are found in my copending applications Ser. No. 401,832 filed Oct. 6, 1964, now U.S. Pat. No. 3,495,046, and Ser. No. 528,934, and the disclosures of these applications are incorporated herein in their entirety by reference and particularly for the purpose of illustrating alternative signal processing circuits for use as components **75** and **76**, FIG. 4.

The preferred values for the circuit elements of FIGS. 5 and 6 are listed in the following table:

TABLE I (FIGS. 5 and 6)

Component of Present Figs. 5 and 6	Component of First Figure of Serial 649, 256	Value of Circuit Element Present Circuit (Serial 649, 256)+
Resistor	Resistor	Resistance Value (Ohms)
145	(22)	68,000
146	(23)	330
149	(24)	7,500
R33	(25*)	560 (3,300)++
205	(26)	330,000
206	(47)	330,000
209		39,000
213		47,000
214	(29)	150,000
215	(30*)	10,000 (100,000)
Inductor	Inductor	Inductance Value
148	(32*)	100 microhenries to 316 microhenries
L4		50 microhenries
Capacitor	Capacitor	Capacitance Value
202	(41*)	100 micromicrofarads
203	(42)	51 micromicrofarads
204	(43)	51 micromicrofarads
208	(44**)	390 micromicrofarads
210		470 micromicrofarads
211	(45**)	390 micromicrofarads
212		.01 microfarad
216	(46)	470 micromicrofarads

+ Where a single value is given, that value applies to both circuits.
++ The value in parenthesis is the old value for the circuit of Serial No. 649,256.
* New component added to 14L30 Chassis
** Value of component changed from that of the 14L30 Chassis.

Resistor	Resistor	Resistance Value (Ohms)
R26	(81)	10,000 (22,000)
R27	(82)	220,000 (470,000)
R29	(84)	470,000
R30	(85)	15,000 (10,000)
142	(86)	5,600 (3,300)
Inductor	Inductor	Inductance Value
L5	(90)	55 (100) microhenries
Capacitor	Capacitor	Capacitance Value
C19	(91)	0.1 microfarad
C20	(92)	.002 microfarad
C21	(93)	.47 microfarad
C22	(94)	75 (390) micromicrofarads
141		39 micromicrofarads

Diodes D3 (98) and D4 (99) — Type IN3064 (Type IN463A)

Resistor	Resistor	Resistance Value (Ohms)
Ro	(120)	1,800
Roo	(121)	4,700
R20	(122)	27,000
R21	(123)	27,000
R22	(124)	2.7
R23	(125)	2.7
R24	(126)	100
R25	(127)	10
R1	(1–R1)	2,200,000
R2	(1–R2)	120,000
R3	(1–R3)	2,200
R4	(1–R4)	18,000
R5	(1–R5)	1,000,000
R7	(1–R7)	1000 (560)
R8	(1–R8)	220 (470)
R9	(1–R9)	10,000
R10	(1–R10)	8,200 (2,700)
R11	(1–R11)	120 (150)
R11A	(1–R11A)	56 (150)
R13	(1–R13)	270 (120)
R13A	(1–R13A)	47 (22)
R15	(1–R15)	1500 (680)
R18	(1–R18)	220
R18A	(1–R18A)	22
R19	(1–R19)	560 (470)
Inductor	Inductor	Inductance Value
	(1–L1)	10 microhenries
L3	(1–L3)	3.9 (5.5) microhenries
L2	(130)	24 microhenries
Capacitor	Capacitor	Capacitance Value
Co	(131)	300 micromicrofarads
C12	(133)	500 (820) micromicrofarads
C13	(134)	50 micromicrofarads
C14	(135)	50 micromicrofarads
C15	(136)	.05 microfarad
C16	(137)	8 micromicrofarads to 80 micromicrofarads
C18	(138)	1,000 microfarads
C17	(139)	1,000 microfarads
C1	(1–C1)	20 microfarads
C2	(1—C2)	20 microfarads
C3	(1–C3)	.005 (.01) microfarad
C4	(1–C4)	0.1 (.07) microfarad
C4A	(1–C4A)	.003 microfarad
C5	(1–C5)	20 microfarads
C6	(1–C6)	.0085 (.01) microfarad
C8	(1–C8)	.002 (.') microfarad
C10	(1–C10)	.001 (. 005) microfarad
C11	(1–C11)	.47 microfarad
Transistor	Transistor	Type
Q1	(1–Q1)	2N4250
Q2	(1–Q2)	2N3860
Q3	(1–Q3)	2N3860
Q4	(1–Q4)	2N3860
Q5	(150)	40,407
Q6	(151)	40407

Diodes D1 and D2 — A13A2

Transformer primary (152) — 14 turns No. 18 A.W.G. center tapped, ½ inch diameter by 1 inch long Secondary 153 — 24 turns No. 30 A.W.G. coupled to primary winding Hum balancing loop **110** 161 — 1 inch diameter loop

with one or more turns depending on location with respect to hum fields

HEAD PARAMETERS

Winding **72** has 150 turns of No. 44 A.W.G. with an inductance of 1,600 microhenries.

Winding 73 has 50 turns of No. 40 A.W.G. with an inductance of 180 microhenries.

The head gap is about 20 microinches long.

Connections are series aiding for winding 72 and 73 during playback.

Recording current is about 1 to 2 milliamperes peak to peak for the signal, and about 200 milliamperes bias current peak to peak at 6.5 megacycles per second.

Tape speed is 120, 60, or 30 inches per second.

A tape with an extra smooth surface, either of audio or of instrumentation grade is preferred.

Referring to FIGS. 7 and 8, there is indicated a reel to reel tape transducer machine having a supply spindle 251, and takeup spindle 252, a tape guide 253, a video transducer head arrangement 255, a capstan drive element 256, a capstan pressure roller 257, and a pushbutton control arrangement 259. The tape transport mechanism 250 may be identical to that illustrated in the tenth figure of my copending application Ser. No. 649,256, and the description of this figure is incorporated herein by reference. The drive for the capstan drive element 256 may correspond to the drive arrangement of the eighth or twelfth figures of my copending application Ser. No. 456,192, and the showing and description of these arrangements is incorporated herein by reference. The head cleaning arrangements and bulk demagnetizing arrangements of said application Ser. No. 456,192 are also incorporated herein with respect to the embodiment of FIGS. 7 and 8. The electronic circuitry with respect to the transducer head of the mechanism 250 may also correspond with that illustrated in the twelfth figure of said application Ser. No. 456,192, for example, and the audio circuit 192 may connect with the relatively large high quality loudspeaker diagrammatically indicated at 260 in FIGS. 7 and 8. This circuitry of Ser. No. 456,192 is incorporated herein by reference. A supply reel is indicated at 262 and a takeup reel at 263, with a length of tape indicated at 265 threaded along the common path which is applicable both during audio and video transducing operation in accordance with the teachings of the prior application Ser. No. 456,192.

As a further embodiment, the transport mechanism 250 may conform with the reversible tape transport shown in the eighth figure of my copending application Ser. No. 401,832 filed Oct. 6, 1964, and the entire disclosure of this copending application is incorporated herein by reference and particularly to illustrate alternative features of the transport mechanism 250.

The machine 250 is provided with a receptacle 270 for receiving a commercially available battery powered cassette type tape record/reproducer unit such as indicated at 271. This unit includes a manual control button 272, a record safety button 273 and a battery condition indicator 274. Further, the unit 271 includes a pivotal cover 275 which may be opened to load and remove the cassette type two reel cartridge. This type of unit also includes a relatively small loudspeaker as indicated at 276, and receptacle means such as indicated at 277 so that the unit can be connected with an external loudspeaker and external power and the like. The transducer device 250 is provided with corresponding plug means as indicated at 278 which automatically engages into the receptacle means 277 as the transducer unit 271 is loaded in the direction of arrow 280 into the receptacle 270. Thus, when the unit 271 is in operative position within the receptacle 270, the transducer head of the unit 271 automatically connected with the audio power circuit 192 of the pending application Ser. No. 456,192 and loudspeaker 260, FIGS. 7 and 8, during recording mode, and is automatically connected to receive proper signal current from an external microphone, not shown, via the audio circuit 192 of the pending application. Alternatively the recording electronics of 271 may be used, preferably powered from the main unit 250. A finger operated latch is indicated at 284 which is reciprocal in the direction of arrow 285 in response to manual pressure on the finger piece 286 and in response to pressure by means of the compression spring 287 which urges the latch to the retaining position shown in FIG. 8. The movement of the member 284 is limited by means of a fixed pin 288 riding in a slot 289 of the member. Any comparable automatic latching, and manually operated release means may be provided for releasibly retaining the unit 271 within the receptacle 270.

In FIGS. 9 and 10, a reel to reel machine is illustrated which may, for example, conform with any of the alternatives described with respect to FIGS. 7 and 8. Similarly, any of the features described herein with reference to FIGS. 9 and 10 may also be applied with respect to FIGS. 7 and 8. In FIG. 9 is illustrated a supply spindle 301, a takeup spindle 302, a supply reel 303, a takeup reel 304, a length of magnetic tape record medium at 305, and fixed tape guides at 311–316 which may, for example, be identical in configuration to the guide indicated at 31 in FIG. 3. Further the mechanism of FIGS. 9 and 10 includes a capstan drive element 320 and a capstan pressure roller 321 which is mounted on a crank arm 322 for pivotal movement about a pivot point 323 against the action of a tension spring 324.

In this embodiment, a magnetic head assembly 330 includes an audio transducer head 331 and a video transducer head 332 which may be indexed in the vertical direction on a common mounting member 333 as was described with reference to the embodiment of FIGS. 1–3. As shown in FIG. 9, during video operation, the video transducing tape path as indicated at 340 extends at the outer side of guides 312 and 313 and at the inner side of guides 314 and 315 so that the video transducing tape path is clear of the audio transducer head 331, but is in sliding engagement with the confronting poles of the video transducer head 332, the heads and circuitry conforming with the description already given with respect to FIGS. 4 and 5, for example. As shown in FIG. 10, during audio transducing mode, the audio transducing path extends as indicated at 341 at the inner side of guides 312 and 313 and at the outer side of guides 314 and 315 so that the tape 305 has its magnetizable surface in sliding engagement with the confronting poles of the audio transducer head 331 while extending clear of and out of contact with the poles of the video transducer 332. In this embodiment as well as in the preceding embodiment, the tape guides such as 312–315 and the capstan pressure roller 321 may be automatically retracted in a neutral position to facilitate threading, or a rapid traverse movement of the record medium from reel to reel.

In the embodiment of FIGS. **9** and **10**, a felt pad **350** is mounted on a stationary panel (not shown) so as to be in sliding engagement with the magnetizable surface of the tape **305** in either audio or video threading condition thereof. This felt pad may serve to dampen vibrations of the tape record medium and/or clean or lubricate the magnetizable surface, and may have any of the characteristics described for the damping pad indicated at 922 in the eighth figure of my copending application Ser. No. 401,832, reference being made particularly to pages 65 and 94 of said pending application which are incorporated herein by reference. The pad **350** may also have the characteristics of the pad 1012 indicated in the tenth figure of my pending application Ser. No. 649,256, and the description thereof at pages 47 and 48 of such pending application is incorporated herein by reference. The tape record medium **305** when moving at video transducing speeds such as 60 inches per second is subject to relatively high frequency vibration such as at 100 cycles or more per second in free spans thereof, and it is found that the pad **350** when acting at such a free span adjacent the transducer head assembly **330** is effective in substantially damping vibration at the heads **331** and **332**. The pad is of a soft springy material capable of being substantially deflected as a result of normal tape tension. When the pad is to perform a lubricating action, it should be porous and impregnated with the lubricating substance. Thus preferably, if lines are drawn tangent to the tape engaging surfaces of the guides **313** and **314** for the video path and the audio path, the pad **350** will extend somewhat beyond such intersection point so as to be depressed by tape tension during video or audio transducing operation. Of course, the pad **350** cam be positioned so as to engage the tape only during video operation, or only during audio operation, or different pads could be provided cooperating with the respective paths.

FIGS. **11** and **12** illustrate an audio/video cartridge transducer machine **400** including a "stop" push button control **401**, an audio selector button means **402**, a video selector button **403**, a record safety button **404**, a head channel position indicator **405**, an unload button **406**, a forward (upward) head indexing control button **407**, and a backward (downward) head indexing button **408**. Actuation of the unload button **406** retracts all of the tape engaging elements **411–417** so as to enable convenient loading of a video cartridge such as indicated at **420**, or audio cartridges such as indicated at **421** and **422**. After loading of the video cartridge **420**, depressing of the video selector button **403** actuates the elements **413**, **414** and **415** to the tape engaging positions shown in FIG. **11** to condition the transducer mechanism for video operation, and also actuates a latch (not shown) for locking the cartridge while in operation. In this mode of operation, capstan drive elements **424** and **425** are driven at relatively high speed so as to move the tape in the direction of the arrow **426**, the tape unwinding from about a rotatable hub **427** within the magazine. **420**, and being wound onto the outer convolution of the coil of magnetic tape indicated diagrammatically at **429**. It will be understood that the video cartridge **420** is indicated in diagrammatic form in FIG. **11**, and it may be considered that a top cover plate of the cartridge **420** has been removed so as to expose to view the endless tape configuration and the internal guide pins such as indicated at **431** and **432** which are within the interior of the cartridge **420**. By way of example tape record medium **434** may be driven at a video transducing speed of the order of 60 or 30 inches per second.

As in known prior art arrangements, the head assembly **435** may be successively indexed to successive adjacent channels for example in a downward direction in response to a conductive strip at a suitable point on the magnetic tape **434**, for example which might be sensed by means of the contact arrangement **411** (which in this event would be in sliding contact with the non-magnetic face of the magnetic tape **434**). Alternatively, the head indexing arrangement indicated in the fourteenth and fifteenth figures of my copending application Ser. No. 401,832 may be utilized, and the description at pages 57–63*a* and at 90 and 91 thereof is incorporated herein by reference.

To remove the video cartridge **420** from the receiving region of mechanism **400** occupied, unload button **406** is depressed, retracting **413–415** away from the cartridge **420** and unlatching the cartridge, after which the video cartridge may be pivoted upwardly relative to the receptacle member **440** to clear the record medium **434** of the elements **411–417** and **424**, **425**. Thereafter, the cartridge **470** may be moved in the direction of arrow **441** so as to remove the edge **420***a* of the cartridge **420** from the receiving aperture **440***a* of receptacle member **440**. The video cartridge receiving region is generally indicated by the reference numeral **445** in FIG. **12** and in this embodiment will be understood to essentially include the region accommodating the endless loop audio cartridge **421** or the two reel type tape cassette cartridge **422**. The controls **401–408** of FIG. **11** have been omitted in FIG. **12** and conventional tape guides for an endless loop cartridge have been omitted for simplicity in FIGS. **11** and **12**.

FIG. **12** illustrates the case where the endless tape cartridge button **402***a* of audio selector means **402** has been depressed so as to advance switch contact element **411** and playback head **412** into operative relation to the endless tape record medium indicated at **450**. This type of cartridge is of conventional configuration and is loaded in the direction of arrow **451** through a guide band **452** which may be spring urged into the cartridge receiving condition shown in FIG. **12**, while being depressed into a suitable recess in the bottom wall **445***a* of region **445** when the video cartridge **420** is pivoted downwardly into the operating position shown in FIG. **11**. The latching means for retaining the cartridge **421** may be carried by the bracket **452** or may take any of the forms illustrated in my copending applications Ser. No. 793,352, now U.S. Pat. No. 3,617,065, and Ser. No. 806,347, filed respectively Jan. 23, 1969 and Mar. 10, 1969, and the disclosures of each of these pending applications is incorporated herein by reference. It will be noted that the record medium **450** engages the opposite side of the capstan **424** from the side engaged by the video record medium **434**, the tape **450** being backed by means of a pressure roller **455** which is a permanent part of the cartridge **421**.

The head **412** may be indexed between successive sets of channels in the conventional manner in response

to a conductive strip on the magnetizable side of the tape record medium **450**. All of the heads **412**, **416**, **417** and **435** may, however, be actuated jointly in the respective opposite indexing directions by successively depressing the indexing button **407** or **408** for manual selection of the channel on the record medium at any desired point in the operating cycle.

The video cartridge receiving region **445** may also be provided with a vertically retractible cassette retaining member **460** having a recess **460***a* for receiving the back edge of the cassette **422** which then is pivoted into the operating position shown in FIG. **12** in a similar way to the video cartridge **420**. Suitable guide pins carried retractibly by the bottom wall **445***a* may be spring urged into an upper position for assisting in the positioning of the cartridge **422** as in the conventional commercial mechanism. One of the guide pins is indicated at **462** in FIG. **12** extending into an aperture of the cartridge **422** in the conventional manner. The video cartridge **420** may either have apertures to accommodate the pins **461** or may serve to depress the pins along with the receiving member **460**, all of which would then be spring urged to the upper position in which they are illustrated in FIG. **12**. When the button **402***b* of the audio selector means **402** is depressed, elements **411** and **412** are retracted, and elements **415–417** are advanced to their conventional tape engaging positions. To unload either of the audio cartridges **421** or **422**, the unload button **406** may be actuated (after depressing of the stop button **401** since the unload button is inoperative when the machine is running.) For the case of capstan elements **424** and **425** which are driven in one direction only, it will be observed that the video tape **434** is driven from left to right and in the direction of arrow **426**, while the record medium **450** is also driven from left to right as viewed in FIG. **12**. The record medium of the cartridge **422** would be driven from right to left. By way of example, tape record medium **450** may travel at an audio transducing speed of 3.75 inches per second, while the record medium of cassette cartridge **422** may travel at an audio transducing speed of 1.875 inches per second. The changes in capstan driving speed and direction may be accomplished in the manners described in the eighth or twelfth figures of my copending application Ser. No. 456,192, or a mechanical shift along stepped pulleys or the like may be utilized. As a further alternative, electric motor drives may be utilized with switching from two pole operation to four pole operation where a common audio drive motor is provided for capstans **424** and **425**.

Any one or two of the three modes of operation illustrated in FIGS. **11** and **12** may be omitted.

In each of the embodiments either the heads may shift relative to the tape or cartridge, or the tape or cartridge may be shifted by means of movable tape guides or the like.

In FIG. **6** the R C circuits **209–210**, **212–213**, and **215–216** have been found to be especially advantageous in stabilizing the picture when fluctuations are present in the tape speed. These have time-constants of 18, 470 and 4.7 microseconds respectively. The circuits have been found to transmit a much greater corrective signal to the horizontal circuits of the picture display enabling it to follow the fluctuations in drive speed. The conventional circuits which it replaced could not give this correction, and became unstable and inoperative when attempts were made to modify them to increase their transmission of the corrective signal.

Correction of frequency modulation of the horizontal scan at rates from 4 Hz to 1,000 Hz is increased greatly without undue instability by using the circuit of FIG. **6**. This circuit has been found applicable to the sync section of most TV chassises as for example the Zenith 14L30, the RCA CTC 16XH, and the Motorola TS-589. In some cases it is advantageous to have resistor **215** equal 3,300 ohms (1.5 microsecond time-constant with **216**); and in some cases capacitor **210** was omitted. In FIG. **6**, where the horizontal sync rate supplied at input **201** varies due to drive fluctuations of the type present in a video transducer mechanism, the control circuit shown in FIG. **6** supplies a control voltage to the grid of tube **V10A**; this control circuit includes a parallel resistance **213** and capacitance **212** feeding into a series circuit to ground including resistance **215** and capacitance **216**, the control voltage being developed across the series circuit including resistance **215** and capacitor **216**. As described at application page 11 of said copending application Ser. No. 649,256, the input capacitor, identified herein by reference numeral **202**, may be connected with the plate (pin 8) of tube (V8) of the Zenith commercial broadcast television receiver chassis No. 14L30. The tube (V8) performs the functions of automatic gain control and sync clipping. The tube **V10A** in said chassis is formed by one half of a type 6KD8 tube. The preferred values for the components of FIG. **6** are given in table I (at application page 12 hereof), from which it will be observed that present FIG. **6** differs from the first figure of Ser. No. 649,256 primarily in the substitution of the parallel resistance-capacitance circuits **209**, **210**; and **212**, **213**, for the components between conductors (72) and (73) in said first figure.

In FIGS. **7** and **8**, by way of example, the loudspeaker **260** is indicated as being selectively connected with audio unit **271** via receptacle **277**, plug **278**, cable **480**, audio power amplifier and rectifier circuits component **481**, and conductors **482**. Power is shown as being supplied to the audio unit from conventional power cord **484** via conductors **485**, the rectifier stages of component **481** and separate conductors of cable **480**.

C_{1a}, R_{1a}, and C_5 modify the gain and frequency response of the amplifier in FIG. **5** so that in the audio position of **121** and **122** a flat response is obtained over the audio range without overloading of the circuits.

I claim as my invention:

1 A A magnetic transducer system comprising

a video magnetic transducer head operable for reproducing video signals, and disposed for selective scanning cooperation with a magnetic tape record medium moving along a video transducing record path, and an audio magnetic transducer head arranged for selective scanning cooperation with a magnetic tape record medium moving along an audio transducing record path, said audio magnetic transducer head having substantially different transducing characteristics than the video magnetic transducer head so as to exhibit substantially different characteristics in transducing an

audio signal including substantially greater output in transducing an audio signal than would be the case if the video magnetic transducer head were so used,

transducer electric circuit for selective actuation to activate said video magnetic transducer head in a video transducing mode for transducing of video signals, and for selective actuation to activate said audio magnetic transducer head in an audio transducing mode for the transducing of audio signal information,

tape path shifting means engageable with a magnetic tape record medium and operable for shifting the magnetic tape record medium selectively to said audio transducing record path during audio transducing mode and guiding the magnetic tape record medium to extend clear of coupling relation with said video magnetic transducer head and in operative coupling relation with said audio magnetic transducer head, and operable for shifting the magnetic tape record medium to said video transducing record path during video transducing mode and for guiding the magnetic tape record medium in operative coupling relation with the video magnetic transducer head,

magnetic tape transport means for driving the magnetic tape record medium along the video transducing record path in said video transducing mode and for driving the magnetic tape record medium along the audio transducing record path in said audio transducing mode, and

a selector connected with said transducing electric circuit means and with said tape path shifting means for selective manual actuation between an audio transducing condition and a video transducing condition, and being operable in response to manual actuation to said audio transducing condition to actuate said transducer electric circuit means to said audio transducing mode and to actuate said tape path shifting means to guide a magnetic tape record medium along said audio transducing record path for operative coupling with the audio magnetic transducer head but clear of coupling with said video magnetic transducer head, and being operable in response to manual actuation to said video transducing condition to actuate said transducer electric circuit means to said video transducing mode and to shift said tape path shifting means to said video transducing condition for guiding a magnetic tape record medium along said video transducing record path and in operative coupling relation with said video magnetic transducer head.

2. A transducer system for transducing alternatively, either video intelligence together with related audio intelligence, or audio intelligence alone, comprising

first transducer head means operable for transducing video intelligence together with related audio intelligence while in scanning relationship with a magnetic tape record medium moving at a video transducing speed,

second transducer head means operable for transducing audio intelligence alone while in scanning relationship with a magnetic tape record medium moving at an audio transducing speed which is substantially slower than said video transducing speed, said second transducer head means having a substantially different construction than said first transducer head means so as to be adapted to transducing audio intelligence at said substantially slower audio transducing speed,

common tape guide means operable alternatively, either for guiding a magnetic tape record medium moving at said video transducing speed in scanning relationship with said first transducer head means, or for guiding a magnetic tape record medium moving at said substantially slower audio transducing speed in scanning relationship with said second transducer head means, and

tape drive means operable alternatively, either for moving a magnetic tape record medium along and under the guidance of said common tape guide means and in scanning relationship with said first transducer head means at said video transducing speed, or for moving a magnetic tape record medium along and under the guidance of said common tape guide means and in scanning relationship with said second transducer head means at said substantially slower audio transducing speed.

3. A transducer system comprising

a transport mechanism having means for selectively accommodating a video record medium cartridge of one configuration and an audio record medium cartridge of a different configuration, at a common record transport region of said mechanism,

a longitudinal scan video magnetic transducer head mounted on said transport mechanism at said common record transport region and disposed along a video record medium path for scanning engagement with a record medium of the video record medium cartridge during a video transducing operation, and

an audio transducer head mounted on said transport mechanism at said common record transport region and disposed generally along said video record medium path and spaced from said longitudinal scan video magnetic transducer head, said audio transducer head being maintained clear of the video record medium during video transducing operation,

said common record transport region having means for driving a record medium in a video record medium cartridge at a relatively higher video transducing speed and for driving a record medium in an audio record medium cartridge at a relatively lower audio transducing speed, and

said transport mechanism having a common drive element engageable with a record medium of a video record medium cartridge to move the record medium at the video transducing speed along said video record medium path, and engageable with the record medium of an audio record medium cartridge to move the same at a different audio transducing speed in comparison to said video transducing speed.

4. A transducer system according to claim 3 with the record medium of the video record medium cartridge extending on one side of the capstan drive element and with the record medium of an audio record medium cartridge extending on an opposite side of the capstan

drive element when operatively associated with said transport mechanism.

5. A transducer system comprising

a record medium supply station,

a record medium takeup station,

a video transducer head and an audio transducer head, and

guide means defining a first video record medium path extending between said stations and in operative relation to the video transducer head,

said guide means further defining a second audio record medium path extending between said stations along a path of different configuration and physically spaced from the video transducer head and in operative relation to said audio transducer head,

the threading of a record medium on said guide means between said stations being alternatively along the first path while avoiding portions of the second path, or along the second path which excludes the portion of the first path at the video transducer head so that the second path is of different configuration from the first path at the region of said video transducer head.

6. A transducer system according to claim 5 with said guide means comprising common record medium guide elements having first surfaces defining the first video record medium path and having different second surfaces opposite said first surfaces defining the second audio record medium path, and a record medium being selectively threadable along said guide elements and over said first surfaces and over said second surfaces respectively so as to extend along the first or second path.

7. A magnetic transducer system comprising

a longitudinal scan video magnetic transducer head operable for reproducing video signals, and disposed for selective longitudinal scanning cooperation with a given channel of a magnetic tape record medium moving longitudinally along a video transducing record path, and a longitudinal scan audio magnetic transducer head arranged for selective longitudinal scanning cooperation with a channel of a magnetic tape record medium moving longitudinally along an audio transducing record path, said audio magnetic transducer head having a greater number of playback winding turns than the video magnetic transducer head so as to exhibit substantially greater playback voltage in reproducing an audio signal than would be the case if the video magnetic transducer head were so used,

transducer electric circuit means for selective actuation to activate said video magnetic transducer head in a video transducing mode for reproduction of a recorded video signal scanned by said video magnetic transducer head, and for selective actuation to activate said audio magnetic transducer head in an audio transducing mode for the reproduction of recorded audio signal information as scanned by said audio magnetic transducer head,

means for guiding a magnetic tape record medium along said audio transducing record path during audio transducing mode with the magnetic tape record medium extending clear of contact with said video magnetic transducer head and in sliding contact with said audio magnetic transducer head, and for guiding a magnetic tape record medium along the video transducing record path during video transducing mode in sliding contact with the video magnetic transducer head, with the video magnetic transducer head scanning along a channel on the magnetic tape record medium in the same direction as and parallel to the scanning direction of the audio magnetic transducer head during audio transducing mode,

magnetic tape transport means for driving the magnetic tape record medium along the video transducing record path in said video transducing mode and for driving the magnetic tape record medium along the audio transducing record path in said audio transducing mode, and

control means for selectively actuation said transducer electric circuit means to said video transducing mode and to said audio transducing mode, and being operable in video transducing mode to operate said tape transport means to drive the tape record medium at a relatively higher speed and being operable in said audio transducing mode to operate said tape transport means to drive the tape record medium at a relatively lower speed substantially lower than said relatively higher speed.

8. A transducer system according to claim 7 with said video transducing record path and said audio transducing record path extending along a substantially common record medium path relative to said record medium guiding means, the common record medium path extending past said video magnetic transducer head and said audio magnetic transducer head, and means providing three relative positions between said heads and said common record medium path, one with said video head only in operative relation to the record medium path, one with said audio head only in operative relation with said common record medium path, and one with both said video transducer head and said audio transducer head substantially clear of said common record medium path.

9. A transducer system according to claim 7 with said guiding means comprising a pair of first guide elements adjacent the video transducer head and a pair of second guide elements adjacent the audio transducer head, the video transducing record path extending on the side of the first guide elements toward the video transducer head and on the side of the second guide elements away from the audio transducer head, and the audio transducing record path extending on the side of the first guide elements away from the video transducer head and on the side of the second guide elements toward the audio transducer head, the pair of first guide elements guiding the record medium in scanning cooperation with the video transducer head during video transducing mode and the second guide elements guiding the record medium in scanning cooperation with the audio transducer head during audio transducing mode.

10. A transducer system according to claim 7 further comprising a shiftable frame having record medium guides and shiftable to a first position with said guides defining a video transducing record path extending in

operative relation to the video transducer head and clear of the audio transducer head and shiftable to a second position defining the audio transducing path.

11. A transducer system according to claim 10 with said control means comprising a control coupled with said frame for shifting the frame to said first position when the transducer electric circuit is actuated to video transducing mode and for shifting the frame to said second position when the transducer electric circuit means is actuated to audio transducing mode.

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