

[54] **AUTOMATIC CONTROLS FOR TAPE PLAYERS OF CARTRIDGE TYPE**

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[51] Int. Cl. G11b 21/08, G11b 15/29

[58] Field of Search 179/100.2 Z, 100.2 MI, 100.2 CA, 179/100.2 S; 274/4; 226/174, 176, 186, 187

[56] **References Cited**

UNITED STATES PATENTS

3,027,112	3/1962	Flan	242/55.19 A
3,127,179	3/1964	Osborne	226/176
3,148,819	9/1964	Frick	226/186
3,337,105	8/1967	Wilson	179/100.2 Z
3,388,844	6/1968	Tamura	274/4 G
2,668,059	2/1954	Roberts	179/100.2

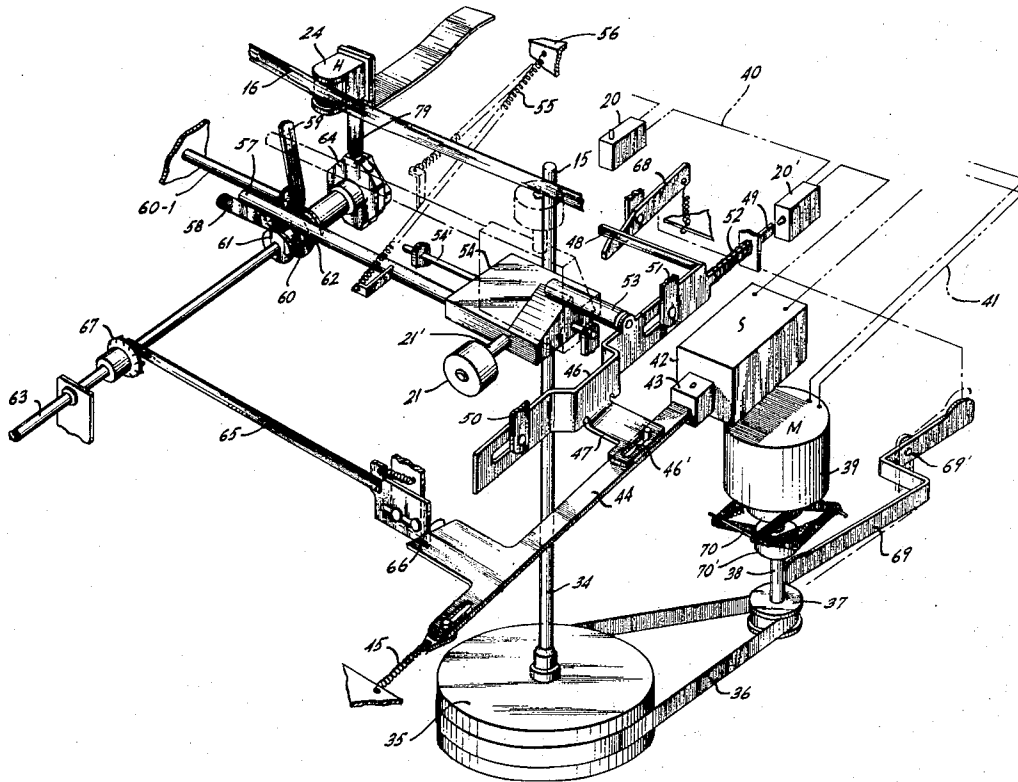
2,732,144	1/1956	Jones	242/55
2,914,620	11/1959	Dale	179/100.2
2,933,319	4/1960	Proctor	274/11
3,370,131	2/1968	Reed	179/100.2
3,388,911	6/1968	Wilson et al.	274/4

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[57] **ABSTRACT**

An apparatus adapted for automatically accommodating for play either a four track cartridge without a built-in pinch roller or an eight track cartridge with a built-in pinch roller upon insertion of said cartridges. The player is set to play the eight track cartridge without adjustment. Upon insertion of the four track cartridges a linkage automatically provides for shifting of the head adjustment cam from a first location providing a series of positions corresponding to the track tape to a second location providing a series of positions corresponding to the track levels of the four track tape and for moving a pinch roller from a storage position into an operative position within the four track tape cartridge.

1 Claim, 9 Drawing Figures



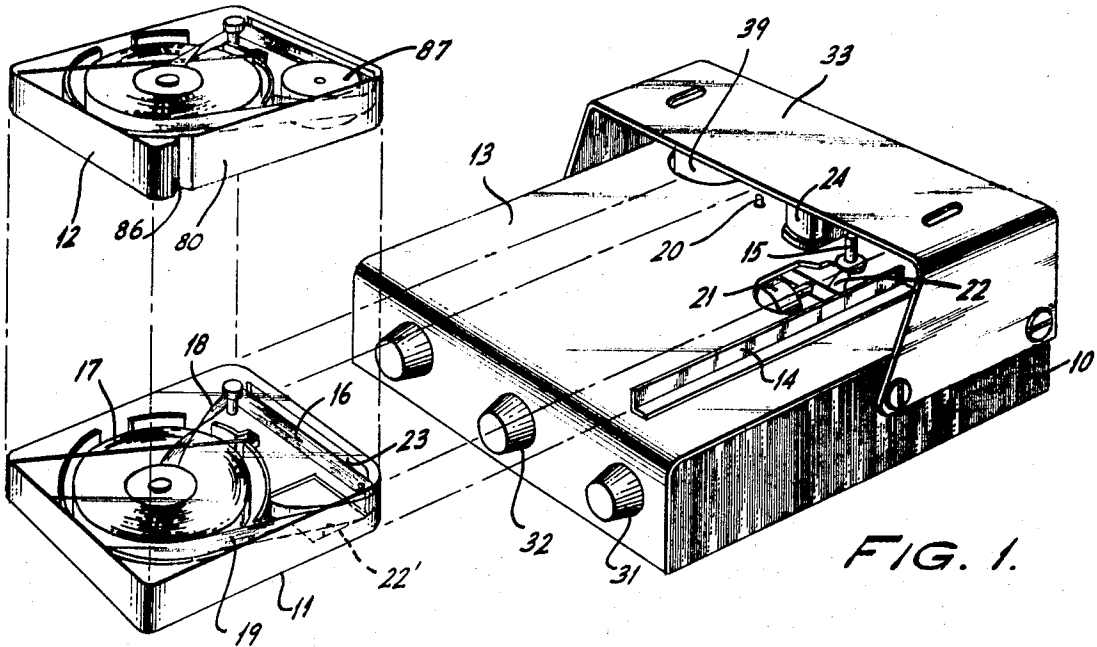


FIG. 1.

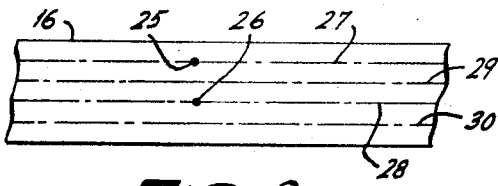


FIG. 2.



FIG. 7.

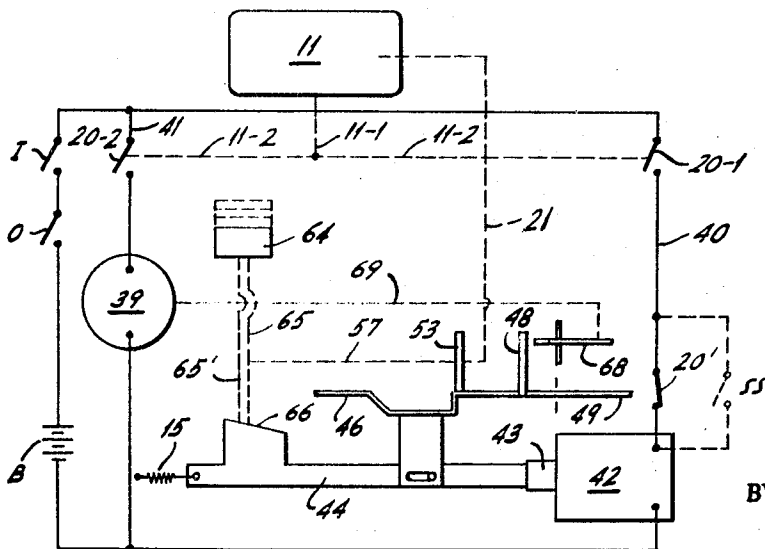


FIG. 9.

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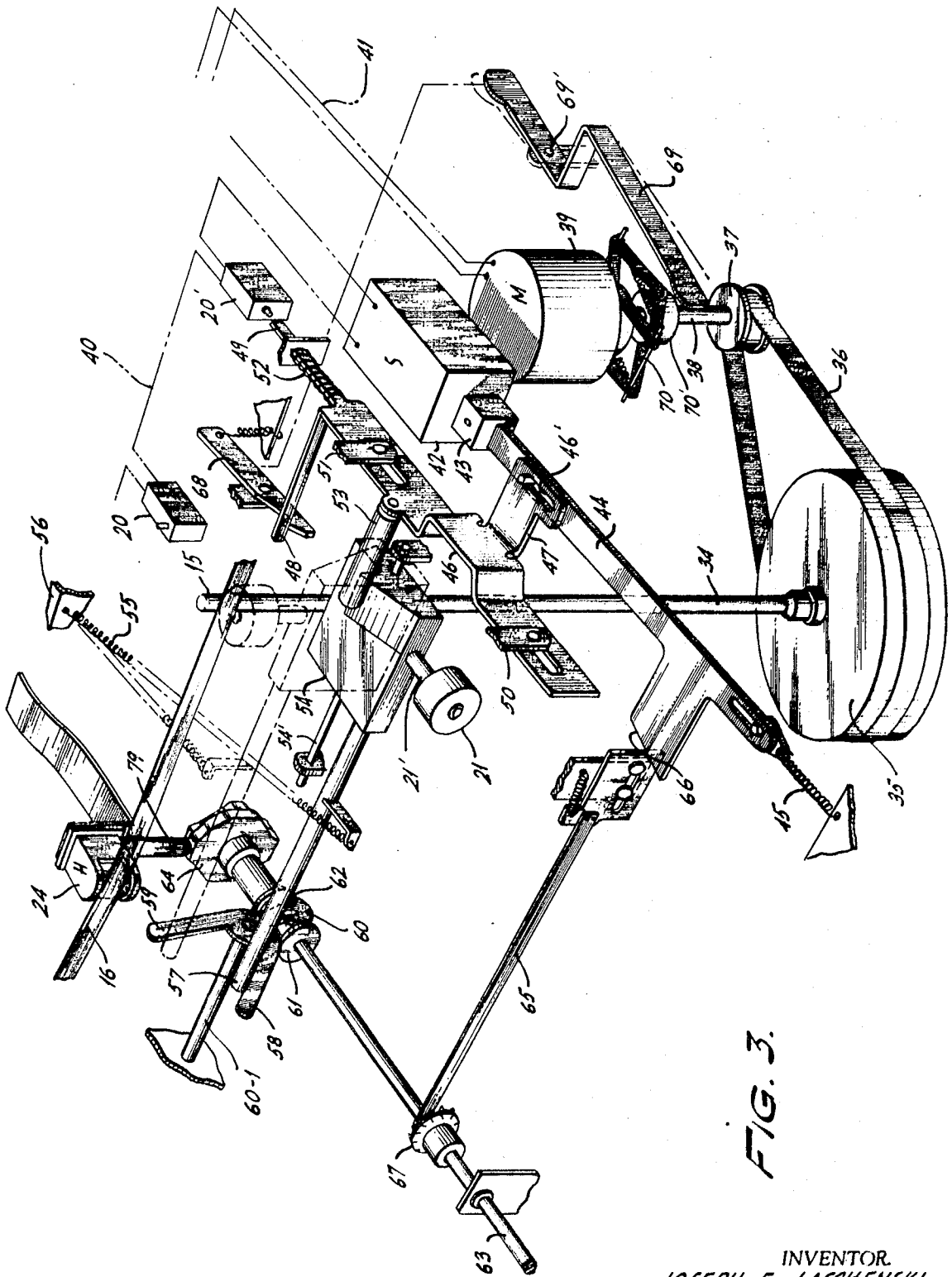


FIG. 3.

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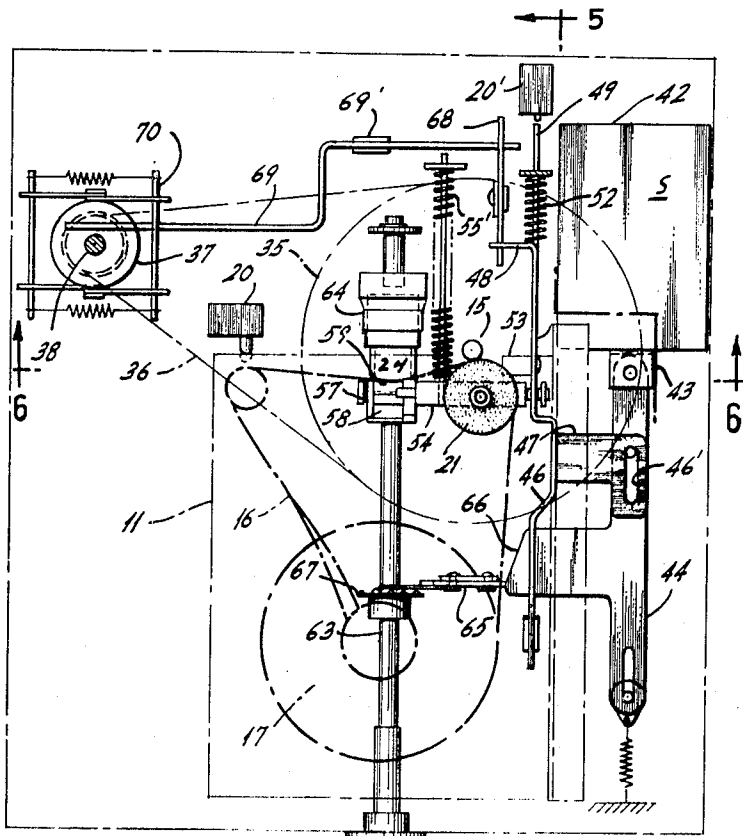


FIG. 4.

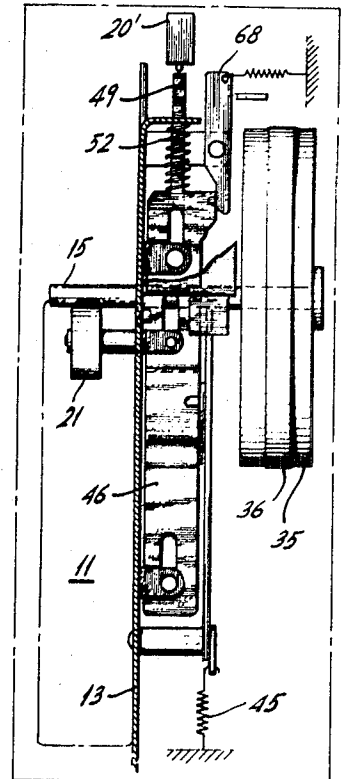


FIG. 5.

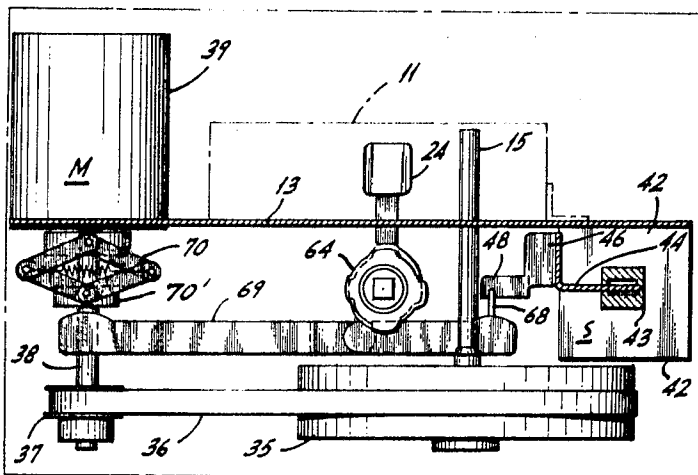


FIG. 6.

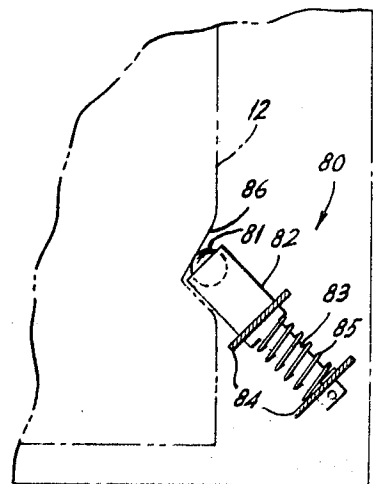


FIG. 8.

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AUTOMATIC CONTROLS FOR TAPE PLAYERS OF CARTRIDGE TYPE

The invention achieves these objectives by novel electromechanical linkage, movable relative to the cartridge and its tape. A preferred form of the invention includes—in addition to the usual motor-driven, tape-driving capstan—a solenoid-actuated and motor-controlled mechanism for properly adjusting a pickup head relative to the tape.

This mechanism, which also cooperates with means for effecting a number of associated control functions, will now be explained more fully with reference to the drawing appended hereto, wherein:

FIG. 1 is a perspective view showing the preferred form of the new tape player, together with different cartridges which can be played thereon.

FIG. 2 is a schematic plan view of a portion of a four-track tape, provided by one of the cartridges.

FIG. 3 is a perspective view schematically showing internal construction of the automatic tape player, in an orientation similar to that of FIG. 1.

FIG. 4 is a plan view of such internal construction of an automatic tape player, in an orientation similar to that of FIG. 1, but showing the same in somewhat modified and less schematic form.

FIGS. 5 and 6 are side and end views, partly in section, taken respectively along lines 5—5 and 6—6 in FIG. 4.

FIG. 7 is a view generally similar to FIG. 2 but showing an eight-track tape which can be played on the apparatus of this invention. FIG. 8 is a fragmentary plan view of a unit specially adapted to play cartridges of certain form, shown in FIG. 1, which are sometimes used with the tapes of FIG. 7.

FIG. 9 is an electro-mechanical diagram for the new tape player.

Referring first, for general orientation, to FIG. 1: player 10 is shown with two cartridges 11, 12, each cartridge containing a tape with some number of programs magnetically recorded thereon. Each program can be played, typically in 20 or 30 minutes, during which time the entire tape is unwound and rewound once. Cartridges 11 and 12 are shown separately from player 10, but it will be understood that in the actual playing of a program one of these cartridges is supported on top surface 13 of the player. The cartridge must be suitably oriented on this surface, which can be done with the aid of guide 14 in cooperation with player capstan 15. Each cartridge has its tape 16 stored therein in form of an endless loop or coil 17, wherefrom successive tape portions are centrally removed, as indicated at 18, and whereto the tape is peripherally returned at 19.

When cartridge 11 is placed on player surface 13 and suitably abutted against capstan 15, a lower front surface of the cartridge depresses switch actuator 20, thereby starting the tape-driving capstan motor. The initial switch operation also causes activation of a pressure roller 21, which until then was in a lower position below player surface 13 (also see FIG. 3), and which at this time is tilted up through an aperture 22 in surface 13 and a corresponding aperture 22' in the underside of cartridge 11. When suitably erected, this roller engages the back of tape 16 and presses this tape against capstan 15, through a further aperture 23 in a front surface of the cartridge. The roller shaft then also locks the cartridge to the player. In addition, still other control operations are automatically initiated by start switch 20, as will be described hereinafter, to cause tape 16 to be drive properly past record-reading pickup head 24, this head being in contact with the tape through front aperture 23 of the cartridge. Included in the control program are a series of operations whereby pickup head 24 is so positioned that record reading devices, forming part of this head, are accurately positioned with respect to record tracks on tape 16.

As indicated in FIG. 2, provision is made for initially positioning two record reading points of said head, generally shown at 25, 26, on record tracks 27, 28 for a stereophonic program. Also provided according to FIG. 2 is a second pair of

record tracks 29, 30 which can be utilized in a later phase of the automatic program performed by the apparatus, as will be explained hereinafter. Of course player 10 (FIG. 1) also has the usual control knobs 31, 32 for controlling tone, volume, and other characteristics of the playback through electronic equipment (not shown). The entire player unit can be supported on the underside of the dashboard of an automobile, by bracket 33.

Referring now to FIG. 3: tape 16 is shown in contact with capstan 15, which is an upper end piece of a vertical shaft 34 driven by flywheel 35. A belt 36 is driven by pulley 37 on output shaft 38 of drive motor 39 to rotate shaft 34 and capstan 15. Electric energy is supplied to the motor through suitable connections under the control of the aforementioned start switch 20, as is generally indicated by line 41.

According to the invention additional connections are provided, which are generally indicated at 40, and whereby electric energy is supplied to a solenoid 42 for automatic performance of certain control actions. Plunger 43 of the solenoid has a link 44 connected thereto, which is pulled forwardly by a spring 45. When the solenoid is energized the spring force is overcome and the plunger and link are moved rearwardly from the illustrated position. The rearward motion of link 44 causes similar motion of a second link or clip 46, yieldably connected with link 44 by pin and slot connection 46' in extension 47. In a rear portion of the mechanism, adjacent solenoid 42, clip 46 has a transverse extension 48 for latching purposes, and also has longitudinal extension 49 for switching purposes. Both extensions are shown in forward position but when the solenoid is energized they move rearwardly, the clip being guided by stationary bearings or supports 50, 51 to enforce longitudinal motion. A compression spring 52 surrounding switching extension 49 normally urges the clip forwardly into the illustrated position, but the force of solenoid 42 is sufficient to overcome the force of this spring, together with that of the aforementioned spring 45, to move links 44, 46 and the extensions thereof rearwardly. The ensuing latching and switching actions will be described presently.

It is to be noted that in further accordance with the invention, clip 46 also has a transversely extending pin 53 secured thereto which is adapted to contact a further link 54, pivoted for rocking motion on bearing means 54'. An additional spring, schematically shown at 55 and anchored at 56, is arranged to rock this link 54 into upright position, as indicated in broken lines. However, when the solenoid linkage is in normal forward position as shown, prior to energization of the solenoid, pin 53 holds link 54 in horizontally tilted position, as is indicated in full lines. When the solenoid linkage then moves rearwardly, pin 53 releases link 54 and allows rocking motion of this link which is enforced by spring 55. The rocking motion of the link causes erection of pressure roller 21, this roller being mounted on the link as shown and being caused by the indicated motion to press record tape 16 against capstan 15, see the broken line showing. At the same time, as already noted with reference to FIG. 1, shaft 21' of pressure roller 21 rises through aperture 22 in top surface 13 of tape player 10, and also through aperture 22' in cartridge 11, hereby locking this cartridge to the tape player.

Still another pin 57 is provided, which is connected to rocking link 54 in transversely extending position to engage a forked lever comprising pin follower arms 58, 59 and cam shifting arm 60. The latter arm is in engagement with flanges 61, 62 secured to shaft 63 of a pickup head controlling cam 64. Lever fork 58, 59, 60 is pivoted at 60-1. The lever and flange elements serve to move shaft 63 and cam 64 longitudinally. For this purpose pin 57 engages one tine 58 of fork 58, 59, 60 when control link 54 is rocked from broken line position to the indicated full line position, whereas this pin engages the other tine 59 of the fork upon the opposite rocking of control link 54. It will be seen that erection of link 54 and pressure roller 21 causes forward shifting of cam 64, while the opposite motion causes rearward shifting of this cam. In addition, the cam can be rotated by a ratchet link 65, actuated by

an extension 66 of solenoid link 44 and turning a ratchet wheel 67.

The elements described up to this point are brought into action when the user deposits a cartridge 11 on player surface 13, FIG. 1. He normally slides this cartridge along guide 14 until the front end of the cartridge reaches capstan 15 and reading head 24. Such insertion of the cartridge is not impeded by pressure roller 21, which at this time is depressed below player surface 13 by pin 53, FIG. 3. When the cartridge has been moved to proper position, a front portion of its walls depresses the actuator of start switch 20. This switch, as already noted, then energizes player motor 39 and solenoid 42 through the circuits schematically shown at 40 and 41. Energization of motor 39 causes rotation of shaft 38 with pulley 37 thereon, and this pulley, by means of belt 36, then rotates flywheel 35 and thereby capstan 15 to drive tape 16. Meanwhile the operation of solenoid 42, caused by start switch 20, has initiated a number of control actions, beginning with rearward motion of plunger 43, link 44, and clip 46 with pin 53. Upon this motion of pin 53, rocking link 54 no longer is held down by this pin, and spring 55 then is free to tilt the rocking link into such position as to erect pressure roller 21 through and cause it to press tape 16 to capstan 15.

This erected position of the pressure roller is best shown in FIGS. 4 and 5. The mechanism is caused thereby to initiate unwinding of tape 16 (FIG. 4), and return of the same to reel 17, as successive portions of this tape are engaged by capstan 15 and guided by roller 21. The tape accordingly moves over program reading head 24, enabling this head to read one of the programs recorded on the tape and in response thereto to supply suitable audio signals to a loudspeaker (not shown). Proper speed of tape motion is maintained by capstan flywheel 35 (FIG. 5).

The initial rearward motion of link 44 (FIG. 4) also causes extension 66 of this link, through pawl 65, to turn ratchet wheel 67 a predetermined angular distance and thereby to turn cam 64, which vertically adjusts pickup head 24. In addition, the aforementioned rocking motion of link 54, shared by pin 57 on this link, initially causes fork lever 58, 59, 60 to shift cam 64 into rearward position. As a result of these initial adjustments, pickup points 25, 26 (FIG. 2) are then aligned with record tracks 27, 28.

The so established position of mechanical elements of the player is maintained during the playing of the program. This is done mechanically, and without continued energization of solenoid 42, by means of a latching mechanism best shown in FIG. 4 and FIG. 6, and which remains in active or latching position so long as motor 39 operates. The solenoid itself is promptly deenergized. For this purpose, rod 49 on solenoid-actuated clip 46 operates limit switch 20' when solenoid 42 has moved bar 44 and clip 46 rearwardly and the switch then, by the circuitry schematically shown at 41 (FIG. 3), deenergizes the solenoid while the motor continues to run. The apparatus thereby avoids trouble due to solenoid hum. As soon as the solenoid has been deenergized, plunger 43 and link 44 are moved forwardly by spring 45. Clip 46, however, remains in rearward position, its extension 48 being held by a latch 68. This latching-in of clip 46, and simultaneous forward return of bar 44, is allowed by pin and slot connection 46'. Only when the circuit of motor 39 is opened, as will be shown hereinafter, and when the motor accordingly stops, extension 48 is unlatched. This is done by a lever 69, pivoted at 69' and operated by centrifugal control means 70 on motor shaft 38. While the motor runs, the linkage of centrifugal control means 70 flies outwardly, holding a control slider 70' in raised position. When the motor stops, slider 70' falls down, tilting lever 69, which in turn tilts latch lever 68, freeing clip extension 48.

Modified tape and cartridge.

The new player accepts a variety of types of cartridges. For instance the user can insert a cartridge 12 containing a tape with four pairs of sound tracks, FIG. 7, in lieu of the two pairs of tracks on the tape of FIG. 2. When cartridge 12 is played the pair of pickup elements 25, 26 is first indexed with a first

pair of record tracks 71, 72, then with a second pair 73, 74, a third pair 75, 76, and finally a fourth pair 77, 78. Such indexing becomes possible when cam 64 has been shifted along the axis of shaft 63 (FIG. 3) in such a way that cam follower 79, supporting pickup head 24, engages the front portion of the cam, as shown. The indexing is then performed by periodically operating ratchet 67 to turn cam 64 a suitable angular distance.

According to one aspect of the invention, automatic shifting of cam 64 along the axis of shaft 63 is performed by moving solenoid follower clip 46 and extension 53 so as to turn link 54, rod 57 and fork 58, 59, 60 into the position shown in full lines. Automatic turning of the cam then is performed by rearward movement of solenoid link 44 and extension 66, which reciprocates pawl 65.

In order to maintain the indicated full-line position of link 54 during the use of an eight-track tape (FIG. 7), cartridge 12 for this tape has a solid bottom, in contrast to cartridge 11 the bottom of which is perforated by aperture 22' (FIG. 1). The solid bottom of the cartridge prevents pressure roller 21 from being erected by its actuating spring 55 (FIG. 3), when solenoid plunger 43 and links 44, 46 are moved rearwardly. The roller presses the cartridge upwardly against suitable guides (not shown).

In order to lock cartridge 12 in place, the apparatus has a locking device 80, shown in FIG. 8, and comprising a bearing ball 81 and a holder 82 for the same. This holder, and a reduced end portion 83 thereof, are guided in suitable bearings 84 and are urged by a spring 85 into engagement with cartridge 12. A notch 86 in the side of the cartridge is provided for reception of bearing ball 81. When the holder is engaged it presses cartridge 12 to the left, where a suitable guide (not shown) can be provided. In order to press tape 16 (FIG. 3) against driving capstan 15, cartridge 12 has a built-in pressure roller 87 (FIG. 1).

Referring finally to FIG. 9: battery B of the vehicle containing the new tape player is connected to this player through ignition switch I and on-off switch O. Electrical connection is made from the battery and switch system to solenoid 42 by conductor 40, and to motor 39 by conductor 41. Interposed on conductors 40, 41 are normally open switch elements shown respectively at 20-1 and 20-2, which form part of switch 20 controlled by the insertion of cartridge 11 in the player. So long as a cartridge is and remains inserted, switch 20-2 is closed and motor 39 rotates. Switch 20-1 is also closed, causing energization of solenoid 42 through normally closed switch 20'. When the solenoid is energized its plunger 43 and link 44 operate the control mechanism for pickup 24, placing the pickup head in one of its several positions indicated here in full and broken lines. Link 44 then also shifts the cam ratcheting surface 66, and at the same time operates locking and latching assembly 54, 68 by control clip 46, which by means of rod 49 opens switch 20'. The latter operation deenergizes solenoid 42 and causes plunger 43 and bar 44 to return toward left under the action of spring 15, while clip 46 remains latched at 68. The latching effect is discontinued only when motor circuit is opened at I or O and when, as a result, motor 39 is stopped. Link 69 then causes clip 46 to return toward left, as indicated above, and roller 21 then is forced into horizontal position by forwardly returning pin 53, thus allowing removal of cartridge 11 from the player.

Normal operation of the apparatus can now be reviewed once more, with reference to FIGS. 1 and 3. It begins with insertion of a cartridge in player 10, which automatically energizes circuits 40, 41 through start switch 20 and normally closed limit switch 20' (FIG. 3) to energize motor 39 and solenoid 42. The solenoid is promptly deenergized at 20' but only when its link 44, by extension 66, has operated pawl 65, against the return spring thereof, to cause ratchet 67 and cam 64 to turn by one angular step and thereby to readjust the indexing of pickup head 24 relative to tape 16 from position for playing the last tracks of the previous tape to the proper position for playing the initial tracks of the new tape. This read-

justment of the pickup head is also affected by the construction of the tape cartridge. If this cartridge is of type 11, having aperture 22' indexed with player aperture 22, the rearward motion of solenoid link 44, clip 46 and clip extension 53 frees link 54. Activating spring 55 of this link then causes the link to turn to vertical position, thereby shifting lever fork 58, 59, 60 and cam 64 into forward position to engage the rear section of the cam with pickup carrier 79.

There follows the normal playing operation, as capstan 15 is driven by motor 39 to unwind and rewind tape 16. Incident to this operation, when the user desires to shift from one set of program tracks 71, 72 to another, for instance to tracks 73, 74 (FIG. 7), he can operate a switch SS (FIG. 9), in parallel with 20', thereby re-energizing solenoid 42 and again operating pawl 65 and ratchet 67. Meanwhile clip 46 remains latched.

On completion of the program, switch O or in some cases ignition switch I is opened. This de-energizes motor 39, thereby terminating the tape motion. This also causes centrifugal control slider 70' to slide down on shaft 38, operating lever 69 and latch 68 and thus causing clip 46 to become unlatched. The linkage then returns to normal forward position, shown in full lines in FIG. 3. As a result, cartridge 11 no longer is locked in by the shaft of roller 21, and can be removed from the player.

While only one embodiment of the invention and some modifications of specific features have been described, the details thereof are not to be construed as limitative of the invention. The invention contemplates such variations and modifications as come within the scope of the appended claims.

I claim:

1. A tape handling machine including a tape deck carrying elements adapted to reproduce the tape of endless reel cartridges placed in play position on said deck, said cartridges being of different types having different numbers of recorded tracks disposed at different positions transverse to the width of said tape, one type of cartridge having a built-in pinch roller and another type of cartridge having an aperture through which a pinch roller may be moved into contact with the tape, said machine including: a capstan disposed to drive the tape of a cartridge placed in play position on said deck; pinch roller means cooperable with said capstan and movable between a first storage position below said deck, and a second, tape-engaging position above said deck; means restraining said pinch roller means against movement from said storage position;

motor means for driving the capstan; a pickup head; means supporting said head above said deck for transverse movements with respect to the width of said tape of an inserted cartridge of either type whereby to index said head with respect to the tape; cam means having portions defining first and second series of surfaces for moving the pickup head transverse the width of the tape, said first series corresponding to track positions on the tape of a cartridge of said one type and said second series corresponding to track positions on the tape of a cartridge of said other type, whereby to adjust said head in correlation with the position of any selected track on the tape of an inserted cartridge of either type; switch means for energizing said motor means in response to placement of a tape cartridge of either type in play position on said deck; and means for moving said pinch roller means to said second position in engagement with the tape of any cartridge of said other type placed upon said tape deck and for controlling said cam means to index said head with respect to the tape in accordance with the position of the tape track to be played, said last recited means including a solenoid and second switch means energized in response to placement of a cartridge of said other type upon the tape deck, and linkage actuated by said solenoid to move to a position in which it releases said restraining means and imparts such movement to said cam means as to select said second series and adjust said head transverse the tape in correlation with the selected track on such tape, said machine being further characterized in that said cam means is mounted for movement translationally, to select as between said first and second series, and rotationally to define head positions within each series and transverse the width of the tape; and that said pinch roller means is mounted for swinging movements between said first position underlying a cartridge on said deck and said second position in which it passes through the aperture of a cartridge of said other type and makes contact with the tape of such a cartridge; and said linkage includes first linkage means translationally movable by said solenoid, and a second linkage means pivotally movable in response to translational movements of said first linkage means, movement of said first linkage means serving to release said restraining means and to adjust said cam means rotationally, and movement of said second linkage means serving to pivot said pinch roller means to its second position and to adjust said cam means translationally, whereby to select one of said two series.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,656,761 Dated April 18, 1972

Inventor(s) JOSEPH E. LASCHENSKI

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, immediately after the title, the following two paragraphs should be inserted:

-- Apparatus of the indicated type is used particularly in automotive vehicles. For use in such a player a variety of tapes are available, including for instance tapes with four tracks for successively playing two different stereo programs, and also including tapes which have more tracks thereon, for example twice as many program tracks. Heretofore, when the driver desired for instance to switch from the playing of a four-track tape to eight track tapes, it became necessary for him not only to exchange cartridges inserted in the player, but also manually to perform certain track selection and control operations, by manipulating a lever or control button. This need for manual adjustment and operation tended to divert the driver's attention, thereby causing a safety hazard. Recognition of such hazard, in turn, tended to interfere with public acceptance of cartridge players.

It is a primary object of this invention to make the use of tape cartridges, and mainly the selection of programs stored thereon, more automatic. It is a further object to provide a player which accepts and plays different tapes, stored in different cartridges. It is another object to provide means to automatically bring a cartridge and its tape into proper relationship with a motorized capstan and with a magnetic pickup head in the player, on insertion of the cartridge in the player, to perform automatic operations for locking the cartridge in place, periodically to re-arrange the pickup head relative to the tape, and to perform automatic operations required for further program selection, on completion of a program. --

Signed and sealed this 7th day of November 1972.

(SEAL)
Attest:

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Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents