United States Patent

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[33] **Japan**
[31] **43/46897;**
Jan. 30, 1969, Japan, No. 44/6324

[54] **PUSHBUTTON SYSTEM TUNER**
11 Claims, 21 Drawing Figs.

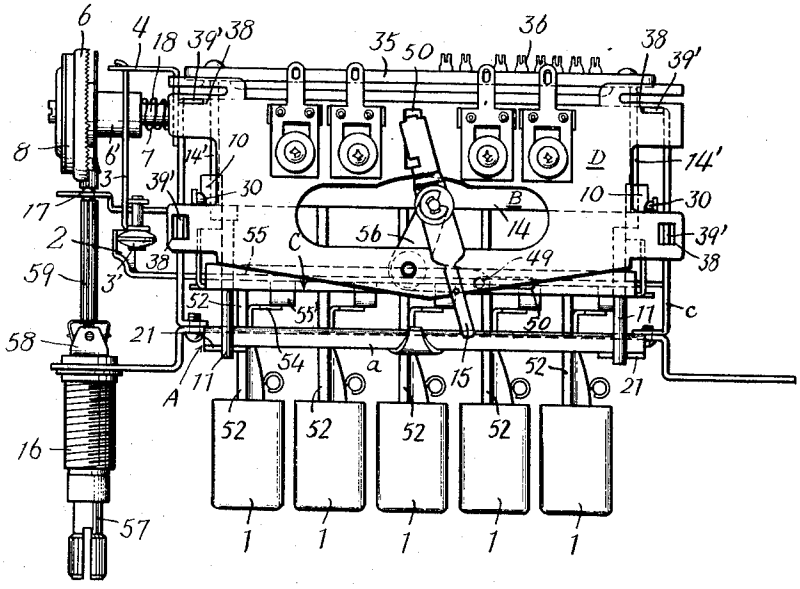
[52] **U.S. Cl.** **334/7,** 334/74, 74/10.33
[51] **Int. Cl.** **H03j 5/06**
[50] **Field of Search** 334/7, 74; 74/10.33

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Primary Examiner—Eli Lieberman
Attorney—Linton & Linton

ABSTRACT: A pushbutton system tuner has a frame, a coil case is provided on said machine frame and has a plurality of coils, a reciprocating plate engages a guide formed on the surface of said coil case whereby said cores can be moved into and out of said coils, a rotary frame which has parallel rods rotatably supported on said machine frame cooperates with said reciprocating plate, pushbuttons with arms are provided with a frequency adjuster to rotate said rotary frame, a shock adjusting means permits the manual adjustment of said rotary frame and a switching means is provided for releasing the connection between said shock adjusting means and said rotary frame through said arm member.



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SHEET 1 OF 6

FIG. 1

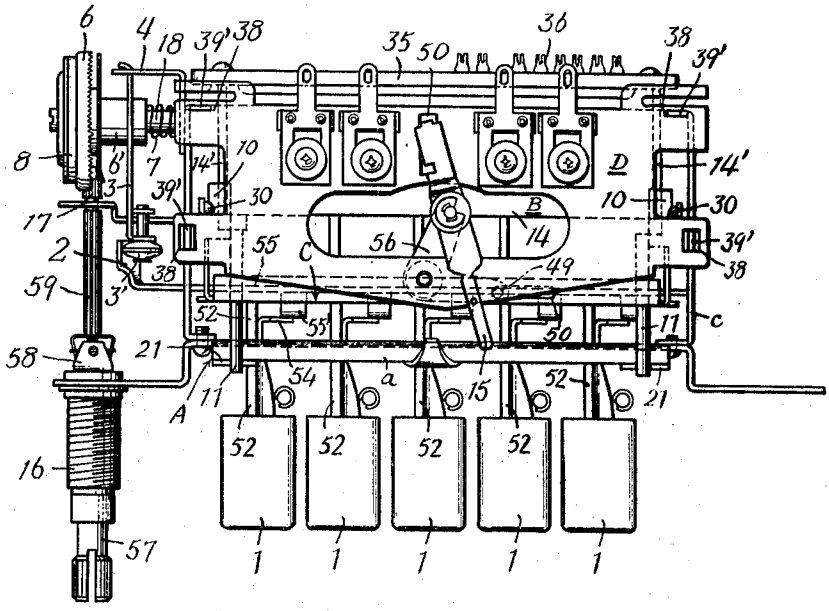
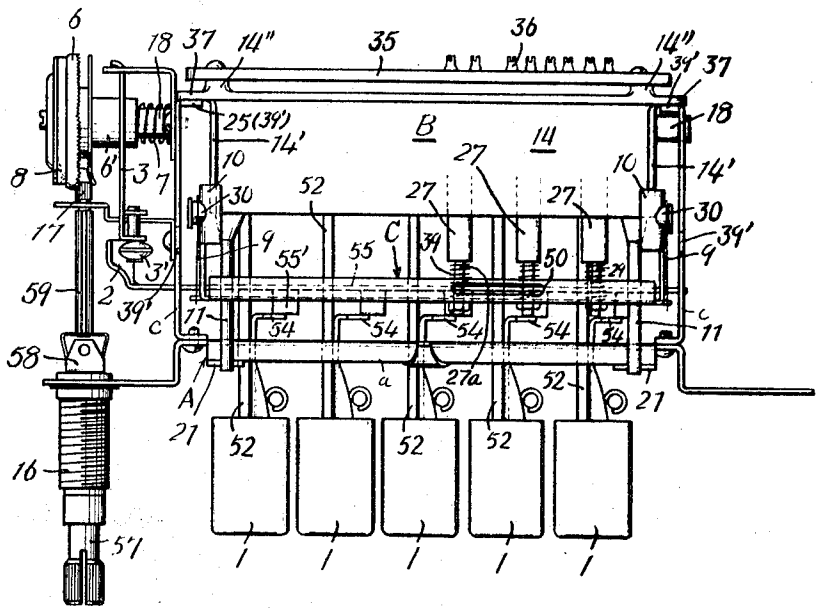


FIG. 2



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FIG. 3

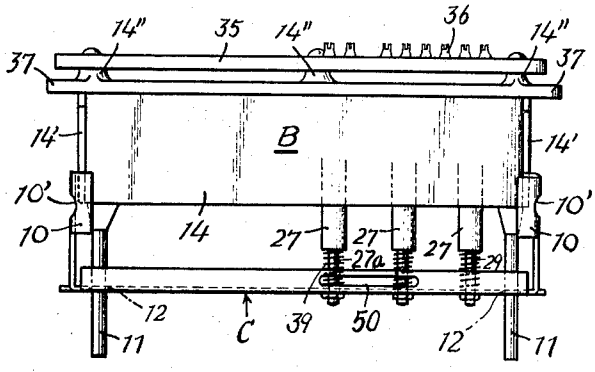


FIG. 4

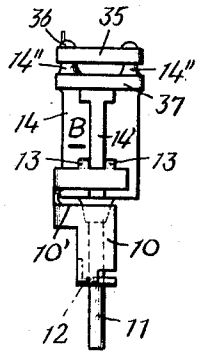
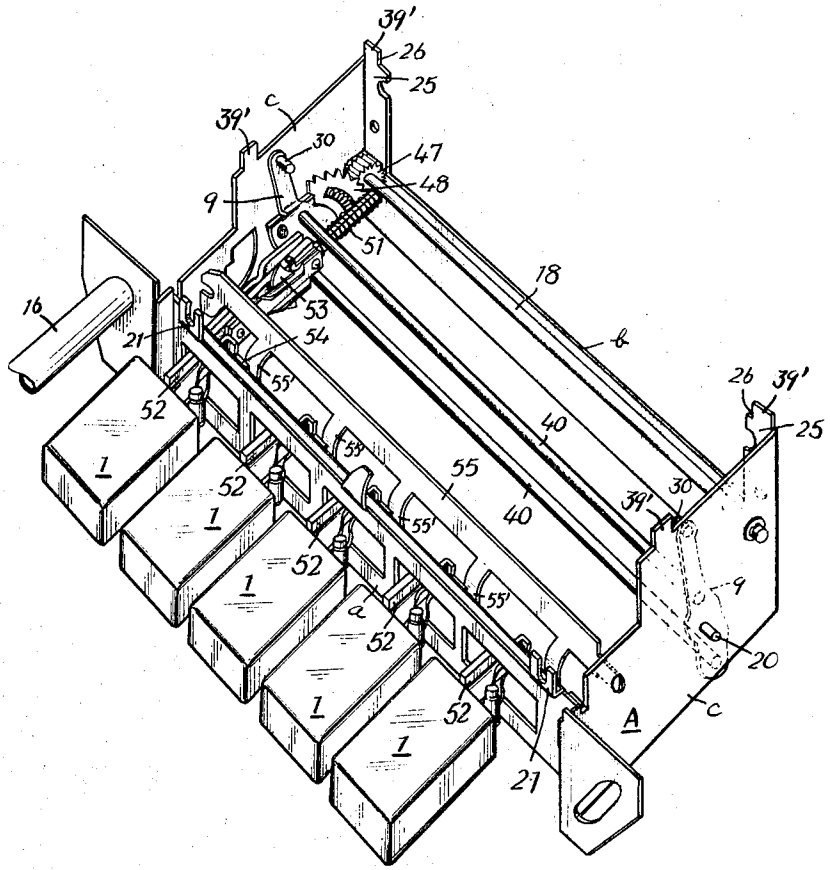


FIG. 5



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FIG. 7

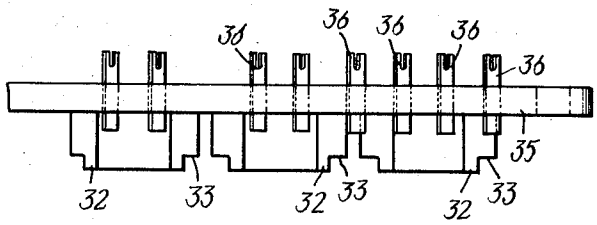


FIG. 6

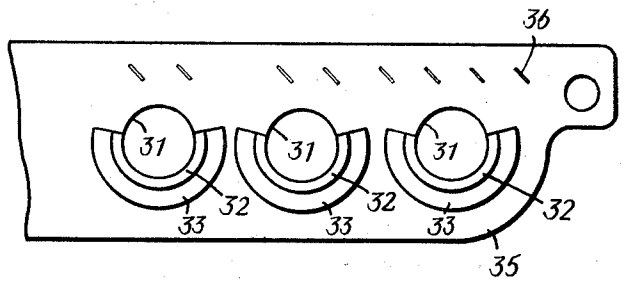
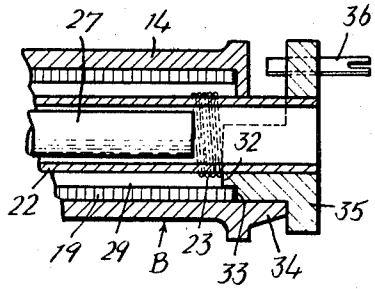


FIG. 8



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FIG. 9

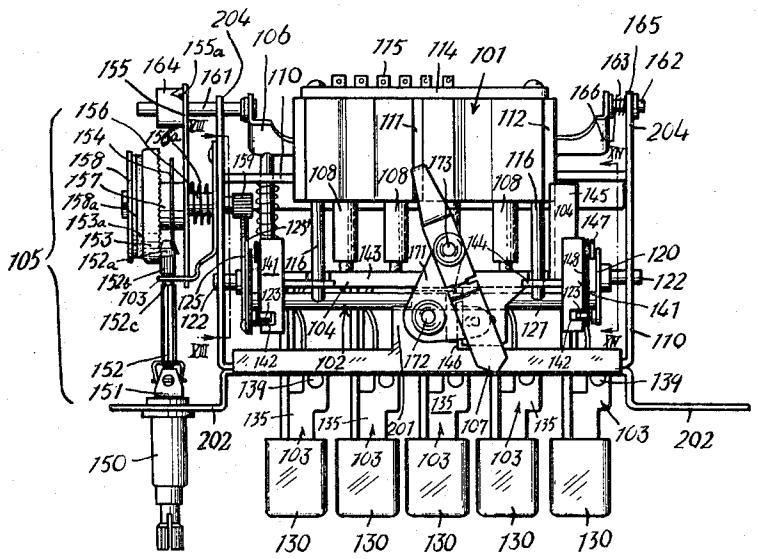
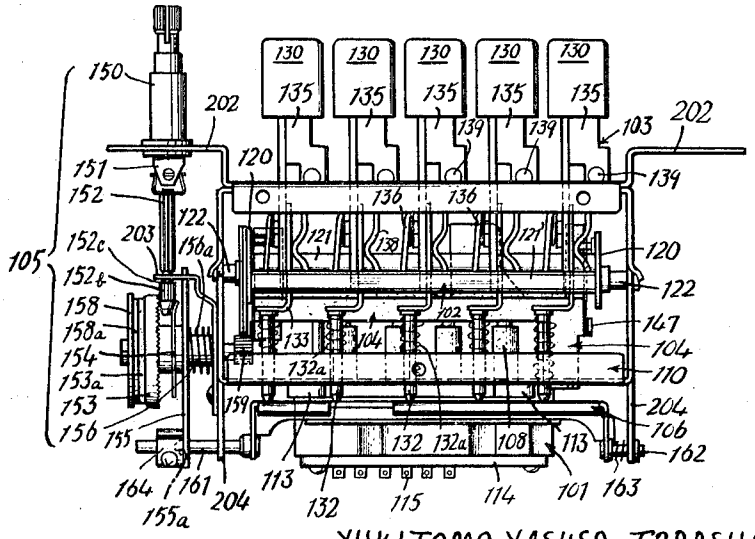


FIG. 10



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FIG. 11

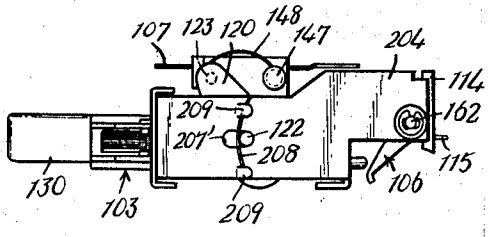


FIG. 12

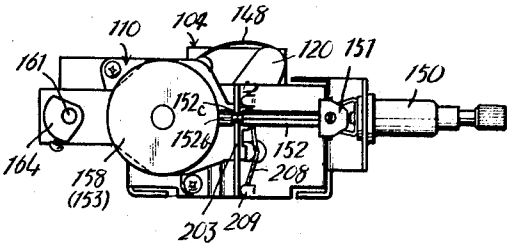


FIG. 13

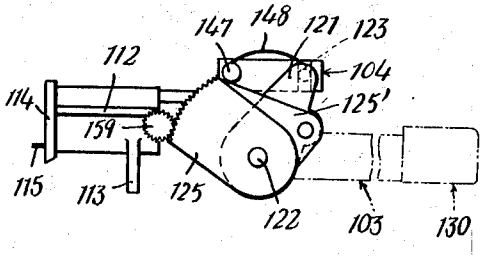


FIG. 14

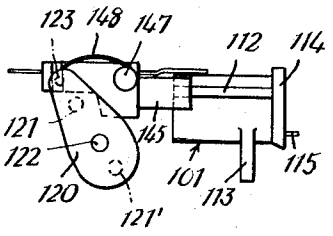


FIG. 18

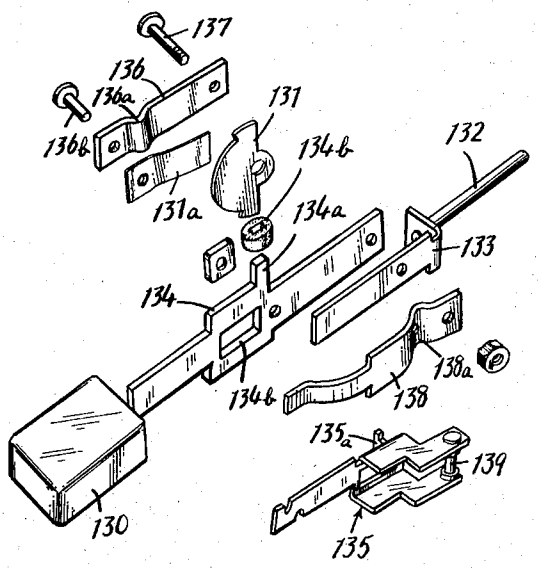


FIG. 20

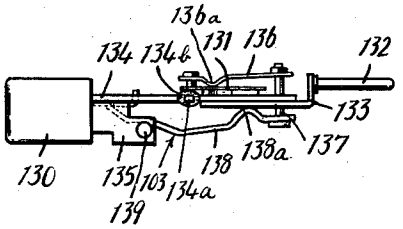
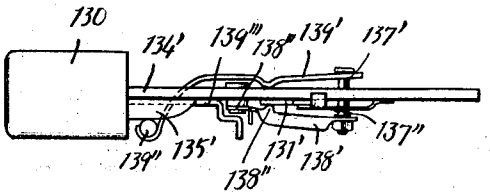


FIG. 21



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FIG. 15

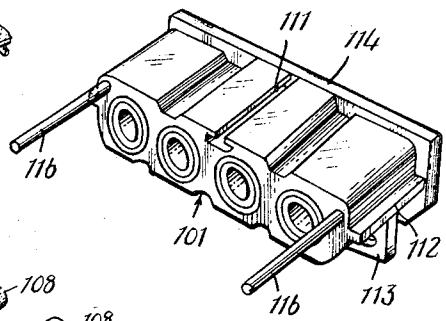


FIG. 16

FIG. 17

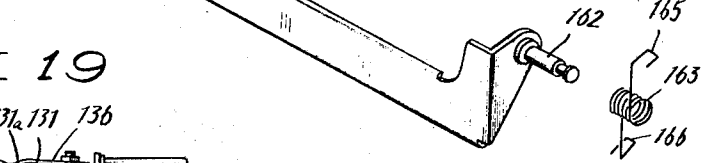
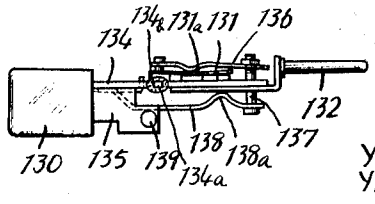


FIG. 19



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PUSHBUTTON SYSTEM TUNER

DETAILED EXPLANATION OF INVENTION

The present invention relates to a new pushbutton system tuner, which is simplified and easy to be manufactured and constructed as well as possible to be formed in a small size. Besides this invention provides a new type of smooth-working tuner, and also, if necessary, provides such a tuner which can serve as a radio receiver to utilize a tape recorder and which permits the attachment and detachment of the fitting part of a tape cartridge in a tape recorder.

Pushbutton system tuners have been conventionally well known. However such conventional pushbutton system tuners are very complicated in structure and are not easy to manufacture and construct, i.e., the conventional tuners have a plurality of coils housed in coil cases in the central structure thereof, and those respective coils are set up as a backplate to be furnished in the back side of frame or other parts of supporting members so that they are united and after thus united one is arranged in the machine frame, which has a basic composition, and when depending upon such a composition such necessities will arise as members or setting-up structure for setting up those respective coil cases and consequently the number of members increases. Not only the compositions for those members requires adjusting operations for uniforming the whole and the precision thereof should be repeatedly examined, which it takes an unexpectedly amount of time and trouble. The structure of said parts or number of setting-up steps become intricate, because such a conventional tuner is especially equipped with a guide part to permit the removal of the removing plate in the coil case set up in the above-mentioned way.

As independent is the removing plate which is provided with core getting into and out said coil, it is necessary to be arranged with the electrical adjustment after once produced, which is difficult. Needless to say it is especially difficult to decide the center in the place to be arranged. In addition, the composed condition of a above-mentioned members is unstable in the composed condition and it is apparent that its work is apt to create errors and is the cause for getting out of order. Further, since the rotating frame is furnished in a layer under the coil group of said case, the thickness of a tuner is naturally to such an extent the total of the thickness of this coil group and the height of the rotation frame. The tuner which is thus bulky and very thick is for example, in a tape recorder mechanism when the pushbutton system tuner is substituted for its tape cartridge and inserted into it, the radio broadcasting can never be performed though it is known to utilize the electric source, output amplifier and speaker of said tape recorder mechanism to advantageously perform the radio broadcasting, since its thickness is quite different from that of the tape cartridge. In addition, the removing members for operating the core to get into and out of said coil are arranged on a rotating shaft so that the mechanism which advances and retreats said removing members by movement of the rotating frame is to respectively arrange the guide members for accurately guiding the movements, and so the mechanism is complicated of itself. Also indespensable is the mechanism which causes the movements of an indicator to indicate the state of channelling a station by cooperating movement of said removing member, and for this purpose there is provided an upper plate on the upper side of the tuner frame, resulting in that the whole structure is remarkably bulky and the thickness is enough therefor as is necessary.

This invention has been successful in removing the above-mentioned disadvantages of conventional tuners. The fundamental object of this invention is to provide a pushbutton system tuner which is simplified in manufacture and construction, and for this purpose it is possible to mold a plurality of coil parts which is a nuclear member in this kind of tuner in the case as well as the utilization of the coil case itself to constitute the removing or operating guide part of the relative member arranged around the coil case. Such a case thus

molded unitarily with coils has to only be set up accurately in the process of manufacturing this case, not to require the members to connect each of the cases as conventionally. Besides not only the process of its connection and constitution is unnecessary, but also such a process as further revision or examination for completed composition is not necessary. Moreover, in this invention since the coil case itself serves as the removing member body on other guiding member to insert and remove the core out of the coil, such a process if unnecessary as prepares and composes, the guide member. In this manner, this kind of pushbutton system tuner is greatly improved in the nuclear part thereof, and the whole manufacture and composition are considerably simplified as well as it is possible to remarkably develop its process.

Another object of this invention is to provide a pushbutton system tuner which is miniaturized and very durable. Its miniaturization is contributed to the fact that the present invention is as mentioned above simplified in the nuclear part thereof and does not necessitate lots of prior composing of members or working guide members. The present tuner which is easy to compose and is miniaturized is superior in strength and considerably developed in its durability. Further, another important object of this invention is to obtain a pushbutton system tuner which is not only miniaturized but fairly thin. The prior pushbutton system tuner is bulky as mentioned above, since it positions the rotary frame on the lower part after the sealed case accommodating coil. The present invention does not adopt the overlapping arrangement of such a sealed case and the rotary frame, but it arranges them in parallel before and behind. In such a manner, the thickness of the pushbutton system tuner is greatly decreased, and it can be accommodated in space which is substantially one-half of that of the conventional tuner. Therefore it is possible for such a pushbutton system tuner to be advantageously connected to the tape recorder mechanism, that is to say, the prior bulky pushbutton system tuner is unfittable for engaging the tape recorder on account of its bulkiness, but it has been in vain utilized, and the present thin tuner is able to be substituted for the tape cartridge in the tape recorder mechanism so as to be inserted into the fitting part thereof, and in this way a useful radio broadcasting is possible, utilizing the electric source, output amplifier, speaker and so on in said tape recorder mechanism. Moreover, one tape recorder mechanism is prepared as the mechanism on the car, thereby enabling it to perform radio receiving which using the pushbutton tuner and it is economical as well as being far superior in utilizing space in the car.

Another object of this invention is to provide a preferable mechanism which accurately predetermines the place fixing the coils in to the above-mentioned united coil case. For this purpose this invention adopts the combination of a mounting hole for the bobbin and a terminal plate having special projections of one side of the circumference of the coil case. The exact composing relation projecting parts on the coil case and the bobbin which is projected at the fixed length from the coil case, whereby the coil is very easy in the setting-up process therefor.

Still another object of this invention is to provide such a pushbutton system tuner which is smooth in working and nimble on operation. The present tuner is as mentioned above simplified in mechanism and requires no operation through complicated members, and at the same time this denotes that the operation is easy and smooth. Furthermore, this invention has devices of arm metal mechanism with pushbuttons, slight shock adjuster performed manually or switching mechanism to switch the working relation of pushbutton operation and this slight shock adjuster, so that a smooth operation may be also obtained in other parts, resulting in providing the pushbutton system which is very easy to be operated.

Many other characteristics and advantages of this invention will be understood from the following explanation with reference to the attached drawings, in which:

FIG. 1 is a plan view showing the inner mechanism removed from its case, of the first embodiment of this invention;

FIG. 2 is a plan view in which the upper plate provided with a dial mechanism and other elements is removed in the above embodiment;

FIG. 3 is a plan view of the coil case united in one body and with the reciprocating member removed;

FIG. 4 is a side view of the coil case;

FIG. 5 is a perspective view of the tuner from which the coil case shown in FIGS. 3 and 4 and the reciprocating member are removed, and respective members provided in the tuner;

FIG. 6 is the partial plan view of the terminal plate;

FIG. 7 is the plan view of the terminal plate;

FIG. 8 is an enlarged cross-sectional view of the terminal plate;

FIG. 9 is a plan view showing the inner mechanism removed from its case, of the second embodiment of this invention;

FIG. 10 is a bottom view of FIG. 9;

FIG. 11 is the right side view of FIG. 9;

FIG. 12 is the left side view of FIG. 9;

FIG. 13 is a side view taken along line XIII—XIII of FIG. 9;

FIG. 14 is a side view taken along line XIV—XIV of FIG. 9;

FIG. 15 is an enlarged perspective view of the coil case;

FIG. 16 is an enlarged exploded perspective view of the reciprocating member and rotary frame;

FIG. 17 is an enlarged perspective view of the switching plate;

FIG. 18 is an enlarged exploded oblique view showing the respective parts of the pushbutton arm member;

FIG. 19 is a plan view showing the pushbutton arm member;

FIG. 20 is a view similar to FIG. 19, but with the elements extended; and

FIG. 21 is a plan view showing one example of a conventional pushbutton arm member.

To explain the present invention with reference to the drawings, the first embodiment of FIGS. 1 to 8 is substantially composed of the four members, i.e., frame case A, coil member B, reciprocating plate C and the upper plate D. The frame A is the most complicated of the above four members as shown in FIG. 5. The combination of coil case B and reciprocating plate C is illustrated in FIG. 3 and 4. Accordingly, an examination of FIGS. 1 and 2 with reference to FIGS. 3 to 5 will lead to an understanding of the composition of the upper plate member D by itself. The frame A consists of the front frame member *a*, the back member *b* opposite to member *a* and the side members *c*, *c*. The side members *c*, *c* and the back member *b* are formed by bending the same member. A group of pushbuttons **1** are provided in the front side of the frame A. The composition of each pushbutton group is shown in FIG. 5, which is the same as in a conventionally known tuner. That is, each pushbutton **1** can press forward one of the sliding members **52** against the elasticity of spring **51**. Such sliding members **52** are provided with plates **53** whose working edges have different oblique angles, and are rotatably supported by pivot shafts **20, 20** opposite each other between the side members *c*, *c*, and can move the rotary frame composed of longitudinal rods **40, 40** and levers **9, 9** according to said oblique angles thereof so as to rotate said rotary frame according to each of said oblique angles. The base of each sliding member **52** is provided with an engaging part **54** contacting a comb piece of a comb-type member **55**, whose upper part is rotatably supported between the side members *c*, *c*, upon the pressing of said button **1** and whose one side at least is arranged with elastic material for returning said engaging part to the previous position, so that rotation of member **55** is provided. The comb-type member **55** has an operative portion **2** bent to an appropriate angle on one end thereof. This operative portion **2** faces a rotor **3'** at the point of the working piece **3** whose basic part is supported by means of the pivot member **4** which is provided at an end part of one of the side members *c*. This working piece **3** is always pressed against working portion **2** by means of the spring **7** arranged on the shaft **18** between the pivot member **4** and the cylindrical part **6'** of the crown gear **6** which is rotatably mounted on one end portion of the shaft **18** between the side members *c*, *c*. Therefore, when the comb member **55** is pressed and rotated by pressure of one of said pushbuttons **1**, the operative portion **2** is raised upwards and the working piece **3** is pushed inwards against elastic force of the spring **7** through the rotor **3'** and the crown gear **6** connected to this working piece **3** is slid inwards in company with the cylindrical part **6'**, thereby releasing its connection to a friction wheel **8** which is arranged next to said crown gear **6** and is fixed to the rotating shaft **18**. Pivots **30, 30** are provided opposite each other on the upper parts of said levers **9, 9**, and these pivots **30, 30** are engaged with the reciprocating plate C. The pivot shaft **20** of one of these levers **9, 9** is fixed as illustrated in FIG. 5 with gear piece **48**, which engages the gear **47** fixed to said shaft **18**, and therefore rotation of this lever **9** rotates said shaft **18**, followed by rotation of said friction wheel **8**. If the crown gear **6** is pressed to this friction wheel **8** by pressure of the spring **7**, said crown gear **6** will be rotated, but in this case the crown gear **6** which is mounted on the shaft **18** is not rotated since, as stated above, the pressure between said crown gear **6** and the friction wheel **8** is released prior to the rotation of the shaft **18** by pressure of any of the pushbuttons **1**. The teeth of the crown gear **6** engages with a pinion **17** which is a point of the shaft **59** connected to the rotatable adjusting shaft **57** by means of a free contacting portion **58**. Rotation of the adjusting shaft **57** rotates the crown gear **6**, and in this case the elastic force of the spring **7** presses said crown gear **6** to the friction wheel **8**, thereby rotating the shaft **18** through said wheel **8** and rotating the rotary frame having lateral rods **40, 40** through the gear **47** and the gear piece **48** so that a core **27** is moved with slight shock and inserts into its coil in coil case B. Supporting parts **21, 21** of frame A respectively support the leading bars **11, 11** of the coil case B which will be described hereinafter.

The coil case B and the reciprocating member C are shown in FIGS. 3 and 4. While the coil case B combines each of the sealed cases with said backplate, the present invention forms a one coil case **14** where the desired coil and other elements are respectively fixed at certain relative positions. Each of the fixtures **14''** is formed on both back sides and the central part of this coil case **14**, and on these fixtures **14''** are fixed the terminal plate **35** of the insulator, on which the terminals **36** are arranged to make well-known electrical connections with the coil of the coil case **14** and other elements. On the front side of said coil case **14** there are projected said guiding bars **11, 11** through holes **12**. The holes **12** are at both ends of the reciprocating member C whose both ends are formed with right-angled engaging parts **10, 10** which are equipped with engaging grooves **10', 10'**, the lower parts of which are open, so as to pivotably engage the pivot parts **30, 30** of the above-stated frame member body A. The points of said guiding bars **11, 11** are also supported on the supporting parts **21, 21** of the front member *a* of the frame A and fixtures **37, 37** are contacted on the back sides of the supporting parts **25, 25** being both back sides of the frame A which are fitted with step portions **26, 26** and the upper surface of the coil case B is fixed thereon. One of the engaging parts **10** has the flanges **13, 13** which are bent inwardly and which are to be engaged with rails **14'** provided on one side of the coil case **14** and an indicator **15** and desired members are arranged as illustrated. A crank piece **56** has one end which is pivoted on the center of indicator **15** pivoted on the upper plate member body D, and a pin **49** at the other end of said crank piece **56** is inserted in an oblong hole **50** formed in the upper surface of the aforementioned reciprocating member C, and the base end of the indicator **15** is inserted in the oblong hole **48** which is longitudinally formed in the center of the upper plate D. Special structure is made on the terminal plate in order to accurately adjust the fitting places of the coil and other elements, which is illustrated in FIGS. 6 to 8. The terminal plate **35** is provided with terminal pieces **36** thereon which as is well known connected to the coil parts, and whose lower parts are furnished with insertion holes **31** along which convex sides **32** are formed in more than half thereof, and engaging steps **33** are provided outside of said convex side **32**, and the inside of this convex **34** is fixed with sleeve **19** where suitable space **29** is

provided to support a bobbin 22 whose circumference is wound with coil 23 thereon and whose back end projects at a given length from the coil case 14, and this projecting part is inserted into the above-stated insertion hole 31 so that the engaging steps 33 are contacted with the end of the sleeve 19 and the convex sides 32 are fitted into said sleeve 19 to contact to the end portion of the coil 23. 27 is a core, and the rod 27*a* of its front end portion is slideably equipped to the removing plate member body C through the spring 39.

The composition according to the first embodiment of this invention is made by the reciprocating member C and the coil case B being so combined that the core 27 may be inserted into the bobbin 22, and guiding bars 11 are supported by supporting parts 21, and pivots 30, 30 of levers 9, 9 are engaged with the engaging grooves 10', 10', and the inner sides of the fixtures 37, 37 are connected with the outsides of supporting parts 25, 25 so that the coil case 14 is mounted onto the cut parts shown in FIG. 5, thereby effecting such a composition as shown in FIG. 2. Thereafter, the connecting projections 39', 39', 39', 39' formed on the machine frame are inserted into the holes 38, 38, 38, 38 of the upper plate member body D and they are suitably twisted to accomplish the composition.

The pushbutton system tuner of the second embodiment of this invention is as shown in FIG. 9 and the followings, which is so thin as not to be bulky when it is attached to the tape recorder mechanism and which can be inserted and removed instead of the tape cartridge.

This pushbutton system tuner is composed of the frame 110, the coil case 101 fixed at the back of said frame 110, the rotary frame 102 rotatably supported at the center of said frame 110, a desired number of arm mechanisms 103 connected to and placing pushbuttons 130 in front of the frame 110, the reciprocating member 104 for moving in and out the cores 108 relative to coil case 101 upon operation of the rotary frame 102 by means of said arm mechanisms 103, the shock reducing means 105 provided on one side of the frame 110 in parallel with said arm mechanisms 103, and the switching plate 106 which is supported at the side of said coil case 101 and whose center is placed under said coil case 101.

The composition according to this second embodiment has the respective features, i.e., the coil case 101 molded as above mentioned in the first embodiment with the desired number of coils, but coil case 101 is furnished with an indicator guiding groove 111 as shown in FIG. 9 as well as the guiding rail 112 on one side at least and on the upper part thereof guiding rods 116 are provided in parallel, and at its lower central part a fixture 113 is projected to the frame 110 as shown in FIG. 10 and FIG. 15, and further the terminal plate 114 made of insulated material is furnished at the back side thereof as in the first embodiment, and the terminal 115 is arranged so as to effect electrical connection to the respective coils. By molding the coil case 101 and all of the coils, those coils are set up in the exact relation, and this molded coil is miniaturized as well as said coil case itself is utilized in the guiding mechanism of the reciprocating member 104 and in that of the indicator, and attachment to the frame 110 is effected only by the fixture 113 and the surface of the coil case 101 is almost free.

The rotary frame 102 is provided at the front side of said coil case 101, which is apparent from FIG. 9, 10 or 16 and this frame 102 has the crank plates 120, 120 on both sides thereof, between which the parallel rods 121, 121' are fixed, and it is rotatably supported to the frame 110 by means of pivot shafts 122, 122 which are projected outsides said crank plates 120, 120 and which are not equipped as conventionally at the central point of the parallel rods 121, 121' but eccentrically project nearly to the lower parallel rod 121' as shown in FIG. 14. The crank plates 120, 120 are further extended more than the fixed position of the upper parallel rod 121 and opposite respective fitting pins 123. One crank plate 120 is fixed with crank gears 125, 125' on its pivot shaft 122 as shown in FIG. 13, to engage the gear 159 of the later mentioned shock reducing means 105 by which said rotary frame 102 is also effected in adjusting for any slight shock. The above-mentioned pivot shafts 122, 122 are eccentric in rotary frame 102, whereby the crank plates 120, 120 provided at the lower part of the frame 110 are appropriately extended upwards so that they are directly utilized as the operating mechanism for the later mentioned reciprocating member 104. The crank plates, though being short and small, are smoothly and exactly given the proper operation through the regular plate 131 of the arm mechanism 103 which push on the parallel rods 121, 121', and especially provide the working distance necessary for the operation of the reciprocating member 104. The crank gears 125, 125' are also laterally placed in front of the coil case 101, and are laid in a layer under the prior coil case and if taking comparative large gear ratio as in a device having such a rotary frame mechanism, a sufficient gear ratio can be provided without bringing about an increase of thickness of the tuner which will be unavoidable.

The arm mechanism providing the pushbuttons at its end, is installed with the frequency adjuster 131 at a position near to the pushbutton side in order to exactly operate the rotary frame 102 in the relation with said rotary frame 102. FIG. 21 shows one example of this kind of conventional arm mechanism, the button plate 135' is fixed to the pushbutton 130, and the arm 134' is slideably moved along the button plate 135' at the case of outlook, and the frequency adjuster 131' is faced with projected part 138'' of the plate spring 138' whose end portion is connected through the spring 137'' to the point of another plate spring 139', and a rotary 139'' on the basic end side of said plate spring 139' is pushed up to the taper or the circle of said button plate 135', thereby pressing to fix the frequency adjuster 131' by means of the projection 138'' of said plate spring 138'. In the prior arm mechanism it has been impossible to provide the frequency adjuster 131' nearly to the side of the pushbutton 130 more than usual because of the fitting point of the plate spring 138', the free part of the 139''.

Thereupon the present invention adopts the compositions shown in FIG. 18, 19 and 20. That is the arm 134 having the button 130, is equipped on its one side with the shaft 133 whose one end is bent into an L-shape, and the bent part of this shaft 133 is fixed to the sliding shaft 132, and the basic end portion of the arm 134 and that of the button plate 135 are inserted into the inner hole of the pushbutton 130, and if necessary this pushbutton 130 is removed therefrom. The other end part of this button plate 135 is provided with the pressing shaft 139 which faces to the extended part of the elastic plate 138 equipped outside of said shaft 133, and this elastic plate 138 forms a pressing part by bending itself as well as having at its point a connecting bolt 137 which is connected to the point part of another elastic plate 136 opposite to said elastic plate 138 through the shaft 133 and the arm 134, and the end part of said elastic plate 136 reaches the side of pushbutton 130, over the frequency adjuster 131, and is connected to the arm 134 by means of a stop 136*b*. A washer 131*a* is equipped between such elastic plate 136 and frequency adjuster 131, and a projected part 134*a* is equipped on one side of the arm 134, on which a buffering ring 134*b* is furnished so that this buffering ring 134*b* connects to the inside of the frame 110 in order to stop the arm 134 at the predetermined place when the arm 134 is pressed back by pressure of the spring 132*a* provided on said sliding shaft 132 as shown in FIG. 9 or FIG. 10. That is to say, under the unlocked condition when the pushbutton 130 is appropriately moved out, the button plate 135 is slidingly moved out from the arm 134 as shown in FIG. 20, thereby consequently releasing the pressing force by elastic plate 138 which has been pressed by means of the pressing shaft 139 of this button plate 135, and the connecting bolt 137 slides to the side of the other elastic plate 136 so as to fix the position to the frequency adjuster 131 by said elastic plate 136. In such a condition the frequency adjuster 131 is set in the predetermined state and thereafter when the pushbutton 130 is pushed forwards, for recovery, a fitting claw 135*a* of the push plate 135 advances within the oblong hole 134*b* of the arm 134, whereby the pressing shaft 129 presses

the basic end side of the elastic plate **138** by which the connecting bolt **137** is pulled out to the side of said elastic plate **138**, and consequently the frequency adjuster **131** is fixed by the pressing bent part **136***a* which is the center of the elastic plate **136**. According to the arm mechanism of this invention, the pressing shaft **139** of the button plate **135** being always on the elastic plate **138** operates directly, and free space **139''** of said button plate is not necessary since this is not such a type, as the rotor at the point part of the elastic plate which extends through the hole provided on the arm from the opposite side of the arm is pressed up to the oblique side or the circle of the button plate, to which the miniaturization of the pushbutton tuner is contributed, that is, this invention makes it possible to adopt the tuner which has the rotary frame in parallel in the front side thereof which does not require the big size of said tuner, thereby providing the fixture of the stable frequency adjuster **131** and obtaining a superior practical production. The central line of such pushbutton arm is, as mentioned above, directed to the middle position of the parallel rod **121**, **121'**, and therefore this central line does not meet the eccentric pivot shafts **122**, **122** of said rotary frame, and in the case of drawing the central line is in the upper part, thereby rotating smoothly the rotary frame. The reciprocating member **104** is placed in the front side of said coil case **101** and the rotary frame **102**, which is shown in FIG. **9** and FIG. **16**, and on its both sides there are respectively oppositely provided the arm parts **141** having the grooves **142** to engage the fitting pins **123** of the rotary frame **102**, and the fixture **143** connecting those arm parts **141**, **141** is arranged with the cores **108** for moving in and out the coils of the coil case **101**, and such a fixture **143** forms the guiding holes **144** on its both sides in which are inserted the guiding rods **116** projected on the both sides of the coil case **101**, and the groove body **145** is projected from one of the side arm parts **141** and mounted onto the guiding rail **112** formed on the side of the coil case **101**. The fixture **143** has on its front side the projecting fitting part **146** having an oblong opening **149** slideably supporting the basic end of the bell crank-shaped lever **171** for operating an indicator **107**. Said bell crank-shaped lever is pivoted by pin **172** in its central bent part on the projection **201** of the center of the frame **110**, and its point part is pivoted by pin **173** on the central part of the indicator. The point part of the elastic wire **148** whose basic end is pivoted by the projection **147**, is fitted on the above-mentioned fitting pin **123**, and the point part of said elastic wire **148** is bent to be supported on said parallel rod **121**, thereby elastically maintaining the engaging position of the fitting pin **123** and the groove **142**.

As stated above, the shock reducing means **105** is provided on the outside of the frame **110** and the composition of this part is that the supporting arm **201** is projected to the side of the frame **110**; the adjusting shaft **150** is rotatably supported by means of this supporting arm **202**; said adjusting shaft **150** is connected to the pinion shaft **152** through the free connector **151**; the end part of this pinion shaft **152** is born on another supporting arm **203** provided on the frame **110**; the switching plate **106** is rotatably provided by means of the pivot shafts **161**, **162** in between the third supporting parts **204**, **204** which are projected backwards the frame **110**; the pivot shaft **161** is extended outwards longer than the supporting parts **204**, **204**; a cam **164** is fixed on the pivot shaft **161**; and, the portions **155***a* of the operating plate **155** whose basic end is pivoted on said supporting arm **203** are oppositely provided so that they are pressed to the cam **164** by the pressure of the elastic material **156***a* wound on the driving shaft **156** which is rotatably supported by the frame **110**. The above-mentioned pinion shaft **152** has its whole circumference formed with a gear and at the same time it is also formed with the supporting shaft **152***c* to be supported by said supporting arm **203** so that the desired product is obtained from a one shaft material, differently from the conventional one wherein the pinion shaft and the pinion are made separately and both are combined. The tubular shaft **157** is fixed at the center of the operating plate **155**, and this tubular shaft **157** is fixed with the crown gear **153** thereon and said driving shaft **156** is slideably mounted, and the point part **152***a* of said pinion shaft **152** is always pressed in the direction of the crown gear **153** by the elastic force of the elastic plate **154** separately provided on the tubular shaft **157** so that the pinion gear **152***b* engages the crown gear **153**, and said point part **152***a* consists of two stepped taper parts **152***a''*, **152***a''*, thereby bringing about no strong twisting work in the connecting angle to the elastic plate **154** of said pinion shaft. Further, one end portion of said driving shaft **156** is fixed with the gear **159** engaging said crank gears **125**, **125'**, and the other end portion projecting outsides the tubular shaft **157** is fixed with the transmitting plate **158**, and a friction material **158***a* provided on said transmitting plate **158** is opposite to a friction material **153***a* fixed on the back of the crown gear **153**. That is, in such a slight shock reducing mechanism, usually the adjusting shaft **150** is rotated, whereby the pinion gear **152***b* engaging the crown gear **153** by the resiliency of the elastic plate **154**, is rotated, thereby rotating the pinion gear **152***b* and in this way the transmitting plate is rotated through the crown gear **153** and the friction materials **153***a*, **158***b*, and the rotation of this transmitting plate **158** drives the driving shaft **156** and the gear **159** to rotate the crank gears **125**, **125'** so that rotary shaft **102** fixed to said gears **125**, **125'**, is rotated to adjust the core to move in and out of the coil case. When pushing any of said pushbuttons the frequency adjuster **131** provided on the arm thereof rotates the rotary frame **102** and the amount of insertion of the core in the coil case **101** is determined by one operation as stated above, and the sliding shaft **132** which is projected to the point of the arm mechanism **103** is projected to the back of the frame **110** prior to the time when such a frequency adjuster connects with the rotary frame **102**, and the lower part of said switching plate **106** is pressed to rotate this pressed part around the pivot shafts **161**, **162**, and the cam **164** provided on the pivot shaft **161** is rotated, thereby pressing the operating plate **155** in the direction of the groove frame **110** against the elastic of the elastic material **156** so that the tubular shaft **157**, the crown gear **153** and the driving shaft **156** which are unitarily connected with said operating plate **155** are pulled as guiding members and therefore the frictional relation between the friction materials **153***a*, **158***a* is released, and the frictional cooperation of the transmitting plate **158** of the driving shaft **156** and the crown gear **157***a* is released, and thereafter as said switching plate **106** is to be rotated, the operation of channelling a station by the pressure of the pushbutton **130** is accomplished independently on said shock adjuster. The coil spring **163** is wound on the pivot shaft **162** in said switching plate **106**, and its one end part **165** is fitted on the supporting portion **204** of the frame **110** and the other part **106** is fitted on the switching plate **106** in order to always press the switching plate **106** under the frame **110**.

According to the second embodiment, this invention adopts the coil case **101** having a plurality of coils, and as the supporting seat **113** formed in the center of the coil case **101** stably supports this case **101**, this is easily attached to the frame **110** and it is unnecessary to support the coil group or the coil case at the front side thereof as conventionally, and therefore the circumferential part of the coil case thus arranged is fully utilized in the guiding mechanism of the reciprocating member **104** for moving the core into or out the coil of said coil case or in the guiding mechanism of the indicator to indicate the channelling state by cooperating in the operation of reciprocating member **104**, and independently on the prior coil group or coil case the frame plate, the upper plate and so on are respectively arranged without the operating or guiding mechanism therefor. In such a way, the composition of the tuner is made considerably easy, and the manufacture and the construction are very simplified, and those parts can be made thin. Thus, the rotary frame is installed at the front side of the coil case **101** provided in the utmost part of the frame **110**, and the rotary frame **102** is not provided as conventionally it having been laid in a layer together with the coil group or the coil case, which makes the tuner according to this invention

very thin, besides since this rotary frame **102** is rotatably provided by means of the pivot shaft which is eccentric to the frame **110** than the central position of both parallel rods, the rotating operation is smoothly effected by the frequency adjuster of the arm mechanism having the pushbutton, and at the same time it is unnecessary in the rotary frame parallel with the coil case to adapt as in the prior art the rotating gear ratio of the gear which is united with the crown gear and the crown gear which is united with the rotary frame in the thick direction of the tuner or the gear, and the gear ratio being able to be voluntarily adopted in the depth the tuner can also be made thin in this point. In summary, the tuner is by far thinner or rather seems as thin as one-half of the conventional one, whereby this invention has greatly improved the applicability or practicability of said pushbutton system tuner to the tape recorder mechanism.

We claim:

1. A pushbutton tuner comprising a four-sided frame, a coil case mounted on said frame and having side rails provided thereon, a plurality of coils provided in said coil case as a unit therewith, rods extending from said coil case, a reciprocating member slideable on said rods and having engaging parts slideable on said side rails whereby said reciprocating member will be guided during its movement to and from said coil case, cores carried by said reciprocating member with each core being slideable in one of said coils, a rotary frame rotatably supported on said first frame and including a pair of parallel rods positioned for cooperating with said reciprocating member, pushbutton arm members slideably mounted on said first frame, frequency adjusting cams positioned to rotate said rotary frame when one of said pushbuttons is manually moved, manually operable shock reducing means connected to said first frame and capable of adjusting the position of said rotary frame, switching means operable by one of said arm members and capable of releasing the cooperative relationship between said shock reducing means and said rotary frame and said coil case, reciprocating member, and rotary frame being position parallel and side by side across said frame.

2. A pushbutton tuner as claimed in claim **1** including a terminal plate connected to said coil case, bobbins on which said coils are wound and which bobbins extend from said coil case, said terminal plate having openings each receiving the extended portion of one of said bobbins with extended portions of said plate each around more than one-half of each of said openings and fitting steps each around the outside of one of said extended portions, sleeves each positioned concentric with one of said bobbins and having an end in one of said fitting steps.

3. A pushbutton tuner as claimed in claim **1** wherein said coil case rods are supported by one side of said first frame and said coil case is supported by an opposite side of said first frame.

4. A pushbutton tuner as claimed in claim **1** wherein said rotary frame includes a pair of end plates to which said frame rods are connected, a pair of pivot shafts each pivotally supporting one of said end plates on said first frame and said pivot shafts are positioned eccentrically downward from the center of said frame rods.

5. A pushbutton tuner as claimed in claim **1** wherein said shock reducing means includes a rotatable gear plate, a manually rotatable pinion shaft engaging said gear plate and having a peripheral groove and a bracket connected to said first frame and having an opening with said shaft groove rotatably supported therein.

6. A pushbutton tuner as claimed in claim **1** including a bell crank lever pivotally mounted on said first frame, said removing member has a slot, a pin on one end of said bell crank lever is slideable in said slot, a channel indicator is pivotally mounted on the other end of said bell crank lever and has a guide arm and said frame has a slot with said guide arm slideable therein.

7. A pushbutton tuner as claimed in claim **4** wherein said rotary frame end plates are pivotally connected to said reciprocating member.

8. A pushbutton tuner as claimed in claim **1** wherein said shock reducing means includes a shaft rotatably supported on said first frame and operatively connected to said rotary frame for pivoting the same, a friction wheel fixed on said shaft, a gear plate slideable on said shaft, resilient means tending to retain said gear plate in engagement with said friction wheel, a working piece pivotally connected to said frame and capable of sliding said gear plate against said resilient means, an L-shaped arm pivotally connected to said first frame, and positioned for being pivoted by said pushbutton arms and pivoting said working piece for moving said gear plate from said friction wheel and manually operable means for rotating said gear plate.

9. A pushbutton tuner as claimed in claim **8** wherein a gear is fixedly mounted on said shaft, a second gear meshing with said first gear is carried by said rotary frame.

10. A pushbutton tuner as claimed in claim **1** wherein said switching means includes a switching plate pivotally connected to said first frame on a side of said coil case opposite to said rotary frame, means carried by said switching plate for disconnecting said shock adjusting means from said rotary frame and rods carried by said pushbutton arm members capable of pivoting said switching plate.

11. A pushbutton tuner as claimed in claim **10** including button plates each having an end in one of said buttons and each positioned alongside one of said pushbutton arm members, each pushbutton arm member having a slot, each button plate having a claw slideable in one of said slots and a pressing shaft, further elastic plates, each connected to an opposite side of one of said pushbutton arm members and said frequency adjusting cams each being carried by one of said pushbutton arm members between one of its sides and one of said elastic plates and said pressing shaft bearing against the other of said elastic plates.

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