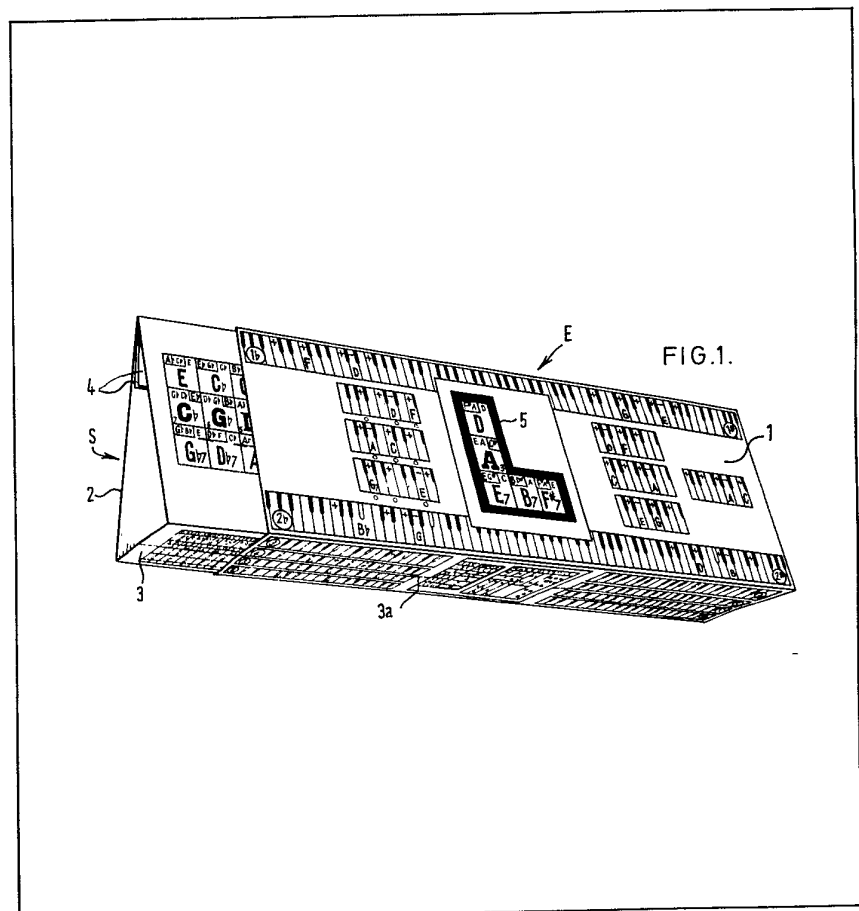


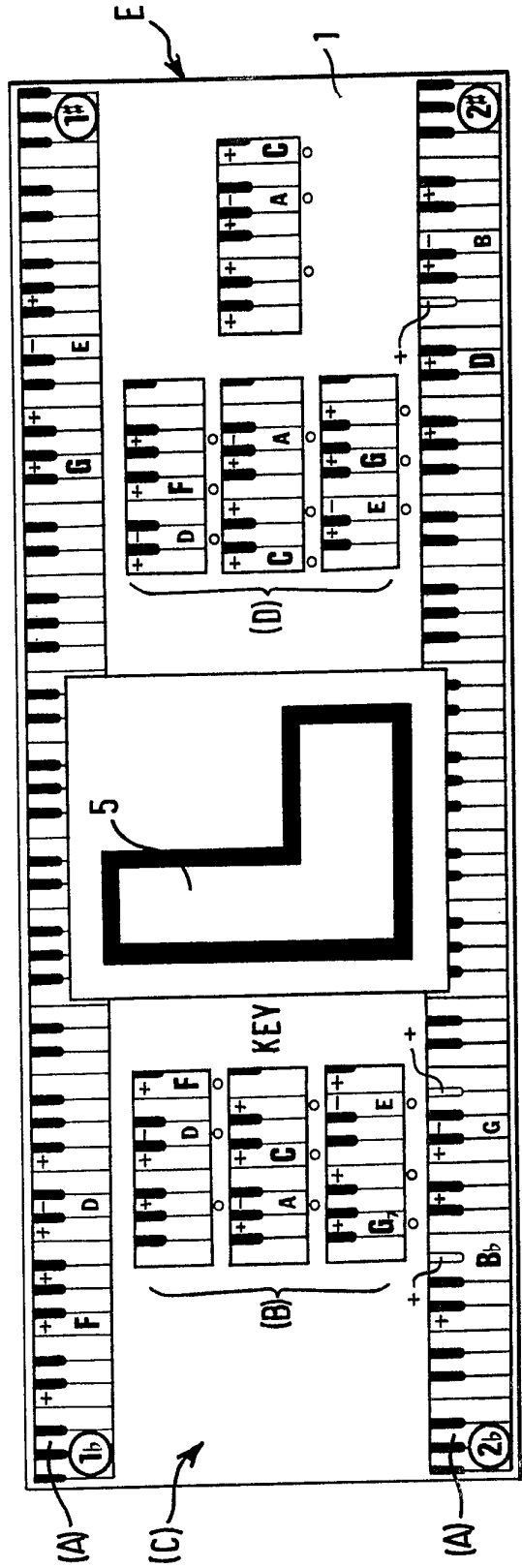
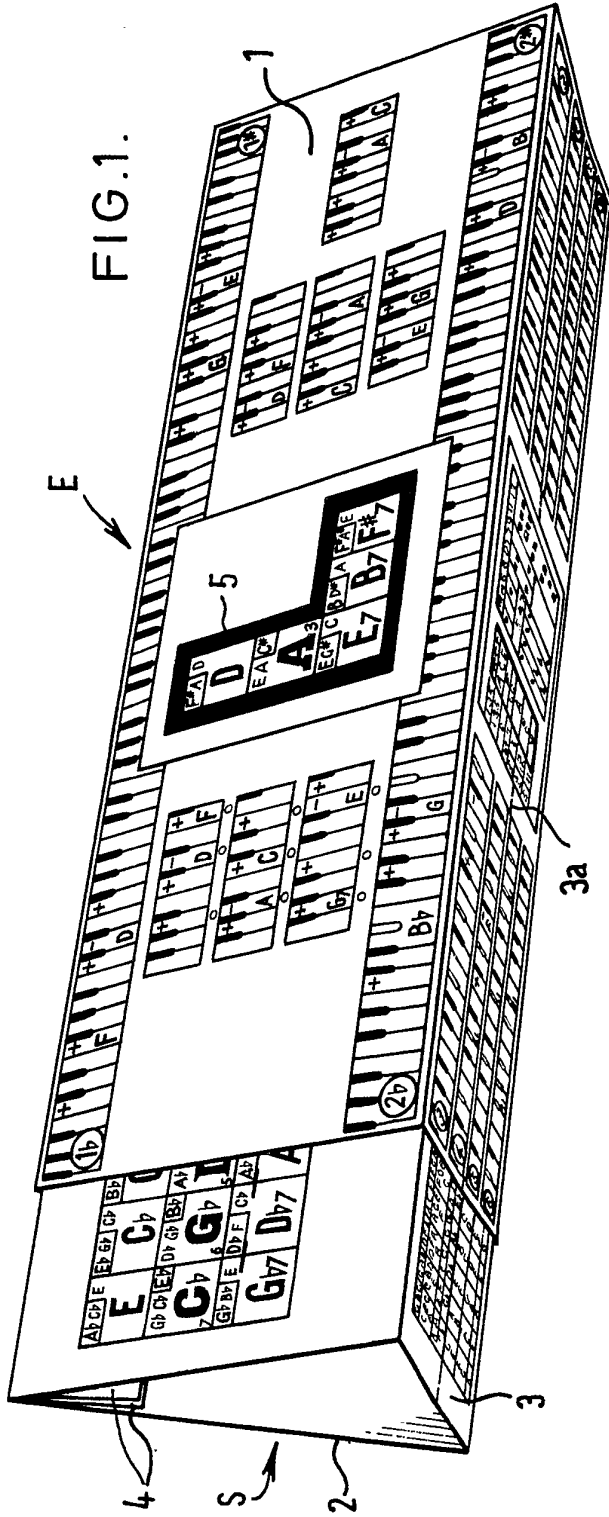
- (21) Application No **7846338**
- (22) Date of filing **28 Nov 1978**
- (43) Application published
18 Jun 1980
- (51) **INT CL³**
G06C 1/00
- (52) Domestic classification
G4B AD
G5X 8
- (56) Documents cited
None
- (58) Field of search
G4B
G5X
- (71) Applicants
Grahame Alastair Craig,
1 Ardclinis Gardens,
East Stiles,
Antrim,
Northern Ireland.
- (72) Inventors
Grahame Alastair Craig
- (74) Agents
Marks & Clerk

(54) Instructional device of the slide rule type

(57) A device of the slide rule type intended for instructional purposes, particularly for instruction in musical theory and practice, comprises an open-ended enclosure having at least one window therein containing a slide bearing information to be displayed through any such window. The device as a whole is collapsible into a flat condition and has at least three sides. Further, the enclosure may be adapted to receive one or more secondary slides which may be capable of being reversibly positioned to display information carried on its respective sides.



The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.



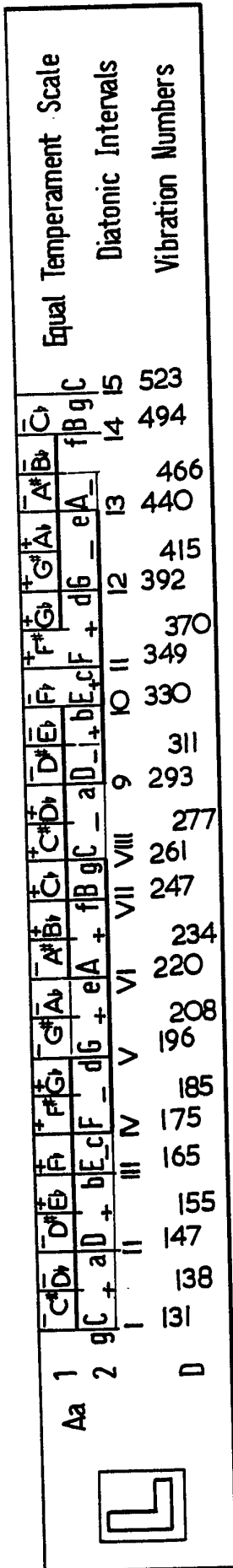


FIG. 11.

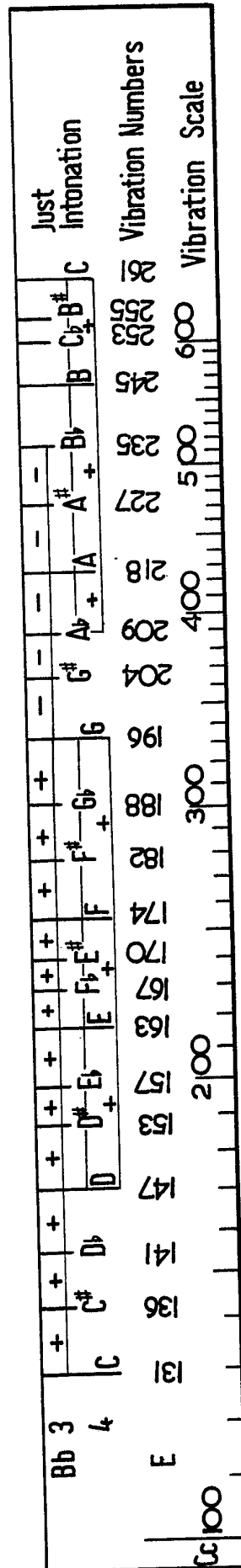


FIG. 12.

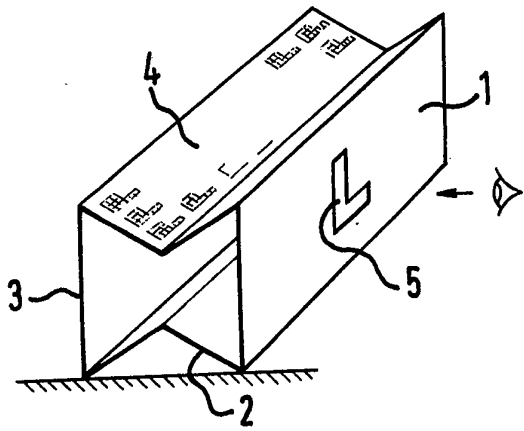


FIG. 13A

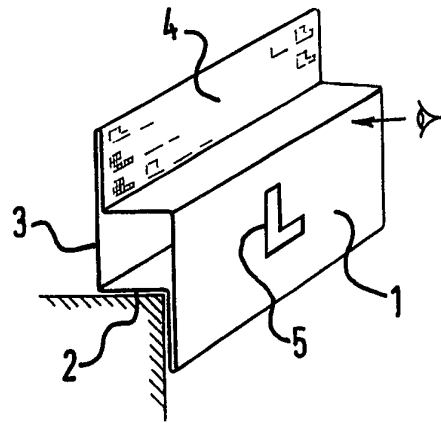


FIG. 13B.

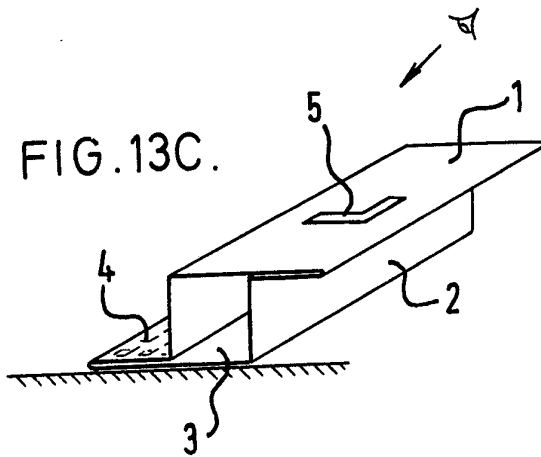


FIG. 13C.

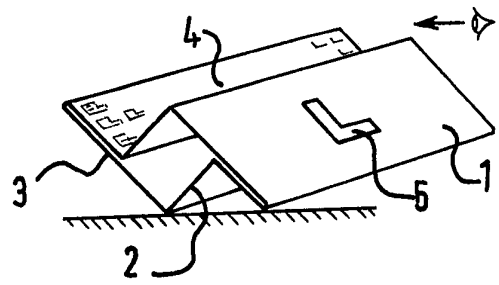


FIG. 13D.

FIG. 13E.

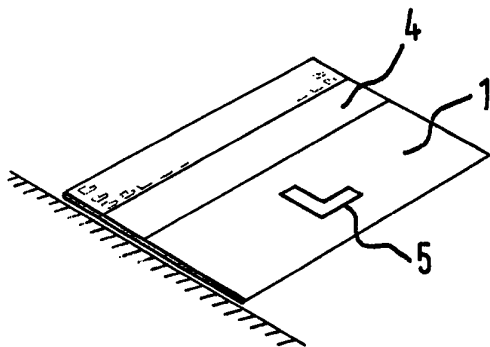
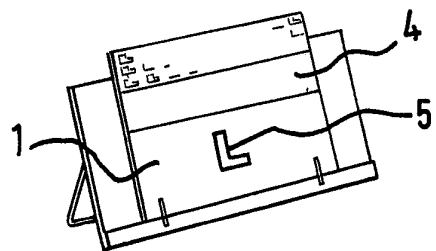


FIG. 13F.



SPECIFICATION

Instructional device of the slide rule type

- 5 This invention relates to a device intended for instructional purposes and of the slide rule type, which type comprises an open-ended enclosure or sleeve which contains a slide adapted to display information by exposure through at least one aperture or window formed in the enclosure. 5
- The general object of the invention is to provide an instructional device of the character referred to which is of compact form whilst having the facility of displaying or indicating a considerable amount of diverse information depending upon the displacement of the slide relative to the enclosure. 10
- 10 In accordance with the invention an instructional device of the type defined is characterised in that each of the open-ended enclosure and the slide therein is a collapsible structure having at least three sides, one or more of such sides of the open-ended enclosure having at least one window through which information carried on the slide is selectively displayed depending upon the position of longitudinal adjustment of the slide relative to the enclosure. 15
- Preferably the enclosure and the slide are three-sided - that is to say triangular in cross-section - and one of the sides is foldable longitudinally in the manner of a gusset so that the structure can be collapsed into a substantially flat condition. Alternatively the enclosure and the slide could for example be four sided - that is to say rectangular in cross-section - two opposite sides each foldable longitudinally, thereby constituting two gussets, so that the structure can be collapsed into a flat condition as aforesaid. 20
- When so formed the device can be folded into alternative configurations to display required information to best advantage when supported on flat or sloping surfaces.
- The windows may be of any desired shape and may be elongated or of L-shape, and extend longitudinally and/or transversely of the panels in which they are formed.
- 25 The slide will normally be provided with means to be gripped by the operator's fingers to facilitate its movement within the enclosure and such means may conveniently be at least one wing-like extension directed internally of the structure. 25
- A practical application of an instructional device in accordance with the invention, is a guide to the playing of a musical instrument or musical education device and two embodiments of such a device are illustrated in the accompanying drawings, in which:- 30
- Figure 1* is a perspective view of a first embodiment of the device shown in a fully-erected state with its slide partly withdrawn from its enclosure or sleeve;
- Figure 2* is a detail of side 1 of the sleeve;
- Figure 3* is a detail of side 1 of the slide;
- 35 *Figure 4* is a detail of side 2 of the sleeve; 35
- Figure 5* is a detail of side 2 of the slide;
- Figure 6* is a detail of side 3 of the sleeve;
- Figure 7* is a detail of side 3 of the slide;
- Figure 8* is a perspective view of a second embodiment of the device shown in an erected state with its slide partly withdrawn from its enclosure or sleeve; 40
- Figure 9* is a detail of side 4 of the sleeve of the device shown in figure 8;
- Figure 10* is a detail of side 4 of the slide of the device shown in Figure 8;
- Figure 11* shows the front side of a secondary slide of the device shown in Figure 8;
- Figure 12* shows the reverse side of this secondary slide; and 45
- 45 *Figures 13A, 13B, 13C, 13D, 13E and 13F* illustrate some alternative folded configurations of the device shown in Figure 8. 45
- The two embodiments of the device illustrated in the drawings are intended to provide all the basic technical information with which it is possible to learn and understand the theory and practice of music and also embodies a system for learning the use of chords from simple triads to compound chords.
- 50 Referring now to Figure 1 the three-sided or triangular form of device therein shown is made of thin sheet material such as cardboard and comprises a three-sided open-ended outer enclosure or sleeve E and a three-sided slide S which is snugly received therein and slidable to different positions relative thereto. The triangular form is isosceles, the two sides 1 and 2 being of equal area whilst the base side 3 is of lesser extent. The base side 3 has a central longitudinal fold line 3a and acts as a gusset to allow the device to be collapsed into a substantially flat condition. An outer protective sleeve or wrapper (not illustrated) will normally be provided to fit around the collapsed device for storage or transit purposes. 55
- The slide S has an open corner with a pair of inwardly extending wings 4 which are intended to be gripped by the operator's fingers to enable the slide S to be moved readily to different positions relative to the sleeve E.
- 60 The markings and windows provided on the three sides of the sleeve E and slide S respectively are described below by reference to the relevant Figures of the accompanying drawings. 60
- Figure 2 shows that side 1 of the sleeve E has in its central part an L-shaped window 5 through which may be viewed, on side 1 of the slide S (Figure 3) the primary information concerning the closely related triads of the tonic major key and the submediant minor triads musically known as the 'relative minor of the major key'. The secondary information concerns the two Dominant Seventh triads which are to the right of the 65

bottom axis of the L-shaped window 5.

Still referring to Figure 2, along the top and bottom of side 1 of the sleeve S are keyboard illustrations (A) showing Major Chord Constructions coloured red (but here designated "+") and Minor Chord Constructions coloured yellow (but here designated "-"). The key signatures to the left of this section are 'flat' and those to the right are 'sharp'.

Section (B) of side 1 of the sleeve S consists of three panel illustrations. The centre panel being the focal point concerns the Tonic Major Key from which there emanate three closely related major chords and three closely related minor chords.

The centre panel (at rest 'C' Major). The Tonic Triad is in the Second Inversion for left hand and coloured red. The closely related minor chord (at rest 'A' Minor). The finger positions are indicated by circles below the panel and coloured yellow. It is to be noted that the yellow note in the panel itself is the relative minor indicator and also illustrates how to transform the 'C' Major chord into the 'A' Minor chord simply by moving one finger.

Section (C) of side 1 is marked with technical names - two against each panel - and these are directly linked with the scale tone of the Tonic major key meaning that any closely related chord takes its technical name from the position in the Tonic Scale of the Major Key that it occupies. Whether the chord is a Major or a Minor is determined by the Triad built upon the note itself.

Section (D) of side 1 illustrates Groups of Inversions and somewhat resembles Section (B). The difference is that one of the Inversions of the Triad is shown (there being three way of playing a three note chord). To the extreme right of this Section there is a panel which shows the tonic chord as a Full chord.

Referring to Figure 2 in conjunction with Figure 3 the L-shaped window 5 allows the display, by rightward displacement of the slide S, of seven progressive increases by the number of 'Flats' and, by leftward displacement of the slide S seven progressive increases by the number of 'Sharps', thereby compassing the total number of Major keys in music. (see legend in the right hand margin of side 1 of the slide S)

Referring now to Figures 4 and 5 which respectively illustrate the markings on side 2 of the sleeve E and slide S it is to be noted that the sleeve is formed with two parallel elongated windows H, H* through which information carried by the slide is displayed. The sleeve side 2 has sections designated (A) to (N) which are identified as follows.

30	A	Treble clef	The clef is set upon the stave The 'C' note on the stave is indicated in colour on the third space up.	30
35			The line from which the clef takes its name is indicated by the '5th'. set alongside the line and five notes above 'middle C'	35
40			The names of the lines are shown E G B D F	40
45			The names of the spaces are shown F A C E A 'flat' sign is placed upon the 3rd line of the stave where it would be placed to indicate the key of 'F Major'	45
50	B	Bass Clef	Indicator for 'middle c'	
55			The clef sign is set upon the stave The 'C' note on the stave is indicated in colour on the third space down The line from which the clef takes its name is indicated by the '5th'. Set alongside the line and five notes below 'middle C'	55
60			The names of the lines are shown G B D F A	60
65			The names of the spaces are shown A C E G A 'flat' sign is placed upon the 2nd line of the stave where it would be placed to indicate the key of 'F Major'	65

	B*	Indicator for 'middle C'	
	C	Sharps	The seven sharps used in key signatures are set in their respective positions on the stave. Alongside are the names for the sharps in sequence F C G D A E B	5
5				
10	D	Flats	The seven flats used in key signatures are set in their respective positions on the stave. Alongside are the names for the flats in sequence B E A D G C F	10
15	E	Setting indicator	The note showing in the indicator is that which indicates the tonic Major scale displayed in the octave scale aperture	15
20	F	Sharp indicator	Where the key signature is determined by sharps the actual number of sharps is displayed in this window	20
25	F*	Flat Indicator	Where the key signature is determined by flats the actual number of flats is displayed in this window	25
30	G	Accidentals Major	Notes of the octave scale required to be written or played either sharp or flat in accordance with the key signature are displayed in this window in either or both columns. to the left from top to bottom are positions 1 to 4 and to the right from top to bottom are positions 5 to 7	30
35				35
40	G*	Accidentals Minor	Notes of the octave scale required to be written or played either sharp or flat in accordance with the key signature are displayed in this window in similar manner to that outlined above	40
45				45
50	H	Scale window Major	The notes showing in the scale aperture are the semitonal intervals of the octave set, also in small case letters are displayed the dominants of the corresponding notes of the tonic series.	50
55	H*	Scale window for the Relative Minor	In similar manner to that described above are displayed the notes of the Relative Minor Scale to the Tonic Major Scale set in the upper aperture, also displayed are the dominants of the notes in the relative minor scale.	55
60				60

5	J	Tetrachords and intervals of scale together with identification of Harmonic and Melodic Minor Scales	<p>The bottom and top tetrachords are indicated centrally in this section, these being the 1 and 1V and the V1 to V111 INTERVALS of the octave scale. The differences between the semitonal intervals of the major scale and the minor scale are readily identified.</p> <p>On the major 1 to V111 are indicated the 9th 11th and 13th intervals needed when considering compound chords.</p> <p>Identification of the Harmonic Minor Scale is by way of the V11 or as it is technically known the leading note. As the minor scale uses the same key signature as its relative Major Key the ascending and decending scale of the minor scale will have according to the Key signature one more flat or one more sharp as the case may be than the sharps or flats of the key signature.</p> <p>Harmonic Minor scales therefore may be read directly from the rule.</p> <p>Melodic Minor scales require that the second tetrachord be modified when ascending in the manner of a major tetrachord therefore the V1 note will be read not according to the minor interval of scale but according to the major interval of scale.</p> <p>When ascending the top tetrachord of the minor scale requires the use of the V1 V 1V 111 intervals of its relative major scale and this modification is picked out on the central indicators of the major and minor scales to draw the attention of the user to these notes.</p>	5 10 15 20 25 30 35 40 45
45	L	MAJOR intervals	The major octave scale intervals	45
	L*	MINOR intervals	The minor intervals of scale	
50	M	Transposer	This scale is set to read as the Dominant when the slide is in the central position	50
55	M*	Transposer ..	This scale is set to read as the Mediant when the slide is in the central position	55
60	N	Transposer	This scale is set to read as the Subdominant when the slide is in the central position	60

N*	Transposer	This scale is set in the supertonic when in the central position special note 1: Mand N in the central position are in conjunction with tonic Major read off directly at any point of the rule thereby presenting without further movement the three Perfect closely related chords used with every major key. This also applies to all minor keys but a similar set of scales have been provided at M* and N* to coincide with the relative minor scale. the overall effect of setting the rule out in this manner is that with the rule in the central position i.e. 'C' Major, the six closely related keys, chords or notes of that key which is to say also the tonic key and the key one sharp greater and one flat lesser than the tonic key and their relative minors, are readily in sight from M down through to M*	5
5			5
10			10
15			15
20			20
25			25
30		Transposition can be achieved generally from one key to another by utilizing any pair from the eight complete semitone scales and should it be necessary to transpose from any other setting then it will be seen that at all times the relative minor and the dominants travel in constant alignment and relativity.	30
35			35
40	The Cycle of Fifths	The cycle of fifths is presented in a completely original form progressing as it does clockwise from 'C' this illustration carries to the outside the Major key signatures and to the inside the corresponding Minor key signatures.	40
45		When read in an anti clockwise direction it becomes the cycle of fourths and on reaching the fourth flat transfers to the inner group of major key signatures.	45
50			50
55	Referring now to Figures 6 and 7 which respectively illustrate the markings on side 3 - that is to say the gusset or base side - of the sleeve E and slide S respectively it is to be noted that the sleeve side 3 is formed centrally with an elongated window P extending transversely thereof for exposing information on side 3 of the slide. The sections of sleeve side 3 (Figure 6) are identified as follows:		55
60	Left hand panel	Here is a continuation of the progressive series of keyboard illustrations for major keys having flat signatures.	60
65	Right hand panel	Here is a continuation of the progressive series of keyboard illustrations for major keys having sharp signatures	65

	Centre panel	1-3-5	appearing beside the window p this introduces the notes of the major triad	
5	" "	1-flat3-5	This introduces the notes of the minor triad	5
	" "	6	This introduces the sixth note of the octave in the major scale	
10	" "	flat7-7	Here is the dominant seventh (flat 7) and the major seventh (7)	10
	" "	TONIC	This indicates either the last note of one octave of scale or it can be used as the beginning of one octave of scale to be read with the succeeding notes in the column giving the 2nd 3rd 4th 5th and 6th notes and then reading the 7th notes of the octave at flat 7-7 above the Tonic or it may be used as the 8th note of the octave when reading compound chord constructions.	15
20				20
	" "	+5-47	This group of columns is for analysis or construction of the following chords +5 (augmented 5th) -5 (diminished 5th) 4(suspended fourth) o7 (diminished 7th)	25
30				30
	Centre Panel Mm6 D7			
35	9 11 13		This group of columns is used for the analysis or con- struction of chords having either a base with Major Triad or a base with Minor Triad where the former follow the illustrations having blocked in squares and the latter follow the open squares then there are those chords which have a base with Major triad and require certain intervals to have flattened notes; these will be treated in detail if and when required. This is extremely original treatment of the subject of chord analysis and is a very compact method of presenting this information throughout the Major keys.	35
40				40
				45
45				50
50				55
	55 Slide right hand segment		This is being explained here as it is the point at which the user may refer to the technical names for the Major intervals of scale and also identify the minor triads. If used in every key it will also indicate the technical name of a particular note as it changes its positional role from key to key.	60
60				65
65				

- A more elaborate embodiment of the invention is illustrated in Figures 8 and following of the drawings and is hereinafter described. This embodiment comprises a four sided collapsible sleeve E' which contains a four sided collapsible slide S'. The top side of each of the sleeve E' and slide S' is in like manner to its second side formed with a central longitudinal fold line 1A so as to constitute a gusset permitting the device to be collapsed when required to a flat condition. 5
- Additionally the fourth side has a ledge-forming overlaid member 6 which is adapted to support a secondary slide S2 which is reversible in order to display different information on its respective sides. The construction and information displayed on sides 1, 2 and 3 of the sleeve E' and slide S' is the same as the 3-sided embodiment which has already been described in detail.
- 10 The fourth side of the sleeve E' relates to the vibration characteristics of pitch, the construction of chords and introduces a new concept for presenting chord references as they relate to the Subdominant, Tonic and Dominant, that is to say the notes appearing in the vertical part of the L-shaped window 5 in side 1. Thus to one side of the fold line on side 4 of the sleeve E' is marked a series of grids. These grids are an extension of the theme of the Subdominant, Tonic and Dominant. Reference has already been made to the 15 three musical notes which appear above each of the large letters on the slide side 1 which appear in the L-shaped window in the sleeve. The grids represent the positions of these groups of musical notes as if they were observed on side 1. The next stage is to present these as individual modifications of the fingerings illustrated separately at the Subdominant, Tonic or Dominant positions.
- 20 The modifications take the form of 10 of the most frequently required chord formations, the chord indicators being abbreviated to the following:
- | | | | | | | | | | |
|-------|----|----|-----|----|----|-----|-----|-----|----|
| sM | s6 | s7 | sM7 | s9 | sm | sm6 | sm7 | s°7 | s+ |
| tM | t6 | t7 | tM7 | t9 | tm | tm6 | tm7 | t°7 | t+ |
| 25 dM | d6 | d7 | dM7 | d9 | dm | dm6 | dm7 | d°7 | d+ |
- In all there are 30 additional chord formations each of which is capable of inversion in accordance with standard music practise. (On side 1 the 7 small keyboard illustrations give examples of inversions of a chord).
- 30 The modification of an S or T or D series from the 'L' is indicated by a dot or an inflection mark (sharp or flat). What happens simply is that the user will play the musical note which is indicated according to its presence on the 'L' face and if an inflection is indicated he will adjust the note shown on the 'L' face accordingly. The grids are set on the fourth side in a position which allows the user readily to refer to either set of 35 information. That is between that on side 1 and that on the fourth side. The second section of side 4 is much more complicated to describe but the arrangement is like the hitherto described section positioned so that the user can easily relate between two sides of the sleeve. In this case between the theory on side 2 and the secondary slide S2. As mentioned already, there is a separate rule S2 which is supported on a ledge-forming element attached 40 to the fourth side of the sleeve. The rule is concerned with JUST INTONATION and EQUAL TEMPERAMENT; these are two means of determining pitch within the OCTAVE. Just Intonation is the true division of pitch in western music. The only instruments capable of using this division are those which are variable. e.g. the voice, a slide trombone or similar action instrument and an unfretted stringed instrument such as the violin. There was prior to the adoption of Equal temperament tuning a tuning known as Mean Tone but this has not 45 been provided for on the outer faces as this form of tuning is not in general use. It is however of academic interest is so far as it was the accepted basis of music from the 16th century until the early part of the present one. Equal Temperament is the standard tuning adopted today as a result of the introduction of the fixed tuning brought about by the invention of the pianoforte and more recently required by fretted instruments like the 50 guitar. E.T. is a compromise which takes advantage of the inability of the ear (in the case of the majority of people) to instantaneously recognise accurately the difference in pitch between two notes. (In fact it would be a clever person that would be capable of distinguishing the difference in tuning between two pianos). E.T. Moves the 2nd, 3rd, 6th and 7th interval slightly to accommodate the 5 pitches (the black notes) which in turn serve to accommodate two pitches (those with inflections in the J.T. scale) from the just tone scale. The result being that by this method music can modulate freely through the 15 keys in the Major Scales 55 (EQUALLY) Hence the title. Scale A1 & 2 on the main device and Scales Aa3 & 4 on the separate slide deal with the Equal temperament pitches. Cc on the main device and Cc on the separate rule are the logarithmic scales available for direct reading of 60 vibration values on A1 to Aa 4 or as a multiplying and dividing agent for determining the higher and lower octave values of pitches illustrated. 'D' lists the individual vibration values of pitches illustrated on the equal temperament scale.
- aA1 ... in colour this scale is set out in minor thirds (yellow) and Major thirds (orange). 65

aA2 ...	in colour this scale is set out in major and minor thirds also the first octave begins Major minor Major the second octave begins Major minor.	
5	Underlined Scale Aa 1 C - G perfect Fifth ... A - E perfect Fifth ... Gb - Cb perfect Fourth	5
	Underlined Scale Aa F - C perfect Fifth ... D - A perfect Fifth	
10	Underlined Scale A 1 C - F perfect Fourth ... A - D perfect Fourth ... E - B perfect Fifth	10
	Underlined Scale A2 C - C perfect Fourth ... E - A perfect Fourth	
	Diatonic Intervals. These are marked I - VIII in first octave and VIII - 15 in second octave.	
15	Using these Scales. Aa1 can be read against A1 with the rule in carrying position. Aa1 & Aa2 can be read against A1 & A2 by setting rule in the base of the gusset The object of the patches is that any combination can be built up at any point to determine what construction a chord is composed of OR to compose a chord having been given its component parts i.e. m3 - M3 - P5 etc. This simplifies the understanding of chord construction speeds up recognition and is quite entertaining.	15
20	Scales B1 - B2 & Bb1 - Bb2 deal with the Just Intonation Pitches. There is only one octave of scale illustrated simply because as previously mentioned Just Intonation is the Pure division of the octave though for practical reasons it has been necessary to adopt a compromise scale which we know as Equal temperament.	20
25	The Just Intonation Pitches allow up to apply the correct Technical Names to the pitches within the octave and this has been done under 'F'. There is no separate related rule (scale) for the J.I. series but the vibration values for each pitch in the octave are given. If the user has any call to calculate then at this stage of his musical knowledge he will be able to work on the Logarithmic Scales provided at 'Cc' 100 - 600.	25
30	The Bb scale works along the base of the gusset and the main purpose of this slide action is to examine and to illustrate the limitations which J.I. presents as a result of movement in the settings between one pitch and another in terms of major keys. At different settings it is not possible to align each pitch of the octave and this illustrates the conflict which results in discords or mismatches.	30
	Vibration Values for the pitches illustrated on the J.I. scale are given under 'E'.	
35		35
B1 ...	in colour this scale shows Major Third (Orange) minor third (blank) Perfect Fourth (Orange)	
40	B2 ... shows minor third (yellow) Perfect Fifth (Orange)	40
	Bb1 ... shows Perfect Fifth (Orange) minor third (yellow)	
45		45
Bb2 ...	shows Perfect Fourth (Orange) Imperfect Major Third (Orange)	
50		50
	The 4-sided embodiment which has been described can, for ease of observation, readily be folded into different positions which are illustrated in Figures 13A to 13F inclusive. Thus Figures 13A, 13C, 13D and 13E show the device supported on a horizontal surface in various configurations, whilst Figure 13B shows the device supported partly by a horizontal surface and partly by a vertical surface at a corner of a piece of furniture. Finally, Figure 13F shows the device supported in an inclined position on a music stand.	
55		55
	In its widest aspect the invention provides an instructional device of the slide rule type which has the facility of displaying a large amount of information in a particularly compact and convenient manner. Moreover the feature of collapsibility means that the device can suitably be made of relatively cheap material. When embodied as a device for musical instruction it is believed that it enables a greater variety of information to be presented in a comprehensive, convenient and compact manner than has ever heretofore been possible.	
60		60
	Other applications of the instructional device could be utilised for the presentation of useful information in other arts or sciences. For instance in photography the three sides of a device could be concerned with camera apertures, speeds and camera-to-subject distances respectively.	
65	Other fields of application could be holography - colour and distance combinations - market research,	65

finance and so forth where different parameters have to be reconsidered or studied in relation to one another.

CLAIMS

- 5
1. An instructional device of the type defined characterised in that each of the open-ended enclosure and the slide therein is a collapsible structure having at least three sides one or more of such sides of the open-ended enclosure having at least one window through which information carried on the slide is selectively displayed depending upon the position of longitudinal adjustment of the slide relative to the enclosure. 10
2. An instructional device as claimed in claim 1 in which the enclosure and the slide are three-sided and one of the sides of the enclosure and of the slide is adapted to fold longitudinally in the manner of a gusset to enable the structure as a whole to be collapsed into a substantially flat condition.
3. An instructional device as claimed in claim 1 in which the enclosure and the slide are four-sided and two opposite sides of the enclosure and of the slide are adapted to fold longitudinally in the manner of a gusset to enable the structure as a whole to be collapsed into a substantially flat condition. 15
4. An instructional device as claimed in any of claims 1 to 3 wherein the slide has at least one wing-like extension directed internally of the structure.
5. An instructional device as claimed in any of claims 1 to 4 wherein one side of the enclosure is provided with a ledge forming member which supports, or is adapted to support a secondary slide. 20
6. An instructional device as claimed in any of claims 1 to 5 for teaching music and characterised in that one side of the enclosure has an L-shaped window for exposing information relating to musical chords carried on the slide.
7. A music instructional device as claimed in claim 6 characterised in that one side of the enclosure has two parallel windows for exposing keyboard information carried on the slide. 25
8. A music instructional device as claimed in claim 6 or claim 7 characterised in that one side of the enclosure has a window extending transversely thereof for exposing keyboard information carried on the slide.
9. A music instructional device substantially as hereinbefore described with reference to, and as shown 30 in, Figures 1 to 7 or Figures 8 to 13F of the accompanying drawings. 30