March 10, 1936. R. H. RANGER 2,033,648

MULTIPLE PART SOUND RECORD

Filed March 21, 1933

Fig. 1.

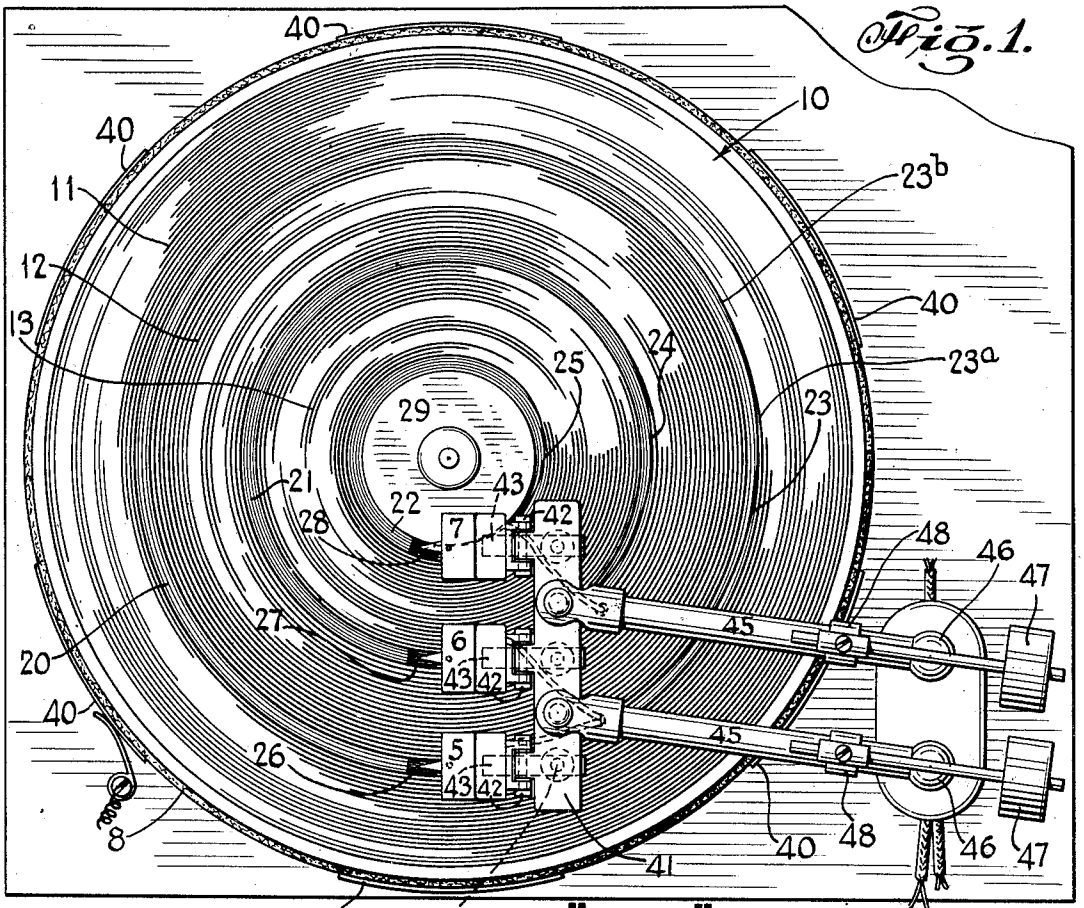



Fig. 2.

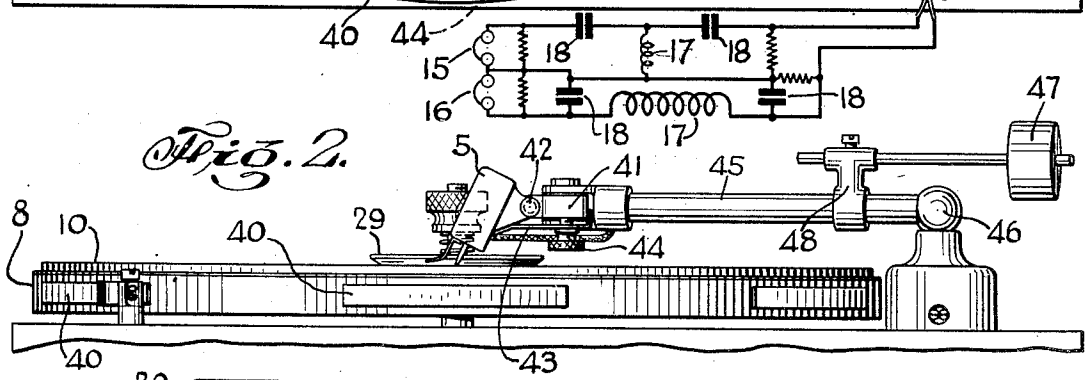
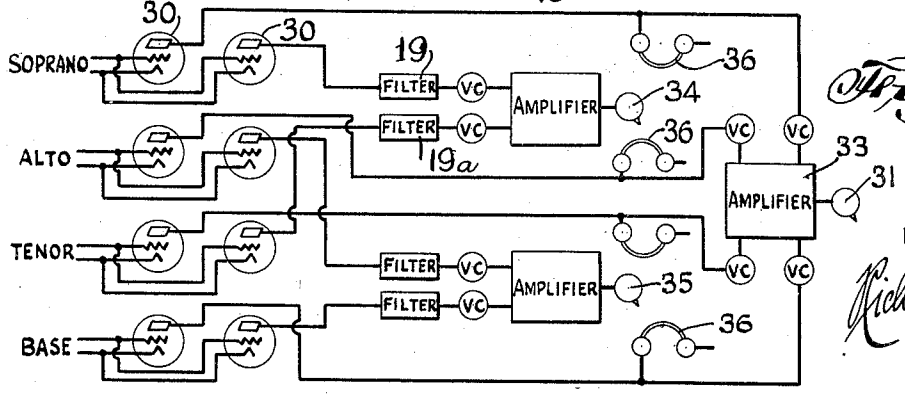



Fig. 3.




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## MULTIPLE PART SOUND RECORD

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6 Claims. (Cl. 274—46)

The present invention has been evolved in connection with the development of an improved phonograph and phonograph record for use in teaching the accurate rendition of music and for convenience of disclosure of the principles of the invention such an embodiment will be more particularly described. It will be understood, however, that the particular description is illustrative merely and that the various features of the invention can be otherwise applied without departing from the scope of the invention.

The invention has for a principal object to provide an improved sound reproducing apparatus and sound record of a type adapted for rendering different parts separately but synchronously.

Another object is to make provision for starting the sound reproduction within a predetermined brief interval after the record is started rotating, and furthermore to provide an arrangement whereby a plurality of reproducing mechanisms may easily be placed upon a record to engage different grooves for synchronous operation.

A further object is to make improved provision whereby different parts of a composition which are recorded in one record track may be separated for reproduction in different loud speakers or ear phones.

Still another object is to provide an improved method for producing phonograph records of the type under consideration.

The nature and objects of the invention will be better understood from the description of a particular illustrative embodiment for the purpose of which description reference should be had to the accompanying drawing forming a part hereof and in which:—

Figure 1 is a diagrammatic plan view of a phonograph and record embodying features of the invention with three reproducing devices engaging the record,

Fig. 2 is a side view showing synchronizing contact elements on the edge of the phonograph turntable,

Fig. 3 is a diagram indicating an arrangement for controlling cutters from separate keyboard units.

In the arrangement shown for the purpose of illustration, which has been particularly designed for use in teaching music, reproducing devices 5, 6 and 7 are positioned above a turntable 8 to engage a record 10 thereon.

The record to be described has three recording tracks or grooves thereon in which are recorded vocal or instrumental parts of a musical composition to be played synchronously by the three reproducing mechanisms. As shown, the record 10 has three recording grooves. Groove 11 contains a record of the complete composition or accompaniment; groove 12 contains a record of two parts, the soprano and tenor superimposed and groove 13 includes similarly a record of the alto and bass. The music recorded in these grooves is reproduced by means of the respective reproducing devices 5, 6 and 7 which may be connected with corresponding loud speakers or ear phones arranged to be used by respective students.

If it is desired, for example, that the sopranos should hear only the soprano and the tenors only the tenor part, filters may be introduced to separate the parts for this purpose. An arrangement for such separation is indicated diagrammatically wherein the sound carrying current from the reproducer 6 is led to the ear phones 15, 16 through a high-low filter comprising the inductances 17 and condensers 18.

As an expedient to improve the separation by filtration of the two parts particularly in the case of instrumental music the quality of the notes of the higher part may be such as to include a number of overtones thereby introducing high frequencies which will readily pass through the filter circuit to the ear phones 15 to give effective intensity while the lower part may be produced as substantially pure fundamental tones, which, the frequency being low, will be almost completely shut off from the ear phones 15, but will pass readily through to the ear phones 16. If the fundamental tones of some of the lower soprano notes are of reduced intensity or are eliminated from the ear phones 15 the note will be reconstructed by the listener from the overtones. Effective separation is thus obtained and the arrangement is preferable ordinarily to one in which a larger number of recording grooves are provided on the sound record or in which a plurality of separate records are provided for the several parts. In order to facilitate the filtering of the separate tones, it has been found best, especially when recording electrically generated tones, to filter the tones as the records are being made. For this purpose the electrical currents of the soprano tones will be passed through a high-pass filter 19 before being applied to the phonograph cutter needle eliminating any low frequency components. Likewise the electrical current of the tenor, for example, will go through a low-pass filter 19a before being added to the soprano in driving the cutter needle jointly.

In order that the needles of the reproducing devices may enter the several sound recording

grooves synchronously and in order that they may be led immediately to the sound recording portions of the grooves during the first rotation of the record suitably marked bands **20**, **21**, **22** wide enough to permit easy placement of the needle are provided adjacent the entry ends of the recording grooves and these bands are traversed by spiral grooves **23**, **24**, **25** of high pitch which lead immediately to the sound recording grooves at the points at which the sound record actually begins.

For the purposes of reliability the guide bands **20**, **21**, **22**, should at least be bounded by grooves which will prevent the reproducing needle from moving prematurely into the recording groove or too far in the opposite direction. In the arrangement shown, each marked band consists of a number of shallow low-pitch grooves and the traversing grooves or high pitch grooves **23**, **24**, **25** are substantially deeper to control the needles. During the first rotation of the record the needles, prevented from slipping laterally by the shallow grooves, will enter the deep grooves and be led thereby immediately to the operative sound recording grooves.

Whether or not the shallow grooves are present the high pitch spiral groove and a low pitch spiral groove lead conjointly into each sound recording groove, whereby a needle placed on the band between these grooves will necessarily be led into the sound recording groove during the first rotation of the record. It will be noted that the high pitch spiral groove and the outermost low pitch spiral groove of the band of grooves form a V guide which guides each needle to the point of the groove and therefore into the record groove at a particular desired point. The low pitch groove may be the outer shallow groove of the band or a deep groove, that is to say a groove of usual depth, such a one being indicated at **23***a* in Figure 1. The two grooves join at the point **23***b* where in effect the sound recording groove begins.

In order further to facilitate accurate positioning of the needles and to provide that the same time interval shall always elapse between the starting of the turntable and the beginning of the music the several bands are distinctively marked for short sections, as indicated at **26**, **27**, **28** indicating that the record should be turned to bring these sections to position under the needles or under the indicating pointers adjacent the needles. As a further convenience for positioning the needles a raised disk **29** is provided at the center of the record against which the needle of the pick-up **7** may be placed when starting the record. The edge of the disk is perferably under cut, so that the needle will engage the clear surface of the record. An arrangement such as shown in which the reproducers engage the record on one substantially radial line, in contrast with an arrangement in which the reproducers are spaced circumferentially around the turntable, is preferable as permitting the cutting of the record by a plurality of cutting heads, one for each record groove, all positively connected and moved radially of the record by one feed screw during the recording.

Four parts, for example soprano, alto, tenor and base, may be recorded on one record such as shown in Fig. 1, all four parts being combined on one record section and two parts on each of the other two sections. For example, the soprano and tenor may be recorded on one section and the alto and bass on another.

An electrical diagram indicating conventionally such a possibility is shown in Fig. 3 in which the currents carrying the four parts received from the electrical organ circuits (or any other source) are impressed upon the respective grids of the tubes **30**. A cutter **31** is energized from the output of four tubes, one for each part, the current in each case passing through a volume control VC and amplifier **33**. Similarly cutters **34** and **35** are each energized from the output of two tubes but the current of the higher part is passed through a high pass filter and that of the lower part through a low pass filter in each case. Ear phones as indicated at **36** may be provided for use of singers or others who may be performing in different rooms and wish to hear an accompaniment or another part. It will be understood that various arrangements may require such listening while performing. An arrangement in which the parts are separately produced has the advantage that each part may be given the desired intensity to provide the proper balance in the whole composition. Obviously the same principle involving separately producing each part and adjusting the relative intensities of the parts can be applied whether the parts are produced vocally, as by singers in different rooms, or instrumentally or by mixed arrangements, and whether the total output is to be recorded on suitable records as herein described or delivered immediately to loud speakers by wire or by radio.

If the different grooves are to be cut separately by successive operations, it is necessary to provide a timing mechanism in order that exact synchronism may be maintained. For this purpose a number of spaced electrical contact elements or other circuit closing elements may be placed around the circumference of the phonograph record or the turntable as indicated at **40**.

The phonograph shown carries three pick-ups **5**, **6**, **7** to engage the three recording grooves of the record **10**. These pick-ups are carried on a supporting bar **41** and may be individually rotated upwardly about their respective pivots to inoperative position so that the operator may select which units are to be used in the particular case. Suitable provision is made for permitting a limited lateral movement of the pick-up by making the pivotal connections indicated at **42** somewhat loose but it will be understood that in view of the method of cutting the grooves they will be uniformly spaced and relatively little allowance need be made for such changes as are due to shrinkage of the record and the like. Each unit is provided with a weight balancing spring **43**, the tension of which may be adjusted by the set screw **44**. The support **41** is in turn carried for movement radial of the record by means of parallel links **45** which are pivoted at **46**. The weight of the supporting bar **41** and associated mechanism is balanced by counter weights **47** adjustably connected to the links as at **48** and can be lifted as a whole to carry all pick-ups clear of the record.

The foregoing particular description is illustrative merely and not intended as defining the limits of the invention. Various other embodiments may be developed within the scope of the invention. For example, different parts of a dialogue may be synchronously recorded in different grooves and reproduced in loud speakers positioned in different parts of a room for giving desired effects. Again, for the purposes of teaching first at a learning speed and later in regular time the same parts may be recorded in

different time on different sections of the same record.

I claim:

1. A phonograph record having a sound recording groove, a plurality of relatively shallow grooves at the entry side of said sound recording groove, a deeper spiral groove crossing said shallow grooves and leading into the sound recording groove whereby a reproducing needle may be engaged with any of said shallow grooves and upon rotation of the record will engage the cross groove during the first rotation and be led thereby into the recording groove.

2. A phonograph record having a plurality of low pitch recording grooves bearing correlated sound records for simultaneous reproduction by independent reproducing devices, a complete annular band adjacent each sound recording groove at the entry side thereof marked to facilitate placing a reproducing needle thereon and a transverse groove traversing each annular band diagonally and leading into the corresponding recording groove whereby reproducing needles resting on said annular bands will engage the transverse groove during the first rotation of the record and be led thereby into the recording grooves.

3. A phonograph record having a plurality of low pitch recording grooves bearing correlated sound records for simultaneous reproduction by independent reproducing devices, a band of relatively shallow grooves at the entry side of each sound recording groove, a deeper spiral groove crossing each band of shallow grooves and leading into the sound recording grooves whereby reproducing needles may be engaged with any of said shallow grooves of each band and upon rotation of the record will engage the cross grooves during the first rotation and be led thereby into the recording grooves in synchronism.

4. A phonograph record having a plurality of low pitch recording grooves bearing correlated sound records for simultaneous reproduction by independent reproducing devices, an annular band adjacent the entrance end of each recording groove to facilitate positioning of the independent reproducing devices and high pitch spiral grooves traversing said annular bands and leading into the recording grooves each band having a distinctively marked short needle receiving section whereby the reproducing devices can be manually placed with the needles engaging the distinctively marked sections and upon rotation of the record said needles will be synchronously led into the recording grooves.

5. A sound record having a sound recording track in which are recorded, for simultaneous reproduction, two parts of a musical composition the higher part being recorded as a tone of complex quality and the lower part being recorded in substantially pure fundamental tones.

6. A sound record having a plurality of sound recording tracks bearing correlated sound records for simultaneous reproduction by independent reproducing devices, each track having recorded therein two parts of a musical composition, the higher part being recorded as tones of complex quality including harmonics and the lower part being recorded as substantially pure fundamental tones, whereby the higher and lower parts can be separated by tone filters, substantially as described.

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