

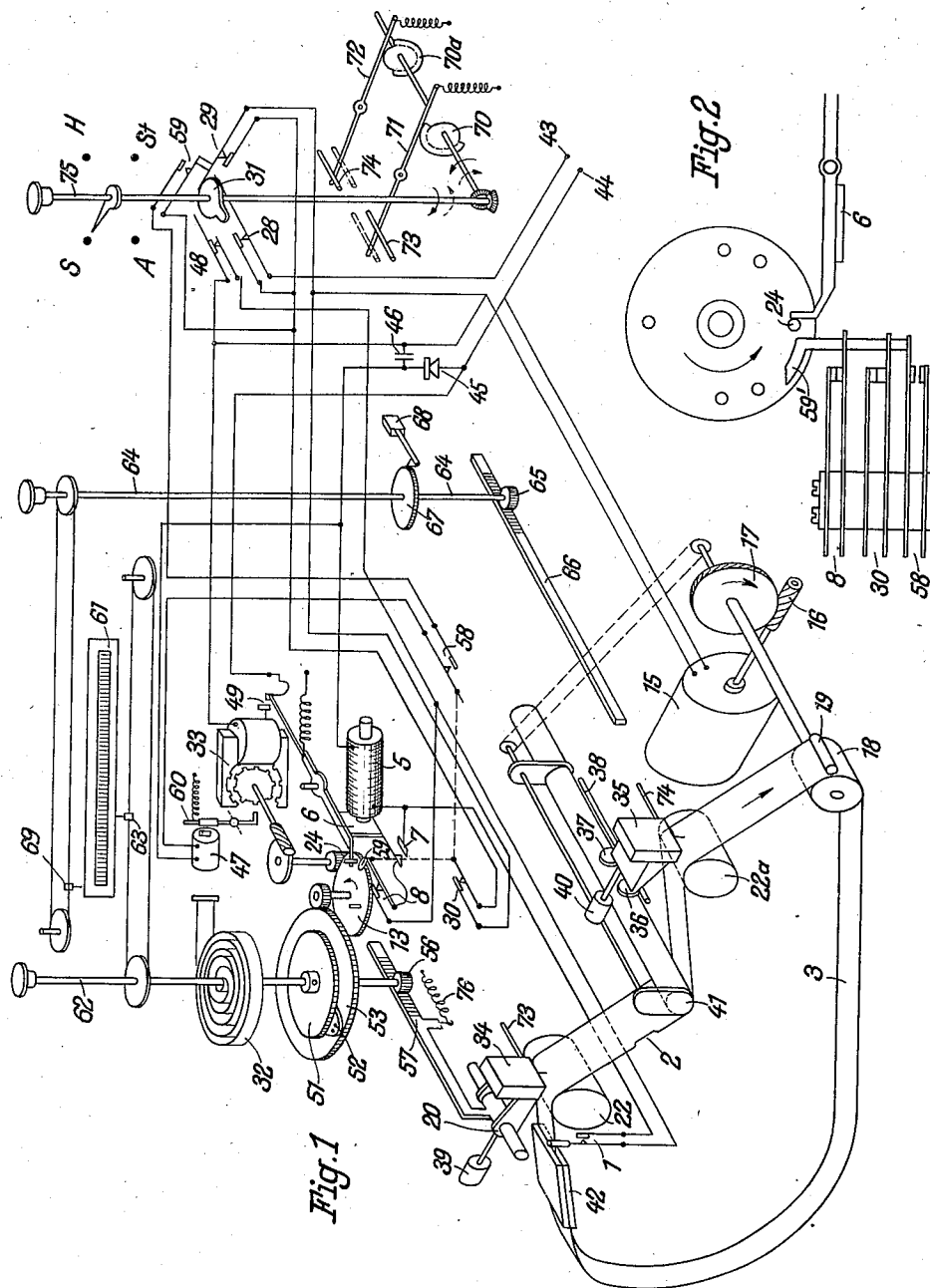
Aug. 8, 1939.

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2,168,792

SOUND RECORDING AND REPRODUCING APPARATUS

Filed Dec. 29, 1937



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UNITED STATES PATENT OFFICE

2,168,792

SOUND RECORDING AND REPRODUCING
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GermanyApplication December 29, 1937, Serial No. 182,179
In Germany January 2, 1937

11 Claims. (Cl. 274—11)

This invention relates to a sound recording and reproducing apparatus for recording and reproducing on endless band-like sound carriers by means of a plurality of longitudinally running sound tracks.

In such sound apparatus as hitherto known, the passage or transference between two adjacent sound tracks is effected by relative transverse displacement between the sound carrier and the sound box in dependence on an electrical impulse which is released by a contact mark provided on the sound carrier.

If, in such sound apparatus, relatively long sound carriers are employed, then it is, in practice, essential to be able to trace or find rapidly and surely the commencement of a sound record on the sound carrier and the principal object of this invention is to provide means for enabling this to be done.

According to the invention, in the circuit containing the means for effecting the relative displacement between the sound box and the sound carrier, is inserted a switch which, with the sound carrier moving, effects as desired either the said transverse displacement or the stopping of the sound carrier when an electric circuit is closed by the contact mark on the sound carrier. If, therefore, it is desired to ascertain, in the case of sound recording, the commencing position of the sound carrier or, in the case of sound reproducing, the commencement of the sound record, then all that is necessary is for the aforesaid switch to be brought into the required control position whereupon the sound carrier will be driven until it is automatically stopped by the closing of an electric circuit by the contact mark provided on the said carrier. Advantageously, care should be taken that this control position is only possible when the sound boxes are shut off or disconnected so that the sound carrier automatically finds its commencing position, so to speak, without any load. In the carrying out of the invention a number of features are provided which relate to a suitable arrangement and assembly of the control elements in accordance with the invention in the complete wiring diagram of the sound apparatus.

In order that the invention may be fully understood, we shall now describe one embodiment thereof by way of example by reference to the accompanying diagrammatic drawing, in which:

Fig. 1 is a perspective view of the most important parts of a sound recording and reproducing apparatus embodying the invention, together

with the pertaining electrical and mechanical control devices, and

Fig. 2 is a plan view of a detail to an enlarged scale.

The various control positions "A—out", "S—recording", "H—reproducing" and "St—stop" are effected by rotation of the control rod 75 which carries the cam disc 31. In the position "A—out" the main switch 28 is opened whereby the whole mechanism is cut off from the current supply. In the remaining control positions, the switch 28 is closed so that the motor 15 also receives current in the position "St—stop". In the position "S—recording", the switches 28, 48 and 29 are closed whilst the switch 59, coupled with the switch 29, is opened. In the position "H—reproducing", the switch 48 is opened whilst the remaining switches are not actuated. In the position "St—stop", the switch 29 is opened and the switch 59 closed, the switches 28 and 48 being likewise closed.

The endless band-like sound carrier 3, which runs over two rollers 22 and 22a is formed with a marginal recess 2 in which, on each revolution of the sound carrier, engages a contact pin which thereby closes momentarily the contact 1. The sound carrier is driven by a motor 15 through the gears 16 and 17 by means of the toothed drum 18 on which it is held by the press roller 19. The recording of the sound tracks is effected according to the needle sound method. The sound tracks are cut into the film by the positively transversely moved cutting or recording box 34 and are reproduced or listened to by the reproducing sound box 35, the needle of which is guided in the sound track. For this reason, the reproducing sound box 35 is freely movable on a supporting rod 38 by means of rollers 36 and 37. For relieving the sound boxes of load or for correct weight adjustment thereof in relation to the hardness of the material constituting the sound carrier, adjustable counter-weights 39 and 40 are provided. A brake path 42 is arranged in front of the cutting box 34 for the purpose of smoothing or steadying the sound carrier 3 which rotates with uniform speed in the direction of the arrow (Fig. 1). A continuous smoothing of the sound carrier is effected between the rollers 22 and 22a by deflection or changing the direction of travel of the sound carrier, which is preferably produced by the shaving remover 41 which is also driven by the motor 15.

For effecting the transverse movement of the slide 20 of the cutting box 34, a wound-up spring

32 is provided, the running down of which, after being released, is controlled or retarded by the electromagnet 5 by means of a small synchronous motor 33 or another suitable control, for example a vane wheel.

If it is desired to commence recording, the cam disc 31 is first rotated to "St—stop" whereby the switch 29 is opened and the switch 59 is closed. The motor 15 is now switched in and the circuit is completed from the network at 43 through the main switch 28, the contact 30, arranged in parallel with the switch 29 to the motor 15 and back into the network at 44.

In parallel with the motor connection is a rectifier 45 and a smoothing condenser 46. The rectifier 45 serves for feeding the electromagnets 5 and 47.

As soon as the recess 2 in the sound carrier 3 closes the contact 1, continuous current flows through the rectifier 45 to the electromagnet 5, the clutch or contact 1, switch 48, contact 30 and through the main switch 28 into the network at 43 from which it was taken at 44. The electromagnet 5 draws the armature 6 whereby the contacts 7 and 49 are closed. In series with the contact 7 is the contact 8 which itself is inserted in parallel with the contact 1 of the sound carrier. The magnet 5 thus remains excited even after opening of the contact 1 owing to the passage of the recess 2 in the sound carrier 3 and thus retains its armature 6.

The armature 6 releases the pin 24 on the contact disc 13. Thus the contact disc 13 is rotated under the action of the wound-up spring 32 through the locking pinion 51 and the pawl 52 arranged on the pinion 53, the uniform rotation of the said disc 13 being controlled by the synchronous motor 33 which has received current owing to the closing of the contact 49. The path of the current to the synchronous motor 33 is from the network at 44 through the contact 49, the synchronous motor 33, contact 30 and the main switch 28 back to the network at 43.

A toothed pinion 56, which is in engagement with a rack 57 secured to the slide 20, is carried by the spindle 62 of the spring 32 at the lower end thereof so that, on the rotation of the spindle 62, a transverse movement of the sound box 34 takes place. The transverse movement of the sound box 34 continues until the pin 24, provided on the contact disc 13 or another pin, runs against the cam 59' of the contact 8. As shown in Fig. 2, the contacts 30 and 58 are coupled to the contact 8 in such a manner that, on the opening of the contact 8 by the engagement of the pin 24 with the cam 59', the contact 30 is simultaneously opened and the contact 58 closed. On the opening of the contact 8, the armature 6 is first released as the contact 8 is in series with the contact 7 and thus the electromagnet 5 is disconnected.

The opening of the contact 30 interrupts the circuit to the motor 15 which is thus stopped. The closing of the contact 58 allows a continuous current to flow from the network at 44 through the rectifier 45 to the electromagnet 47 and through the contact 58, the switch 59, which is closed with the control on "St—stop", and the main switch 28 back into the network at 43.

The electromagnet 47 draws its armature 60 towards itself and thus stops the further running of the synchronous motor and the unwinding of the spring 32 and consequently also stops the further transverse movement of the cutting box 34.

A spring 76, engaging the rack 57, equalises the tooth space between the rack 57 and the pinion 56 and connects the two in a force closure manner. The spring 76 can, however, be made sufficiently strong that thereby the spring 32 may be dispensed with.

The sound carrier 3 is now in the commencing position and the whole arrangement can be put out of circuit by turning the cam disc 31 to "A—out" as the main switch 28 is then open. The cam disc 34 may, however, also be turned to the position "S—recording" or "H—reproducing".

In all the three positions, "S—recording", "H—reproducing" and "A—out", the switch 59 is always opened. The electromagnet 47 is thus not supplied with current and the armature 60 is left free and also the synchronous motor 33. The contact disc 13 thus rotates for a fraction of its path until its pin 24 strikes against the armature 6, whereupon the cam 59 of the coupled contacts 8, 30 and 58 is freed and the contacts 8 and 30 are closed and 58 opened.

The switch 29 closed when the cam disc 31 is on "S—recording" and "H—reproducing", prevents, during recording and reproducing, the motor 15 from being put out of circuit and thus stopped owing to the interruption or the breaking of the contact 30 after the transverse movement of the sound box 34 has been effected.

When the cam disc 31 is turned to "Reproducing", the switch 48 is opened. As this switch 48 is in series with the contact 1, then on the closing of the said contact at the control position 2, no transverse movement of the reproducing or listening box 35 can take place. This is indeed superfluous as the needle of the box 35 is automatically guided in the sound tracks.

It will be obvious that a positive transverse movement must be given to the box 35 if the sound apparatus is operating in accordance with the light sound method. In this case, the switch 48 is omitted and the control current for the magnet 5 passes instead to the magnet which releases the transverse movement of the sound box 35.

As, in the various control positions, a predetermined position of the sound boxes is necessary, a device is provided whereby the necessary position of the sound boxes is automatically obtained in dependence on the rotary movement of the control rod 75. For this purpose, a shaft, carrying control cams 70 and 70a, engages the control rod 75 by means of a bevel gear. On these control discs are pressed resiliently double-armed levers 71 and 72, the free ends of which engage under pins 73 and 74 of the swingably carried sound boxes 34 and 35. The arrangement of the control discs 70 and 70a is such that in the position "St—stop" and "A—out" both boxes are raised from the sound carrier 3 whilst, in the position "S—recording", the box 35, and, in the position "H—reproducing", the box 34, is held in the raised position.

In order to keep a check on the recordings on a sound carrier and in order rapidly to be able to find the individual recordings, a scale 61 is provided, over which two pointers 63 and 69 are movable. The pointer 63 is coupled to the shaft 62 of the spring 32 by a tension cord or in any other suitable manner. It shows how many sound lines have been made on the sound carrier during recording.

On the scale 61 itself marks indicating the beginning and end of each sound recording can be made. Moreover, the mass of the sound record

is given or registered on the scale so that, by providing exchangeable scales, these can be used as an indication of the contents of any sound carrier. In order, on the reproduction of a sound carrier, to pick up any sound recording, the scale appertaining to the sound carrier is placed in position, whereupon the pointer 69 is adjusted to the commencement of the desired part to be reproduced. The pointer 69 is coupled with a shaft 64 which is in engagement through the pinion 65 and the rack 66 with the reproducing sound box 35, so that, on the displacement of the pointer 69, the sound box 35 is at the same time displaced transversely to the path of the sound carrier. In order to be able to obtain an accurate adjustment to the desired sound track, a stop wheel 67, with a stop 68, is provided on the shaft 64, the wheel 67 being provided with teeth corresponding in number to the number of sound tracks which can be made on the sound carrier.

As all the control positions of the sound apparatus are produced by means of a common control shaft 75, a remote control of the sound apparatus can obviously be effected in a simple manner.

I claim:

1. In a sound recording and reproducing apparatus of the type referred to, the combination of: a sound box; a longitudinally movable endless sound carrier associated therewith; means for driving said sound carrier; an electric circuit for actuating said driving means; a second circuit operable to effect relative transverse movement between said sound carrier and said sound box; an electromagnet included in said circuit; a pivoted armature associated with said magnet; means operable by said electromagnet for effecting said relative transverse displacement; a normally-closed contact arranged in parallel with said second circuit; a normally-open contact arranged in series with said parallel-arranged contact, said open contact being adapted to be closed on movement of said armature; a second normally-closed contact included in both said circuits, a switch arranged parallel with said second contact, and a main contact adapted to be closed by movement of said sound carrier to effect said transverse displacement and, with said switch closed, to allow of continuation of movement of said carrier and, with said switch open, the stopping of said carrier.

2. In a sound recording and reproducing apparatus, the subcombination of: a sound box; a longitudinally movable endless sound carrier associated therewith; driving means for said sound carrier; an electric circuit for actuating said driving means; a second electric circuit for effecting relative transverse displacement between said sound carrier and said sound box; means for retarding said displacement; a switch in series in said first-mentioned circuit, and a main contact in said second circuit operable, on movement of said carrier, to close said circuit, whereby in one position of said switch said relative transverse movement may be effected with continued longitudinal movement of said carrier and in another position thereof, said carrier is stopped.

3. In a sound recording and reproducing apparatus, the subcombination of: a sound box; a longitudinally movable endless sound carrier associated therewith; means for driving said sound carrier; mechanism for effecting relative transverse displacement of said carrier and said sound box, said means including a rotatable disc having

a pin thereon, said disc being operatively connected by gearing to said sound box; an electric circuit for controlling said carrier driving means; a second electric circuit for controlling said displacement mechanism; a normally open contact in said second circuit, said contact being adapted to be closed momentarily by movement of said carrier therepast; a second normally-closed contact in both said circuits; and a switch in parallel with said last-mentioned contact, the arrangement being such that, on the closing of said first-mentioned contact by movement of said carrier, said disc is caused to rotate to effect the required transverse displacement of said sound box, whereupon said pin on said disc opens said second mentioned contact thereby breaking said second electric circuit, said carrier driving means circuit being also broken if said switch is open and remaining closed if said switch is closed.

4. In a sound recording and reproducing apparatus, the subcombination of: a sound box; a longitudinally movable endless sound carrier associated therewith; driving means for said carrier; an electric circuit for actuating said driving means; operable to effect relative transverse displacement of said sound carrier and said sound box; a synchronous motor associated with said second circuit operable to retard said means; means for preventing rotation of said synchronous motor; a main contact in said second circuit adapted to be closed by passage of said carrier therepast; and a switch in series with said first-mentioned circuit, said switch being adapted, in one position thereof, after a transverse displacement of said sound box has been effected, to allow continuation of movement of said carrier and in another position thereof to stop said carrier.

5. In a sound recording and reproducing apparatus, the subcombination of: a sound box; a longitudinally movable endless sound carrier associated with said sound box; means for driving said carrier; mechanism for effecting relative transverse displacement of said carrier and said sound box, said means including a rotatable disc having a pin thereon; and said disc being operatively connected to said sound box; means for rotating said disc; an electric circuit for controlling said carrier driving means; a second electric circuit for releasing said disc rotating means; a normally-closed contact arranged in both said circuits, said contact being adapted to be opened by the striking of said pin thereagainst on rotation of said disc on release of said mechanism; a synchronous motor operatively connected to said disc for retarding the rotation thereof; an electromagnet associated with said synchronous motor; an armature for said electromagnet operable on energisation of said magnet to lock said synchronous motor against rotation; a circuit for actuating said electromagnet; a normally-open contact in said circuit, said contact being adapted to be closed on the opening of said normally-closed contact; a switch in parallel with said normally-closed contact; a second switch associated with said first-mentioned switch and included in the circuit of said electromagnet in such manner that said switch is open when said first-mentioned switch is closed whereby, when said first-mentioned switch is closed, said carrier driving means circuit remains closed and said electromagnetic circuit is open.

6. In a sound recording and reproducing apparatus, the combination of: a longitudinally movable endless sound carrier; a recording sound

box associated therewith; means for moving said carrier; means for effecting relative transverse displacement of said carrier and said sound box and a single control means, operable on movement of said carrier, for actuating said transverse displacement-means and for stopping the movement of said carrier at any predetermined point on said carrier.

7. In a sound recording and reproducing apparatus, the combination of: a longitudinally movable endless sound carrier having a marginal recess at any predetermined point therealong; a recording sound box associated therewith; electrically-controlled means for moving said carrier; electrically-controlled means for effecting relative transverse displacement of said carrier and said sound box and a single main contact member associated with said electrically-controlled means adapted to be closed on passage therepast of said marginal recess in said carrier to set said transverse displacement means in operation and to stop the movement of said carrier after a transverse displacement has been effected.

8. In a sound recording and reproducing apparatus of the type referred to: a longitudinally movable endless sound carrier; a recording sound box associated therewith; means for driving said sound carrier; a first electric circuit for actuating said driving means and a second circuit for effecting relative transverse displacement between said sound carrier and said sound box; a normally closed contact included in both said circuits and adapted to be opened at the end of said relative transverse movement; a switch arranged in parallel with said contact; and means, operable on movement of said carrier, to close said second circuit to cause, in one position of said switch, said transverse displacement with continued movement of said carrier in the same direction and in the other position of said switch, said transverse displacement and subsequent stoppage of said sound carrier.

9. In a sound recording and reproducing apparatus of the type referred to: a longitudinally

movable endless sound carrier; a recording sound box and a reproducing sound box associated with said carrier; means for moving said carrier; means for effecting relative transverse displacement of said carrier and said recording sound box; a single control means, operable on movement of said carrier, for actuating said transverse displacement means and for stopping the movement of said carrier at any predetermined point on said carrier; and means for moving said sound boxes towards and away from said sound carrier as required.

10. In a sound recording and reproducing apparatus, the combination of: a longitudinally movable endless sound carrier; a recording sound box associated therewith; means for moving said carrier; means for effecting relative transverse displacement of said carrier and said sound box; a single control means, operable on movement of said carrier, for actuating said transverse displacement means and for stopping the movement of said carrier at any predetermined point on said carrier; and an indicating device, operable on said relative transverse displacement, for indicating the extent of a recording.

11. In a sound recording and reproducing apparatus of the type referred to: a sound box; a longitudinally movable endless sound carrier associated therewith; means for driving said sound carrier in one direction; a first electric circuit for actuating said driving means; and a second circuit adapted to be closed by movement of said carrier to effect relative transverse displacement between said sound carrier and said sound box; a normally closed contact included in both said circuits and said contact being adapted to be opened momentarily at the end of said relative transverse movement; and a switch in parallel with said contact, said switch being adapted, in the closed position, to maintain said first circuit closed, in spite of the opening of said contact, for the purpose specified.

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