

Dec. 25, 1934.

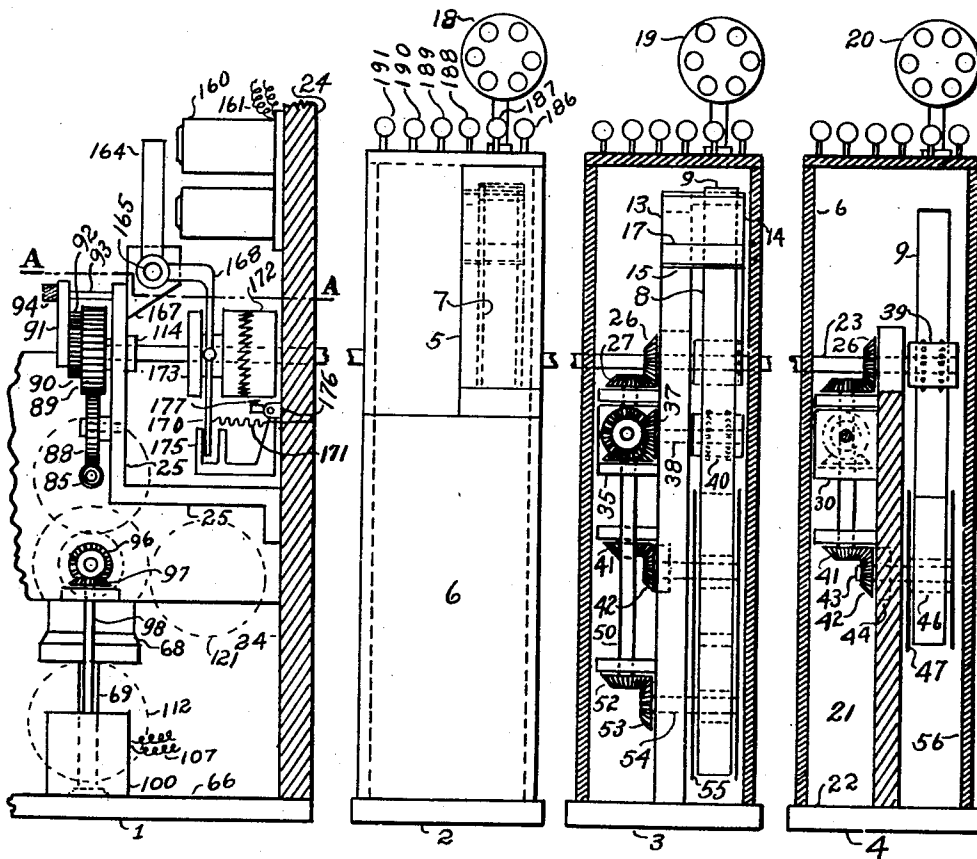
E. S. HOPKINS

1,985,253

MULTIPLE ACOUSTIGRAPH

Filed July 15, 1929

3 Sheets-Sheet 1



Inventor:

Edwin S. Hopkins

Dec. 25, 1934.

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3 Sheets-Sheet 2

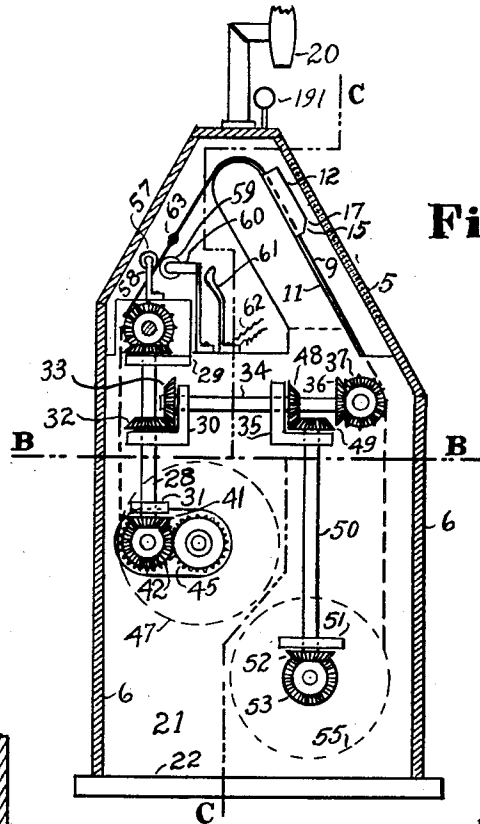


Fig. 2.

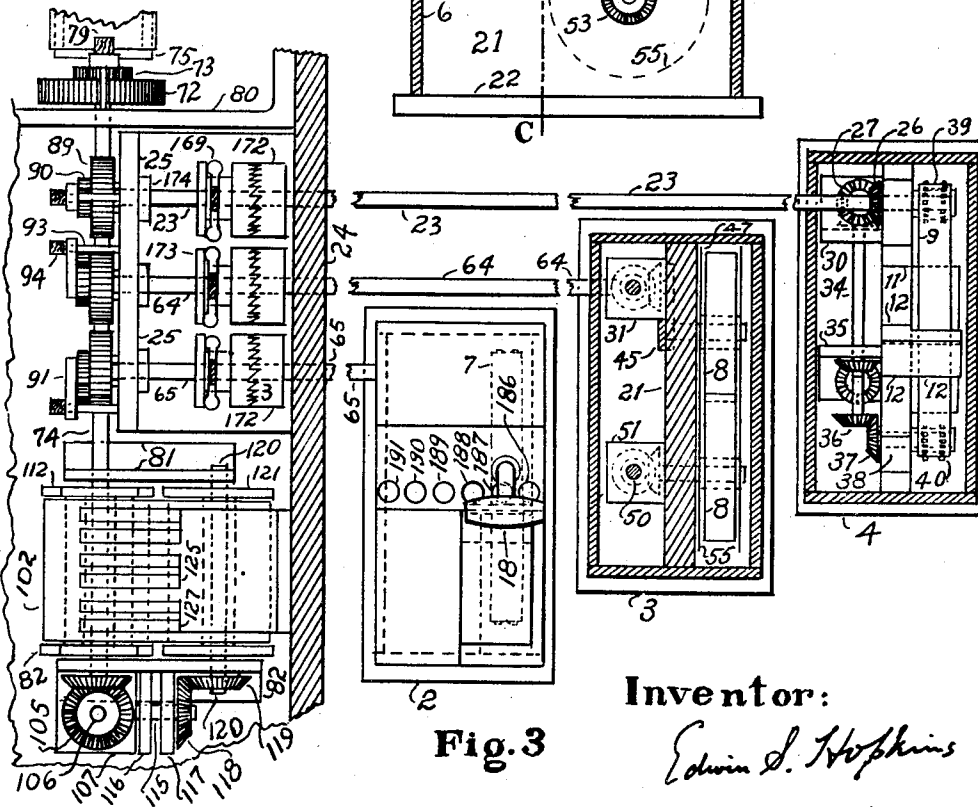


Fig. 3

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3 Sheets-Sheet 3

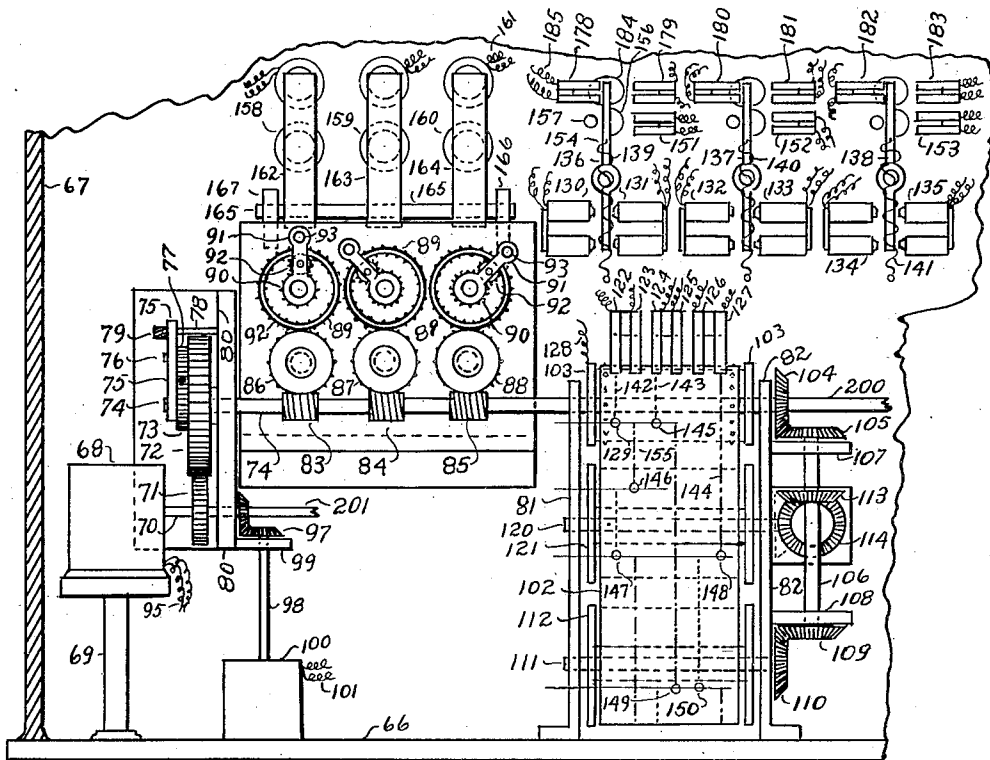


Fig. 4

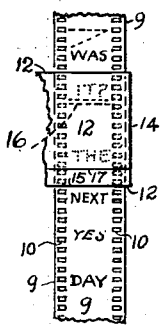


Fig.5

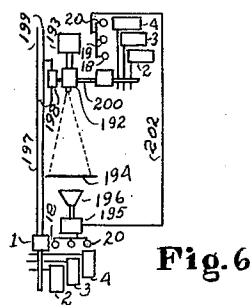


Fig. 6

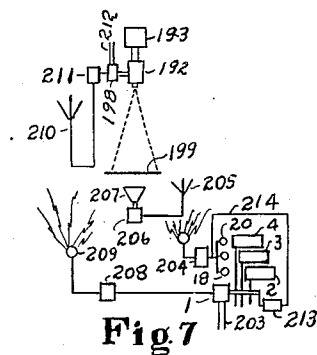


Fig. 7

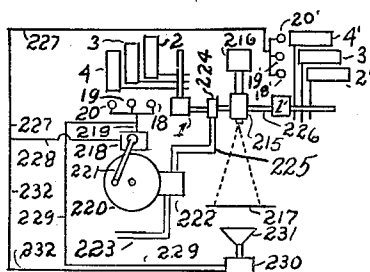


Fig.8

Inventor:

Edwin S. Hopkins.

UNITED STATES PATENT OFFICE

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MULTIPLE ACOUSTIGRAPH

Edwin S. Hopkins, New York, N. Y.

Application July 15, 1929, Serial No. 378,538

17 Claims. (Cl. 88—16.2)

The main purpose of my invention is to enable a group of actors and singers to perform a text of words and music synchronously with the exhibition of a motion picture film of analogous subject matter. Such a synchronous performance may be delivered directly to the public, or their voices may be amplified and transmitted to an auditorium, or their voices may be broadcast and received in a number of different auditoriums where motion picture machines with duplicates of the film may be run synchronously, so that the one group of performers supply vocal effects for many motion pictures simultaneously. Their voices may also be recorded on phonographs of any type.

My invention includes means of exhibiting to the performers the text to be made audible which indicates to the performers the exact instant for the utterance of each syllable and note. The text exhibiting apparatus is operated in synchronism with the cinematograph. In broadcasting the several cinematographs are run in synchronism with the broadcasting from the exhibiting machine.

As a variation of $\frac{1}{2}$ of a second between film and sound will destroy the effect of the synchronism, it is necessary that the performers be guided with the greatest exactness. I provide the means for doing this, as hereinafter explained in detail.

In carrying out my invention I find it generally desirable to employ the herein described apparatus, processes and manufactures, but it is to be understood that in carrying out the objects of my invention, less than all the different means, mechanisms, processes and manufactures herein described may be employed for some uses; or parts only may be employed; or other mechanisms, processes and manufactures similar may be substituted, and while the preferred forms embodying my invention are shown, it is to be understood that many of the structural details may be varied and many changes in details and steps resorted to, without departing from the scope and spirit of my invention, nor do I limit myself to the specific devices, manufactures and processes shown, although I believe them especially suited to the ends to be attained by my invention.

In the accompanying drawings, which are largely diagrammatical, and in which many parts are omitted from particular figures, and which are not to be considered as working drawings but merely as illustrations of the principles of the invention; and which form a part hereof; and in which the same reference letters and nu-

merals indicate the same or corresponding parts:

Fig. 1 is a front elevation of the apparatus, showing controller unit 1 and exhibitor units 2, 3 and 4; unit 2 being a front elevation with the cover on, unit 3 being a front elevation with the cover cut away, and unit 4 being a vertical, cross sectional elevation on line C—C of Fig. 2, as seen from the front;

Fig. 2 is a side elevation of unit 4, as seen from the controller, with the cover cut away;

Fig. 3 is a plan, showing unit 2 as seen from above, with its cover on; unit 3 as a sectional plan on line B—B of Fig. 2, and unit 4 is a plan with the upper part of the cover cut away;

Fig. 4 is a side elevation of the controller, looking towards the exhibitor units;

Fig. 5 is a plan of a strip of text for exhibition, with the indicator plate shown;

Fig. 6 is a diagram of the apparatus and connections as it may be used in a theatre;

Fig. 7 is a diagram of the apparatus and connections as it may be used in broadcasting to multiple theatres; and

Fig. 8 is a diagram of the apparatus as used for making phonograph records.

It is to be noted that a greater or less number of the exhibitors units, as 2, 3 and 4, may be provided than the three shown.

Elements, such as a controller and one or more units may be located in widely separated places, geographically, and the performers in one location may play certain roles and those in other cities may play the other roles, all being received in a central location and broadcasted to the various theatres running the analogous motion picture. In this case the controllers are run in synchronism and vocal effects are transmitted to the central location, preferably by land wires, and then broadcasted, the various cinematographs running in synchronism with the controller units.

Exhibitor units 2, 3 and 4 carry text exhibitor strips 7, 8 and 9, visible to performers through glass windows as 5, set in the upper front part of covers, as 6. Text exhibitor strips 7, 8 and 9 bears words and musical notations in accordance with the work to be broadcasted. Strip 9 is shown in detail in Fig. 5.

For the purpose of making exhibitor strips, pieces of fogged but undeveloped cinematograph film are useful, as it has sprocket feed holes and the emulsion takes ink. Or paper strips may be used when provided with sprocket feed holes, as 10.

Strip 9 is drawn upwards along runway 11 and

passes under a semi-transparent or translucent reading-line plate 12, supported by the runway 11 at edge 13. Edge 14 of plate 12 is open to allow the film to be easily threaded into place from the side.

This text strip contains words for performers,

25
10
Was
it?
The
next
YES
day.

15 The word "next" is about to pass under the lower edge 15 of reading-line plate 12. The word "next" must be read exactly as it passes under the lower edge of the reading-line plate. In the case of words of several syllables, each syllable is separated and each passes under the reading-line at the proper moment for utterance. As speech runs up to 300 words per minute or five words per second, if they average three syllables there will be 15 syllables per second. Each syllable takes $\frac{1}{3}$ of a second. If a displacement of $\frac{1}{3}$ of a second occurs synchronism is destroyed. It is clear, therefore, that the moment of utterance of each syllable must be exactly indicated.

30 The words, "... was it?" are the cue for the speech, "The next day." The dotted lines indicate the omission of a portion of the previous speech. The words "... was it?" are thus the signal for the next speaker to begin his speech. 35 The cue words may be in a different color or in a different font of type.

In the illustration Fig. 5, the word "The" has already been spoken, and is shown in dotted lines as being under the semi-transparent plate 12. 40 The cue is shown at 16. The plate here indicated is of thick glass, the lower edge bevelled between lines 17 and 15. A paper-thin transparent plate may be used, such as transparent celluloid.

45 The word "YES" indicated in italics, is an interjection of another speaker, to be spoken as the word passes under line 15. The word "yes" may appear on the strip of another exhibitor unit. Placed on strip 9 it enables exhibitor unit 50 4 to be used by two speakers. Or if the speaker of the word "Yes" is using another strip, its presence on strip 9 will prevent the speaker using strip 9 from being confused by an unexpected interpolation of another word in his speech.

55 A wider strip than indicated may be used, in which case the roles of several speakers could be placed in separate columns, instead of interlarded, as "next", "Yes" and "day". The words of different speakers using the same strip may 60 be in different colors or in different styles of print or script.

When three units are used with one speaker to each unit, two are idle while one is speaking. When the scene changes one or more of the performers may not be required on the next scene. They may then stand aside and allow the units to be used by other speakers. Thus one textual strip may have the role of one player at one location, then display the role of another player, and eventually go back to the role of the first player. Thus two or more roles may be provided on one strip. Or one player may from time to time find portions of his role on different strips. This enables the strips to be 75 economized, as if there were a strip for every

speaker a great length of film stock would be required, most of the strips being taken up with blank spaces while one player is speaking.

In case the performers are on the stage of a theatre behind or to one side of the cinematograph screen, they may utter the sounds directly to the audience. It is unnecessary for them to gaze at the screen itself, in fact impossible for them to get good results by doing so, as they cannot recognize the lip movements on the screen until they are made, and it is then too late to utter the requisite sounds in synchronism. They must pay very close attention to the words passing under the strip to utter them at the proper instants. In case the voices are to be amplified and transmitted to a distance, the players may speak into the microphones as 18, 19, 20, or one microphone may be provided for all.

It is extremely desirable for the performers to see the words after they have passed the reading-line, and to have some differentiation made in the words after they have passed the reading line. If the words disappeared under an opaque reading indicator a great deal of uncertainty and confusion would exist and synchronism would be difficult to maintain while unnatural effects of haste would be caused in voices. Thus the words being a little less distinct after passing under the reading-line but still being visible enables the performer to gauge with great exactness the instant of utterance. If the words were arranged longitudinally and the strip moved horizontally it would be impossible to maintain synchronism, exactly, as the passing of the words and syllables longitudinally would not be with the same exactness, as a considerable interval would exist between the beginning and end of the word and the performer could not time perfectly, as is possible when the words are arranged on a strip moving vertically. 40

It is also of great importance to have the strip move at a certain speed, approximately $22\frac{1}{4}$ feet per minute, or one-fourth the speed of the cinematograph film. If the strip were made as long as a cinematograph film, the words would be at a considerable distance apart and would move so rapidly as not to be easily distinguished. If the strip were made to move at say 10 feet per minute, they would pass the reading-line so slowly that the proper instant of utterance could not be selected by the performer. A factor, of course, is the actual size of the words on the strip; if the words be made smaller a shorter film strip may be used. The proportions indicated in the drawings are the happy medium which it is necessary to attain to insure success. As but a difference of $\frac{1}{3}$ of a second too soon or too late is enough to destroy the effect of synchronism, the discovery of the proper proportions, speeds and arrangement of the text strip is one of importance, which required actual reduction to practice to isolate.

In order to position the words on the text strip at the proper locations, the talking motion picture may be made and then the cinematograph film and sound record are run simultaneously in connection with a blank strip run at one fourth the velocity of the cinematograph film. As the words are heard they may be marked down on the blank strip. This is a tedious process. The marking may also be assisted by observation of the individual "frames" of the cinematograph film and microscopic examination of the sound record. The precise location of the words 75

may thus be ascertained. From the first text strip made negative and positives may be made by photographic processes.

My invention provides means for operating a plurality of such text strips in synchronism with a cinematograph film, and also means for bringing the strips into synchronism with the film should they accidentally get out of synchronism.

Central standard 21 is mounted on base 22, and carries the apparatus. Cover 6 is placed over the apparatus to deaden sounds of mechanism. The microphone 20 may be placed on the cover or may be separately supported, as by being suspended from overhead.

The units 2, 3 and 4 are identical in construction and most of their parts are given the same reference numerals. Shaft 23 of unit 4 drives its apparatus. Shaft 23 is journaled in standard 21 and in standard 24 and its lug 25, of the controller 1. Shaft 23 carries mitre gear 26 which engages mitre gear 27 on shaft 28 journaled in lugs 29, 30, 31.

Shaft 28 also carries mitre gear 32 which engages mitre gear 33 on shaft 34, journaled in lugs 30, 35. Shaft 34 carries mitre gear 36, which engages mitre gear 37 on shaft 38 journaled in standard 21. On the right hand side of standard 21 as regarded in the drawings shaft 23 carries feed sprocket 39 for strip 9, while in the same position shaft 38 carries feed sprocket 40, which draws the strip up from the reel below.

Runway guide pillar 11 constitutes the upper part of standard 21 and strip 9 passes from sprocket 40 up under plate 12 and over the rounded top of the pillar 11, and is drawn down by sprocket 39; the rotation of which in a counter clockwise direction causes this to take place. Sprocket 40 also rotates in a counter clockwise direction and at the same speed as sprocket 39, and the strip is threaded taut between them. It thus passes under plate 12 at the speed determined by the sprockets.

Jockey rollers to hold strip 9 in place on the sprockets may be provided if desired.

The lower end of shaft 28 carries mitre gear 41, which meshes with mitre gear 42 rotating on stud 43 set in standard 21. Integral with mitre gear 42 is a spur gear portion 44, rotating in a well in standard 21, and engaging spur gear 45, which is in a similar well and is mounted on spindle 46, journaled in 21. The other end of spindle 46 carries winding reel holder 47 for winding the slack of text strip 9 after it passes sprocket 39.

Shaft 34 carries mitre gear 48, which engages mitre gear 49 on shaft 50, journaled in lug 35 and lug 51. The lower end of shaft 50 carries mitre gear 52, which engages mitre gear 53, mounted on shaft 54, journaled in standard 21. The other end of shaft 54 carries winding reel holder 55. When the apparatus is in operation, as reel holder 47 winds reel holder 55 unwinds. The gearing would indicate that these speeds are equal, but the holders are mounted frictionally on the shafts so that the differences in diameters of the strip may be accounted for.

Side 56 of cover 6 is readily removable so that new reels may be inserted. By reversing the machine the strips may be re-wound on the initial reel holders, or the strips may be threaded between reels 55 and 47 and re-wound without passing over pillar 11. Or the re-winding may be accomplished after the reel holders are removed.

Should any special signals be desired to be sent at selected locations on the text strip, means are provided therefor, illustrated only in Fig. 2.

Roller 57 is carried in rigid standard 58 mounted on standard 21. Roller 59 is carried on flexible standard 60 mounted on standard 21. Electrical switch flexible contacts 61 are connected to any circuit desired from terminals 62. Protuberance 63 is attached to text strip 9 where desired. When it passes between rollers 57 and 59, standard 60 is forced to the right as regarded in Fig. 2, and effects an electrical contact at 61. Instead of a protuberance at 63 an aperture may be made in the strip, and well known means utilized for making an electrical contact. The circuit so completed may be used for a variety of purposes, such as stopping the apparatus, starting other apparatus, indicating signals to orchestra leaders, causing sounds of automatic instruments to be made and as signals to the performers, etc.

Rollers 57—59 also serve as a guide to lead strip 9 to sprocket 39.

As seen in plan, Fig. 3, the exhibitor stands 2, 3 and 4 are staggered. This allows shafts 23, 64 and 65 to reach standard 24. Additional exhibitor stands may be provided by enlarging the controller to provide for them.

The controller apparatus is mounted on standard 24, supported on base 66, and having rear wall 67, and other walls and ceiling not indicated. The controller apparatus is thus isolated from the microphones acoustically.

Motor 68 mounted on pedestal 69 has main shaft 70, to which is affixed spur gear 71, engaging the external teeth of an internal-external spur gear 72, which is the first member of a planetary gear system. Spur gear 73 is mounted on shaft 74 and its hub serves as an axis for spur gear 72. Thus 72 and 73 are concentric. Gear 73 is fixed to shaft 74. Mounted on the end of shaft 74 as an axis about which it turns freely is arm 75, this arm thus being concentric with 74, 72 and 73. To arm 75 is affixed stud 76 which serves as an axis for spur gear 77, which engages spur gear 73 and the internal teeth of spur gear 72. Manually operable stop plunger 78, with knob 79 which contains a spring forcing rod 78 against face of lug 80, holds arm 75 in any position in which it is manually placed. Spur gear 77 may thus be rotated about 74 as a center, it being the planet gear for gear 73 as the sun. The rotation of arm 75 thus serves to alter the angular attitude of motor shaft 70 and driven shaft 74. If rotated during operation the speed of 74 as regards 70 is altered. Thus if motor 68 is running synchronously with a cinematograph, but for some reason the text strips are ahead or behind, the rotation of arm 75 in one direction or the other will correct such a discrepancy.

Shaft 74 is journaled in lug 80 and also in standards 81, 82 attached to base plate 66. Shaft 74 carries worm gears 83, 84, 85 affixed to it, which engage spur gears 86, 87, 88, mounted to rotate on studs affixed to plate 25. These spur gears drive shafts 23, 64, 65 respectively, each through a planetary system, the parts of which are numbered alike, and similar to the previously described planetary system. Internal-external gears as 89 are driven by engagement of their outer teeth with spur gears as 88. Spur gears as 90 affixed to the ends of shafts as 23, 64, 65 have hubs which serve as axes for internal-external gears as 89, which are thus concentric with spur gears as 90. Arms as 91 are mounted on the ends of shafts as 23, freely rotating thereon, and have studs which carry spur gears as 92. Gear 92 meshes with the teeth of spur gear 90 and with 75

the internal teeth of spur gear 89. Arm 91 may be manually rotated, and is held in any desired position by stop-plunger 93, having knob 94, containing a spring forcing plunger 93 against plate 5 lug 25. Arm 91 thus carries gear 92 as a planet about gear 90 as a sun, and the rotation of arm 91 thus changes the angular attitude of shafts as 23, 64, 65 in respect to shaft 74, each independently of the others, or if 91 is rotated during 10 operation, shafts 23, 64, 65 may be made to go faster or slower as regards shaft 74 than their usual speed in respect to 74. The arms, as 91, being separably operable, text strips 7, 8, 9 of the various exhibitor stands may be independently 15 advanced or retarded as regards the others. Thus if a mistake is made in threading, or if one of the speakers is characteristically slow or fast as compared with the others, suitable adjustments may be made. The planetary systems of shafts 20 23, 64, 65 are similar in construction to that of shafts 74—70, although other forms of altering the angular attitudes of the respective shafts may be employed if desired.

Motor 68 has terminals 95, which are power 25 leads or which may connect it with a synchronous cinematograph motor.

Shaft 70 journalled in the motor and in lug 80 carries mitre gear 96 which engages mitre gear 97 on the upper end of shaft 98, journalled in lug 99 30 and in apparatus 100, with terminals 101. This may be, as the situation demands, a broadcasting apparatus for broadcasting to control a distant cinematograph motor, or it may be a means of regulating motor 68, or a means of regulating a 35 cinematograph motor located in the vicinity.

When three or more performers are performing before the exhibitor units, if all the text strips are run continuously there will be long stretches of blank strip on two of the units while the third 40 is being spoken from. My invention provides means for stopping and re-starting individual text strips while the other or others are advancing. This prevents the waste of strip material which would otherwise be necessary.

To accomplish this I provide a supplementary 45 strip 102 having apertures at selected points in sets of two rows each; one set for each text strip. Apertures in one row are used to stop the text strip and apertures in the other row to re-start it. 50 Strip 102 is advanced by sprocket roller 103 fixed on shaft 74. Affixed to end of shaft 74 is a mitre gear 104 which engages mitre gear 105 on the upper end of shaft 106, journalled in lugs 107, 108, and carrying on its lower end mitre gear 109 55 engaging mitre gear 110 on the end of shaft 111, which is journalled in standards 81, 82 and upon which is mounted strip holder 112. Shaft 106 also carries mitre gear 113 engaging mitre gear 114, on the end of shaft 115, journalled in lugs 60 116, 117, and carrying on its other end mitre gear 118, engaging mitre gear 119 on the end of shaft 120, which is journalled in standards 81, 82 and upon which is mounted strip holder 121.

Thus the rotation of shaft 74 causes roller 103 65 to unroll strip 102 from holder 121 and holder 112 to roll up the slack. Shafts 111 and 120 are frictionally connected to strip holders 112 and 121 to accommodate differences in diameter of the rolls as they roll and unroll.

Control strip is provided with three pairs of 70 brushes mounted on an angle lug attached to 24. Electric brushes 122 and 123; 124 and 125, and 126 and 127 are provided with terminals, while sprocket roller 103 has a common terminal 128

for them. When an aperture in strip 102, as 129, passes under brush 122 an electrical circuit is completed through 128 and the remainder of the circuit provided. This circuit is broken as soon 5 as the aperture passes from under the brush.

Electro-magnets 130 and 131, 132 and 133, and 134 and 135 are provided, connected respectively to brushes, 122, 123, 124, 125, 126 and 127. Their circuits return through batteries not indicated to terminal 128. Each of the three sets of magnets 10 is provided with a lever armature, 136, 137, 138, pivoted on studs in standard 24. Critical line springs 139, 140, 141 are provided for the armature levers, one end attached to pin on the lever and the other to a peg in standard 24. They 15 are so arranged that they will hold the levers in whichever attitude they are left by the last attraction of the magnets.

On the strip 102 uniformly dotted lines indicate a space during which the text strip is being 20 moved, while chain dotted lines indicate spaces during which the corresponding text strip is inactive or stopped.

As viewed in Fig. 4 strip 102 is moved upward. Dotted lines 142, 143 indicate that two speakers 25 are speaking simultaneously. Chain dotted line 144 indicates that one speaker is at that time silent; that is the text strip is not moving. When holes 129, 145 are reached, text strips 7 and 8 are stopped. Strip 9 being already stopped a period 30 of silence ensues. When hole 146 is reached strip 7 begins again. When holes 147, 148 are reached strip 7 stops and strip 8 continues stopped while strip 9 begins to move. When holes 149, 150 are 35 reached, strip 8 begins to move, strip 9 stops and strip 7 remains stopped.

Electrical contact switches are shown at 151, 152, 153. The upper arms, as 154 of the armature levers have blades for closing these contacts. In 40 the attitude shown by the armature levers all the strips are moving.

When hole 129 is reached magnet 130 draws armature lever over and makes contact at 151. This causes strip 7 to stop, as explained later. Text strip 7 remains stopped as long as contact 45 at 151 exists. This period of silence is indicated by chain dotted line 155. When aperture 146 is reached magnet 131 functions and contact at 151 is broken, and strip 7 begins to move again, until hole 147 is reached when magnet 130 functions and draws armature over to contact at 50 151 and text strip 7 is again stopped.

Text strip 8 is stopped by hole 145 reaching brush 124, which operates magnet 132. Hole 149 starts text strip 8 going again. Chain dotted line 144 indicates that text strip 9 is stopped 55 until hole 148 is reached, when strip 9 starts again and continues moving until hole 150 is reached when it is stopped by the action of magnet 134. Thus each of the pairs of rows of holes 60 controls a speaker text strip, which starts and stops as indicated by the location of the holes on the contact strip 102.

Lever armatures have blades as 156 to make 65 contacts. When they return they come to rest against peg stops as 157. Polarized magnets may also be used in place of magnets shown if desired.

Control of text strips 7, 8, 9 by strip 102 is effected as follows: Electro-magnets 158, 159, 70 160 are provided, mounted on standard 24, with terminals as 161, and with armatures 162, 163, 164 mounted on levers pivoted on spindle 165, supported by wing lugs 166, 167 in lug standard 25. The lower end, as 168, of the armature 75

lever, is forked at 169, and engages a member of a clutch and one branch 170 extends below the clutch and is connected to spring 171, which normally holds the armature lever arm in such position as to keep the clutch members, 172 and 173 in engagement. Clutch member 172 is next to standard 24, and is affixed to the right hand end of shaft 23, which is cut through in clutch member 172, the left hand end being journaled in clutch member 172 and lug 25, and having fixed to it collar 174 bearing against lug 25. Clutch member 173 is moved back and forth by the action of the electro magnet and the spring 171 in opposition thereto.

Switches 151, 152, 153 are connected to magnets 160, 159, 158 respectively. When switch 151 is open shaft 65 is in operation and text strip 7 is moving. When switch 151 is closed magnet 160 functions and the clutch is opened, shaft 65 and text strip 7 coming to rest. This is made positive by bell crank lever 175, pivoted at 176 and having prongs engaging lower end of magnet lever branch 170, so that when the magnet lever functions brake 177 of lever 175 is pushed against clutch member 172 and stops it. When switch 151 flies open this braking action ceases and the clutch members are drawn together again by spring 171, and text strip 7 begins to move again. As noted, by suitable arrangements of apertures in 102 all the strips may be simultaneously brought to a stop or set moving, or any one or more than one may be made to move as desired.

Switches 178, 179, 180, 181, 182, 183 are provided. Lever arms 136, 137, 138 are provided with double sided blades as 184, so that when lever 136 is in the left position its blade completes contact of switch 178, and when in the right position it completes contact of blade switch 179. These switches have terminals as 185. Switch 178 is connected to a white light lamp 186 on unit 2 and 179 is connected to a red light lamp 187 on unit 2. Thus the white lamp remains lighted while strip 7 is running and the red light remains lit and the white light goes out when strip 7 is stopped. The other pairs of switches are similarly connected to white and red lamps on units 3 and 4.

Green light lamp 188, violet light lamp 189, yellow light lamp 190 and blue light lamp 191 are provided, positioned in view of the speakers on each unit. They are connected with electric circuits leading to push buttons, which may be operated by a supervisor in the audience. He may from time to time flash any of the lamps as instructions to the performers. Thus a green light flashing may indicate to the speaker a signal to speak more slowly, violet to speak more rapidly, yellow to speak louder and blue to speak more softly.

Fig. 6 is a diagram of connections for use in a theatre. Cinematograph 192 with lamphouse 193 casts images on screen 194. Units 2, 3, 4 and controller 1 are behind the screen on the stage, and microphones 18, 19, 20 deliver sound impulses to amplifier 195 and horn 196 delivers sound to the auditorium. Electrical leads 197 go to motor 198 at cinematograph 192 and keep controller 1 and cinematograph 192 in synchronous operation, current coming from any common source as 199. A supplementary set of units, 2, 3, 4 are provided near the cinematograph with controller 1 connected mechanically to the cinematograph by shaft 200 or shaft 201, or other convenient means. Broken-off ends of shafts 70

and 74 as seen in Fig. 4 may be utilized for this purpose. The cinematograph motor 198 may operate both the cinematograph and controller 1, or the controller motor 68 may operate both. Electrical leads 202 connect microphones 18, 19, 20 to amplifier 195. Both performers back of the screen and those near the cinematograph may perform simultaneously or separately, as desired. Those back of the screen may speak directly to the audience instead of into the microphones if 10 circumstances permit.

Fig. 7 indicates a broadcasting arrangement. Controller 1 is fed from mains 203, and speakers at units 2, 3, 4 deliver sound to the microphones 18, 19, 20, from which impulses are broadcast by 15 broadcasting station 204, which may be near at hand or at any convenient distance and reached by land wires. Broadcasting so sent is received in antennae 205 and receiving station 206, and amplified by 207 is delivered to the audience. 20 Meanwhile broadcast station 208 broadcasts a wave at 209 that is received on antennae 210 and receiving station 211. Current from mains 212 operates motor 198, which is controlled in synchronism with controller 1 by apparatus 211. This wave is of the kind used in 25 television broadcasting. However, cinematograph 192 may by careful operation be run in synchronism with controller 1 without such broadcast connection and control. Thus if the cinematograph is started in synchronism with controller 1 it will project images synchronous with the sounds coming by broadcasting. Instead of the waves coming through the air they may be received in land wires by wired wireless, such as power, telephone or telegraph wires. Any 35 number of theatres may be supplied with broadcasted sounds to synchronize with cinematograph films, it being only necessary to start the cinematographs at the proper time, being threaded 40 with identical films.

In connection with controller 1 a phonograph is provided, as 213, adapted to be operated in synchronism with the controller by mechanical connection or otherwise. If it is a disc record 45 phonograph an electrical pick up of the customary kind is provided, with leads 214 to the broadcasting apparatus 204. Thus the phonograph record may supply electrical impulses to be broadcasted, or sent by wired wireless as the case may be. The impulses from the phonograph may be interpolated between the utterances of the speakers, or may be employed separately. Any type of phonograph may be used, such as 55 cylindrical, disc or tape, or even the phonograph record alongside a motion picture film on the edge of the film. As such a film track is already synchronized with the film, it is particularly well adapted to be used for broadcasting purposes where similar films are in the several cinematographs. 60

The cinematographs may be kept in synchronism by impulses from land wire, wireless, or timing devices locally positioned to give them an exact speed, the phonograph being similarly given an exact speed at a definite ratio with that of the cinematographs. 65

Figure 8 is a diagram of apparatus and connections for use in making phonograph records that will be synchronous with motion picture 70 films of analogous optical effects.

Cinematograph 215 with lamphouse 216 casts images on screen 217. Units 2, 3, 4 and controller 1 are on the left of the cinematograph in the figure of drawing and microphones 18, 75

19 and 20 receive sound from speakers and deliver corresponding electrical variations to the phonograph electrical amplifier 218, through electrical leads 219. Recording disc 220 is engraved by stylus 221, operated by electrical impulses and variations from amplifier 218.

Phonograph operating unit 222 causes disc 220 to be rotated. It receives electrical current for power purposes from mains 223. It sends current to motor 224 through leads 225. Motor 224 is in mechanical connection with unit 1 and cinematograph 215 and operates them, 222 and 224 being so connected electrically as to operate at a selected ratio of speed. The connection between the motor and the unit 1 and cinematograph 215 may be electrical instead of mechanical if desired.

A supplementary set of units 2', 3' and 4' are supplied on the right of the cinematograph, the control unit 1' thereof being mechanically coupled to the cinematograph 215, by shaft 226. Shaft 201 may be utilized for this purpose, or shaft 200, being the ends shown broken off in Fig. 4 of shafts 70 and 74 respectively.

Electrical leads 227-228 carry electric variations from microphones 18', 19' and 20' to phonograph amplifier 218 for recording on disc 220. These variations may be recorded coincidentally with those from microphones 18, 19 and 20, or otherwise than coincidentally.

Leads 219-229 carry electrical variations from microphones 18, 19 and 20 to loud speaker unit 230, with horn 231. Leads 227-232 carry current variations from microphones 18', 19' and 20' to the loud speaker unit 230.

The speakers at units 2, 3 and 4 may look at the cinematograph image on screen 217 if desired or this may be used for the convenience of the director of the actors.

Units 2, 3 and 4 may be placed back of the screen if desired. If the screen is translucent they may look at the image on the back if desired.

The recording of the phonograph may be carried out by the use of units 2, 3 and 4 and associated parts, without the use of the cinematograph, loud speaker or supplementary units 2', 3' and 4'. Usually the loud speaker is not used in recording use.

Although the phonograph recorder is linked electrically with motor 224, which operates controller 1, it may be directly connected either mechanically or electrically with controller 1, by passing the motor, in which case the cinematograph would not be utilized.

A disc phonograph is shown but it is to be understood that ribbon or tape forms of phonograph, or magnetic or photographic phonographs may be used or any form whatever of phonographic recording.

What I claim is:

1. In a textual strip exhibitor comprising a plurality of exhibitor units with sprocket shafts to a control unit, a control unit therefor comprising a source of power; a common power transmitting shaft to transmit power to such individual units; a planetary gear system intermediate such source of power and such common transmitting shaft, manually operable and adapted to effect changes of selected extent in their angular attitudes; such power transmitting shaft fitted with a plurality of gears, one for each unit; a plurality of sprocket shafts extending between such exhibitor units and such control unit, one for each exhibitor unit; a plurality of systems of planetary gears, between such transmitting shaft and such exhib-

itor units, one for each unit, manually operable and adapted to effect changes of desired extents in the angular attitudes of the transmitting shaft and the several sprocket shafts independently.

2. In the art of making a sound record by a plurality of performers having different response reaction times to stimuli synchronous with a separately made motion picture film of analogous subject matter means adapted to indicate to each of said performers selected moments in time for their making of selected sounds to be recorded comprising a plurality of movable exhibitor strips of an interchangeable character bearing words or signals thereon at selected intervals, one strip for each performer, means to advance said strips simultaneously at a selected relation to each other in the view of the performers and means adapted to vary said relation of said strips as respects the strip of one performer or the strips of more than one performer relative to the strip of another performer or the strips of other performers whereby to compensate for their different response reaction times to stimuli, and means adapted to record sounds made by said performers.

3. A synchronous textual strip exhibitor of the class described comprising a plurality of interchangeable synchronous textual strips having words disposed thereon across their length and not parallel thereto, said strips making up the several roles of a complete text, and means adapted to exhibit to a plurality of performers the words and symbols of their respective roles synchronously with the projection of a motion picture of analogous subject matter, said synchronous exhibiting means comprising means for moving said strips simultaneously and passing said words and symbols under a translucent or semi-transparent substance having an initial edge, said initial edge so placed as to indicate the moment of synchronization for the utterance of sounds to synchronize with said motion picture.

4. The matter of claim 3 comprising in addition one or more microphones adapted to transform sound waves from the utterance of the speakers guided by the said textual strips into electrical variations, means adapted to amplify said variations and means adapted to transform said amplified variations into sound effects.

5. A synchronous textual strip exhibitor of the class described having a plurality of units, each unit adapted to exhibit to a performer one of a plurality of interchangeable synchronous textual strips, said strip having words disposed thereon across its length and not parallel thereto, said strips of the several units making up the complete text for a plurality of performers, one for each unit; said units adapted to be driven from a common source of power, and manually operable means intermediate said power source and said units adapted to effect changes, to selected extents at selected times in the angular attitude of said power source to the angular attitude of said unit strip drivers simultaneously and to the same degree for each unit.

6. A synchronous textual strip exhibitor of the class described having a plurality of units, each unit adapted to exhibit to one of a plurality of performers one of a plurality of interchangeable synchronous textual strips, said strips having words disposed thereon across its length and not parallel thereto, said strips of the several units making up the complete text for the said plurality of performers, one performer for each unit; said units adapted to be driven in unison from a com-

mon source of power; a transmitting member between said power source and said units comprising a common transmitting means and a connection therefrom to each of said units adapted to drive all of said units in unison, and a plurality of manually operable means, one for each unit, intermediate its said connection to said common transmitting means, adapted upon individual manual operation to effect changes to selected extents in the angular attitude of said unit driving means to said common transmitting means, independently of the remaining units.

7. The matter of claim 6 comprising positioned between two portions of the said transmitting member and connecting them between the said power source and said connections to said units a system of planetary gears including a planetary member, a sun member and other customary parts of such a system, said planetary member manually displaceable circumferentially around said sun gear, whereby to effect changes of selected extent in the angular attitudes of the two portions of the transmitting member between which said planetary gear system is positioned.

8. The matter of claim 6 having a transmitting member from a power source and a plurality of connections therefrom to a plurality of units for speakers, a plurality of planetary gear systems intermediate said transmitting member and said units, one system for each unit, each system having a planetary member and a sun member and other customary parts of such a system, said planetary member manually displaceable circumferentially around its sun gear, whereby to effect changes of selected extent in the angular attitude of said transmitting member to said unit connection, each planetary system independent of the other.

9. A textual strip exhibitor of the class described adapted for the guidance of a plurality of speakers comprising a plurality of units, each of said units including a vertically positioned guideway for a textual strip adapted to bear horizontally positioned words and symbols, a stationary indicator positioned on said guideway to indicate to performers the moment of utterance; sprockets and associated means adapted to feed said textual strip through said guideway and means adapted to operate said sprockets and textual strips of the several units in unison synchronously; the said units positioned in a staggered manner front to rear as viewed in plan; said units having sprockets for the feeding of textual strips and shafts therefor, with a control unit at the side, said shafts adapted to derive driving power from said control unit and each sprocket shaft positioned to reach its unit without passing through any other unit by reason of the staggered position of said units.

10. In a text exhibitor of the class described having a plurality of exhibitor units each adapted to display to a speaker or performer matter to be uttered, said matter on an interchangeable textual strip adapted to progress vertically, an utterance moment indicator for each unit's textual strip comprising translucent material, the initial edge of which is adapted to be the utterance moment indicator, and the translucent quality adapted to indicate to the performer the words or symbols already uttered without withdrawing them wholly from his vision upon utterance.

11. In a text exhibitor of the class described, for the guidance of speakers, comprising a plurality of units adapted to exhibit to speakers words and symbols to be uttered, and a control unit of the class described adapted to control the several

speaker units, an interchangeable control strip of the class described, means adapted to advance said control strip at a predetermined ratio of speed as respects the speed of the transmitting shaft common to the several speaker units; apertures in said control strip at selected locations; electrical means adapted to start and stop the sprocket shafts of said speaker units, comprising a clutch on said shaft adapted to start and stop one section of said shaft as respect the other, an electro-magnet adapted to operate said clutch; electrical brushes adapted to bear on said control strip, and electrical connections and current between said brushes and said magnets whereby said clutches are operated by the passage of said apertures of said control strip past said brushes, whereby to start and stop said exhibitor strips at selected locations for selected periods of time during operation by reason of the positions of said apertures.

12. In a control unit as set forth in claim 11, sets of tandem electrical circuits, the first circuit of a set comprising a pair of magnets with a common armature pivoted between them, fitted with a critical line spring adapted to hold such magnet armature in the attitude to which it is last drawn by one of the magnets; a pair of brushes for a pair of lines of apertures in said control strip, one brush adapted to close the circuit of one magnet on the passage of an aperture and the other brush adapted to close the circuit of the other magnet upon the passage of an aperture; whereby to throw the armature lever from side to side; the second circuit of said tandem circuit comprising a switch opened or closed by the operation of the armature lever of the pair of magnets of the first circuit, and a magnet adapted to operate the clutch of the sprocket shaft, whereby to open said sprocket shaft clutch upon the turning on of current in the second circuit and to allow it to close upon the turning off of current, and sources of current for said tandem circuits.

13. In combination a cinematograph in mechanical connection with a multiple unit text exhibitor of the class described, so disposed that the cinematograph may exhibit upon a screen before an audience and performers may appear to have their voices accompany synchronously such motion picture projection; means whereby said cinematograph may be operated at a fixed ratio of speed as compared with said text exhibitor; manually operable means adapted to change said ratio of speed to selected extents at selected locations; said text exhibitor adapted to exhibit different texts to a plurality of performers, the several different texts of which make up the whole text of the performance, and means whereby the ratio of speed of exhibition of any individual text may be changed to a selected extent for a selected time as compared with the cinematograph speed independently of the ratio of speed of any other text or texts.

14. The matter of claim 9 when comprising in connection therewith a cinematograph synchronously coupled therewith, whereby said textual strips and a cinematograph film of analogous subject matter may be advanced synchronously.

15. The matter of claim 9 when comprising in connection therewith a phonograph recording apparatus coupled therewith, and means whereby the utterances of speakers guided by said textual strips are recorded phonographically by said phonograph recording apparatus.

16. The matter of claim 9 when comprising in connection therewith a cinematograph synchro-

nously coupled therewith, whereby said textual strips and a cinematograph film of analogous subject matter may be advanced synchronously and when comprising in addition in connection therewith a phonograph recording apparatus coupled with said textual strip exhibitor, and means whereby the utterances of speakers guided by said textual strips are recorded phonographically by said phonograph recording apparatus, synchronously with the advance of said cinematograph film.

17. The matter of claim 3 comprising in addition one or more microphones adapted to transform sound waves from the utterance of the speakers guided by the said textual strips into electrical variations, means adapted to amplify said variations, means adapted to transform said amplified variations into sound effects, and branch or supplementary means adapted to transform said amplified variations into recorded sound waves in a phonograph record comprising a phonograph recording apparatus adapted therefor.

EDWIN S. HOPKINS.