

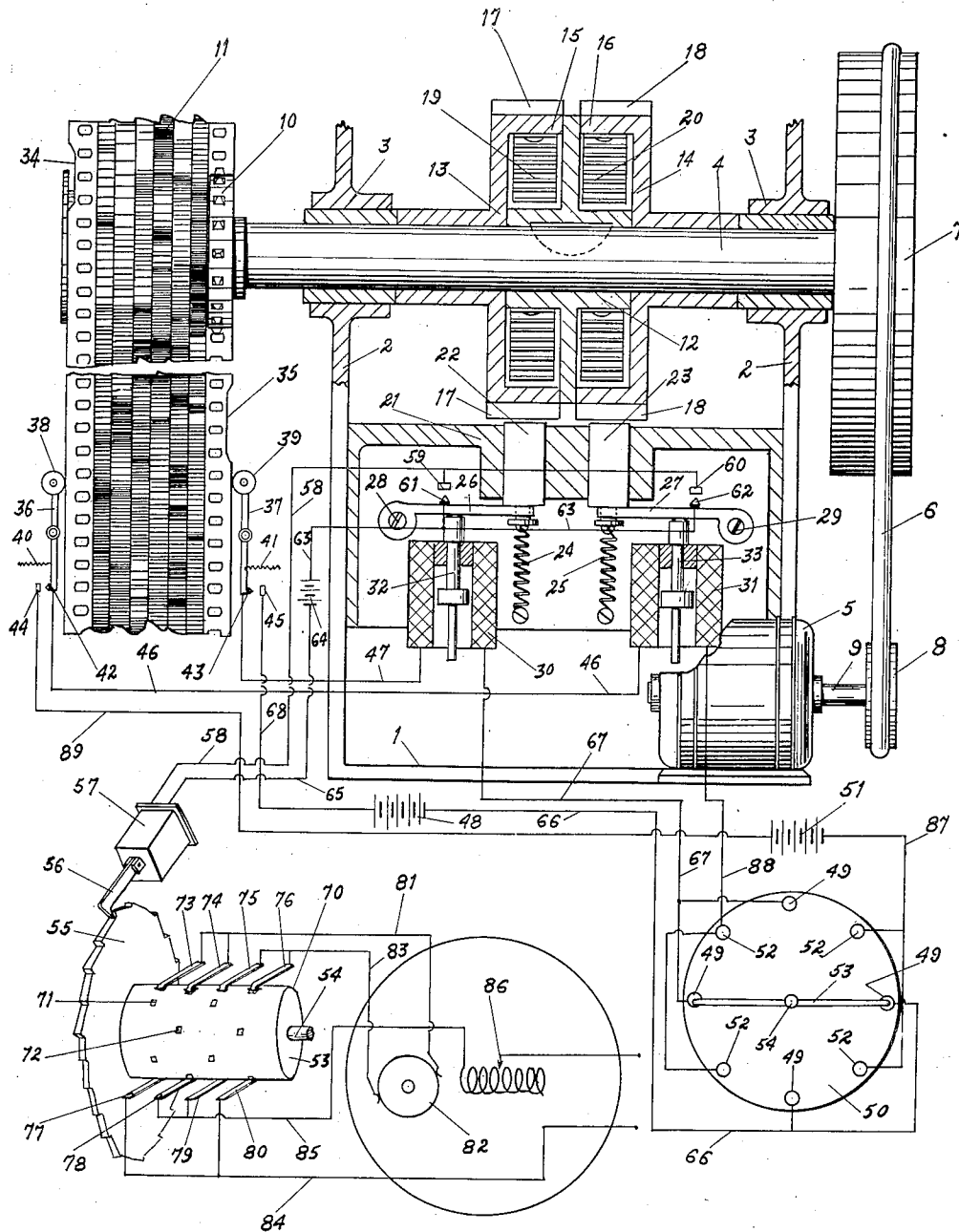
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REVERSING MECHANISM FOR DRIVING SHAFTS

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REVERSING MECHANISM FOR DRIVING SHAFTS

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This invention relates to improvements in reversing mechanism for driving shafts, the principal object of the invention being to provide a mechanism of this character which is particularly adapted for automatically reversing the sprocket shafts in film driving apparatus.

In the art of photographically reproducing sound, the space actually occupied by the sound record on a film is very small as compared with the area of the film, which for practical purposes must be of substantial width. Consequently, in practice a very large portion of the film must be wasted, or several sound records may be taken on the same film. By taking a number of sound records in parallel relation and in reverse order on a single film it is practical to utilize the entire available film space. With such an arrangement of the sound records, however, the difficulty arises that when the film has been run through the reproducing machine the operation of reversing the film to reproduce the next succeeding sound record consumes considerable time, and if the consecutive sound records happen to be parts of a continuous record, every time the film has completed its passage through the machine there is an awkward pause while the direction of movement is being reversed. The object of the present invention, therefore, is to provide a mechanism in which the reversal of the film is accomplished automatically so that there is hardly any appreciable pause between the completion of movement of the film in one direction and the beginning of its movement in the opposite direction.

Other objects and advantages of the invention will appear as the description proceeds.

The drawing accompanying this specification is a partly sectional, diagrammatic and broken away side view of a machine embodying the features of the present invention.

Referring to the drawing, 1 designates a base plate supporting a pair of standards 2 carrying at their upper ends bearings 3 in which is mounted for rotation a sprocket driving shaft 4. Motion is imparted to the shaft 4 from a motor 5 by means of a belt 6 which passes over pulleys 7 and 8 secured respectively on the shaft 4 and the motor shaft 9. On the end of the shaft opposite from the pulley 7 is secured a film driving sprocket 10 adapted to engage and cause traveling movement of a film 11 in one direction or the other, depending upon the direction of rotation of the motor.

Keyed to the shaft 4, approximately midway of its length is a sleeve 12, and mounted for rotation on said shaft adjacent to the opposite ends of said sleeve are a pair of flanged disks 13 and 14, the flanges 15 and 16 of said disks extending toward each other and thereby forming a housing enclosing the sleeve 12. The

flanges 15 and 16 of the disks are peripherally toothed, as indicated at 17 and 18 respectively, and within the housing formed by the said disks and their flanges are disposed a pair of springs 19 and 20 wound in opposite directions and each of which is secured at its inner end to the sleeve 12 and at its outer end to its companion disk flange 15 and 16 respectively.

Mounted for vertical reciprocation in a block 21 supported between the standards 2, are a pair of plungers 22 and 23, the upper ends of which normally lies just out of contact respectively with the teeth of the flanges 15 and 16, said plungers being maintained in such normal position by coil springs 24 and 25 respectively, which springs are secured at one end to a fixed portion of the frame and at their opposite ends to their companion plungers. A pair of transversely extending levers 26 and 27 are disposed below the plungers 22 and 23, each of said levers being pivoted at one end thereof as indicated at 28 and 29, and having its opposite end underlying its companion plunger. Below the pivoted levers 26 and 27 are disposed a pair of solenoids 30 and 31, the armatures 32 and 33 of which are in the form of plungers adapted, when the solenoids are energized, to be thrown outward into engagement respectively with the levers 26 and 27 thereby to swing said levers on their pivots and thus push the plungers 22 and 23 into engagement with the teeth 17 and 18 respectively of the flanged disks 13 and 14.

The operation of the solenoids is controlled by the film 11, and for this purpose the film is provided, in its opposite edges with a pair of notches 34 and 35, one adjacent to each end of the film. At opposite sides of the film are pivotally mounted a pair of levers 36 and 37, each provided at one end thereof with a roller 38 and 39 respectively, in position to engage the corresponding edges of the film, a pair of springs 40 and 41 being provided for maintaining the levers with their rollers in constant engagement with the edges of the film as it travels between said rollers whereby when the respective notches 34, 35 arrive opposite their corresponding rollers, the roller will drop into its notch. Each of the levers 36, 37 carries at the end opposite from its roller, a contact member 42 and 43 respectively, said contact members being adapted to be carried into contact with fixed contact members 44 and 45 respectively when the levers are swung on their pivots by reason of their rollers dropping into the notches 34 and 35. The movable contact 42 of lever 36 is connected by a wire 46 with solenoid 31, while the contact 43 of lever 37 is connected by a wire 47 with solenoid 30.

The circuit through the solenoid 30 includes a battery 48 and a plurality of fixed contacts 49 disposed at diametrically opposite points on an insulating disk 50, while the circuit through sole-

noid 31 includes a battery 51 and a plurality of similar contacts 52 also disposed at diametrically opposite points on said disk, the contacts 49 and 52 being alternately disposed on the disk. For connecting the contacts 49 and 52 in pairs across the disk, a bridge piece or arm 53 is secured on one end of a shaft 54 which is mounted for rotation in juxtaposition to said disk, and which shaft carries at its opposite end a ratchet disk 55 the teeth of which are adapted to be engaged by a hook shaped pawl 56 forming the armature of an electromagnet 57. One terminal of said electromagnet is connected by a wire 58 with a pair of fixed contacts 59 and 60, disposed respectively above the levers 26 and 27, and which levers carry movable contacts 61 and 62 in position to contact with said fixed contacts when the levers are swung upward on their pivots. The contacts 61 and 62 are connected by a wire 63 with one terminal of a battery 64, the opposite terminal of which is connected by a wire 65 with the other terminal of the electromagnet 57.

The mechanism for reversing the direction of rotation of the motor shaft 9 and thereby the shaft 4 comprises a drum 70 of insulating material secured on the shaft 54, in which drum are disposed a plurality of circuit closing members the ends of which project beyond the periphery of the drum at diametrically opposite sides and form circumferential rows of contacts 71 and 72, the contacts 71 being in staggered relation to the contacts 72 axially of the drum. Disposed in position to contact with said rows of contacts at one side of the drum are a plurality of spring contacts 73, 74, 75 and 76, while at the opposite side of the drum are a plurality of similar spring contact members 77, 78, 79 and 80 in position to engage the opposite ends of the same contact members 71 and 72. The spring members 73 and 74 are shown connected by a wire 81 with one of the brushes of the commutator 82 of an electric generator, while the spring contacts 75 and 76 are connected by a wire 83 with the other brush of said commutator. The spring contact members 77 and 80 are connected with a wire 84 which leads to one terminal of the motor 5, while the spring members 78 and 79 are connected with a wire 85 leading to the other terminal of the motor, an adjustable resistance element 86 being preferably included in the circuit.

By reason of this construction, the direction of the current to the motor will depend on which of the contacts 71, 72 are in engagement with the spring members. For instance, as shown in the drawing the spring members 74, 76, 78 and 80 are in engagement with contacts 72. In this position, assuming that current flows from the generator through wire 81 to spring contact 74, the current will pass across the disk through contact 72 to spring member 78, thence through wire 85 and resistance element 86 to the motor, thence through wire 84, spring contact 80, across the drum through contact 72 to spring 76, thence through wire 83 to the generator. Now, suppose the ratchet disk is advanced one step, thus carrying the contacts 72 out of engagement with their corresponding spring contacts and carrying the contacts 71 into engagement with spring contacts 73, 75, 77 and 79. Current will now flow from the generator, through wire 81, spring contact 73, across the drum through contact 71 to spring contact 77, wire 84, to the motor, and thence, through resistance element 86, wire 85, spring contact 79, across the drum through contact member 71 to spring contact 75, and thence

through wire 83 to the generator. It will thus be seen that the current to the motor will flow in the opposite direction when the contacts 71 are in operation from that in which it flows, when contacts 72 are in operation, thus alternately reversing the direction of rotation of the motor shaft and consequently of the shaft 4 as the ratchet disk 55 is rotated step by step.

The operation of the apparatus is as follows: With the shaft 54 in such position that the contact arm or bridge 53 is in engagement with the two contacts 49 at opposite ends of the horizontal diameter of the disk 50 as shown in the drawing, assume that the film has been moved to bring the notch 35 opposite the roller 39. As soon as the roller has dropped into said notch the contacts 43 and 45 will be in engagement, whereupon current will flow from battery 48, through wire 66, contact 49, across the disk through arm 53 to opposite contact 49, thence through wire 67 to solenoid 30, wire 47, contacts 43—45, wire 68, to battery 48, thus energizing the solenoid 30. The energizing of this solenoid will cause its armature 32 to move upward, carrying with it the lever 26 and thus pushing the plunger 22 into engagement with the teeth 17 of flange 15 whereby the disk 13 will be held against rotation. Upon continued rotation of the shaft 4 the spring 19 will be wound up and the increasing tension thereof will act as a brake to check rotation of the shaft preparatory to reversal of the direction of rotation of said shaft. In the meantime, the upward movement of lever 26 has closed the contacts 59—61, so that current will flow from battery 64, through wire 65, electromagnet 57, wire 58, contacts 59—61, wire 63, to battery 64, whereby the electromagnet is energized and retracts its armature 56, thus rotating the ratchet disk 55 one step, and reversing the direction of current to the motor and consequently the direction of rotation of the shaft 4 as hereinbefore described. In the meantime the film has moved so as to carry its notch 35 past the roller 39 so that said roller now rides on the edge of the film, thus breaking the circuit through solenoid 30 and permitting plunger 22 to move away from teeth 17 under the action of spring 24, thus freeing the shaft 4 for rotation in the opposite direction. The tension which in the meantime has been imparted to spring 19 will give an added impetus to the movement of the shaft in the new direction. The one step movement of disk 55, in addition to reversing the current through the motor, has moved the arm 53 out of engagement with the contacts 49 and into engagement with the next succeeding pair of contacts 52 thus breaking the circuit at this point through solenoid 30. The shaft will continue to rotate in the new direction until the notch 34 of the film arrived opposite roller 38, whereupon the roller will drop into said notch, thus closing contacts 42—44, so that current will flow from battery 51, through wire 87, contact 52, arm 53 to opposite contact 52, wire 88, solenoid 31, wire 46, contacts 42—44, and wire 89 to battery 51. The solenoid 31, being thus energized, forces its armature 33 upward and with it the lever 27 and carrying the plunger 23 into engagement with the teeth of disk 14, thus locking said disk against rotation and causing the spring 20 to be wound up during the further rotation of the shaft 4 due to momentum. The upward movement of lever 27 has in the meantime carried the contact 62 into engagement with contact 60, so that current will pass from battery 64, through wire 65, electromagnet 57, wire 58, contacts 60—62, wire 63, to 150

battery 64. The electromagnet, being thus energized, will retract its armature and thereby move the disk 55 one step and again reverse the current to the motor and reset the arm 53 as hereinbefore described.

It will be seen from the foregoing that the action of the machine is entirely automatic, the reversal of the direction of rotation of the shaft 4 taking place every time one of the notches in the film arrives opposite its cooperating roller.

I claim:

1. A motion reversing mechanism, comprising in combination, a rotatable shaft, means for rotating said shaft, separate holding means co-operatively associated with said shaft, one adapted to hold said shaft when the same is rotating in one direction and the other adapted to hold said shaft when the same is rotating in the opposite direction, and means automatically actuated during operation of either of said holding means to reverse the direction of rotation of said shaft rotating means.

2. A motion reversing mechanism, comprising in combination, a rotatable shaft, a reversible motor for imparting motion to said shaft, means for reversing the direction of current to the motor thereby to rotate the shaft in opposite directions at predetermined times, independently operable means for temporarily holding the shaft against rotation in the opposite directions, means to actuate said holding means and means automatically actuated during operation of either of said holding means to operate said current reversing means and set the actuating means for the other holding means for operation.

3. A motion reversing mechanism, comprising in combination, a rotatable shaft, a reversible motor for imparting motion to said shaft, means for reversing the direction of current to the motor thereby to rotate the shaft in opposite directions at predetermined times, normally inoperative independently operable means for temporarily holding the shaft against rotation in the opposite directions, means for alternately selecting one of said holding means for operation, means for operating the selected holding means, and means actuated by said operating means for simultaneously actuating said current reversing means and selecting means.

4. A motion reversing mechanism, comprising in combination, a rotatable shaft, a reversible motor for imparting motion to said shaft, a pair of members mounted for rotation on said shaft and springs connected thereto, the respective springs being wound in opposite directions, independent means for holding said members against rotation thereby to place the respective springs under tension during rotation of the shaft in opposite directions, independent electrical means for actuating said holding means, the circuit of each of said electrical means including a normally open switch, a selecting device for directing current through one or the other of said means, a current reversing device in the circuit of said motor, electrically actuated means for operating said current reversing and circuit changing devices, and means for closing said normally open switches alternately at predetermined times.

5. A motion reversing mechanism, comprising in combination, a rotatable shaft, a reversible motor for imparting motion to said shaft, a pair of toothed disks mounted for rotation on said shaft, a spring connecting each of said toothed disks to the shaft, said springs being wound in opposite directions, independent means for hold-

ing said disks against rotation thereby to place the respective springs under tension during rotation of the shaft in opposite directions, a solenoid for actuating each of said holding means, the circuit of each solenoid including a normally open switch, a selecting device in the circuits of both of said solenoids for directing the current through one or the other of the solenoids, a current reversing device in the circuit of said motor, an electromagnet for operating said current reversing and circuit changing devices, means actuated by either of said solenoids for closing the circuit through said electromagnet, and means for closing the circuits alternately through said solenoids at predetermined times.

6. In a motion reversing mechanism, the combination with a reciprocable strip, of a rotatable member adapted to move said strip, means for driving said member, independently operable means for temporarily holding the rotatable member against rotation in opposite directions, means carried by said strip and automatically operative to permit actuation of the respective holding means during movement of the strip in opposite directions, and means automatically operative during actuation of said holding means to reverse the direction of rotation of said rotatable member driving means.

7. In a motion reversing mechanism, the combination with a reciprocable strip, of a rotatable member adapted to move said strip, means to drive said member, independently operable means for temporarily holding the rotatable member against rotation in opposite directions, electrical means for actuating said holding means, means carried by said strip and automatically operative to permit closing of the circuit through the respective electrical means during movement of the strip in opposite directions thereby to actuate the respective holding means, means for selecting the circuit to be closed, means for reversing the direction of rotation of said rotatable member driving means, and means automatically operative during actuation of either of said electrical means to actuate said selecting and reversing means.

8. In a motion reversing mechanism, a rotatable driving shaft, means for driving said shaft, independent means for temporarily holding the shaft against rotation in opposite directions, a solenoid for actuating each of said holding means, a plurality of pairs of electrical terminals in the circuits of the respective solenoids, a movable contact forming member adapted to bridge said pairs of terminals, means for moving said contact forming member from a pair of terminals in the circuit of one solenoid to a pair in the circuit of the other solenoid thereby to actuate said holding means alternately, means for reversing the direction of rotation of said shaft driving means, and means actuated by the respective solenoids for simultaneously operating said moving means and reversing means during actuation of either of said holding means.

9. A motion reversing mechanism comprising in combination a rotatable shaft, a sprocket thereon and adapted to move a film means for rotating said shaft, independently operable means for temporarily holding the shaft against rotation in opposite directions, and film operated means for actuating said holding means and periodically reverse the direction of rotation of said shaft rotating means.

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