Assembly Instructions for
STEENBECK ST 1200W/ST 1600/ST 1900 Editing Machines

When lifting the machine, lift by gripping chassis- NOT TABLE TOP. Unpack contents of crate making sure no parts are left in wrappings. For your protection do not dispose of wrappings until film editor is fully assembled.

1) Secure right and left leg sections (if not already mounted at the factory).

2) Loosen knurled screws on the angle brackets behind the optical housing. Attach projection housing and tighten knurled screws.

3) Mount square pipe of loudspeaker on pipe stump next to projection housing. Feed speaker wires through hole in pipe to interior of table. Remove the rear chassis access panel. Connect the wires to the spring clips on under side of table top. For this push in on center part of spring clips and insert wire on side opening. The wire is held in place by spring pressure. Now screw on the separately packed flywheels on bush underneath sound rollers.

4) Place film flanges on take up and supply spindles and then the film plates on the flanges.

The Editing Machine is now ready for operation and can be connected to the supply.

Caution: Check operating voltage specified on type plate on rear of Editing Table.
OPERATING AND MAINTENANCE INSTRUCTIONS
For
STEENBECK ST 1600 4 Plate Editing Table

The film transport deck of the ST 1600 is of a very clear and distinct arrangement and thus very easy to operate. However, we ask the user to read the following instructions:

After proper and careful assembly the equipment is connected to the A.C. power. The A.C. main switch may then be turned on. A pilot light next to the A.C. main switch will indicate that the equipment is ready for operation. Above the main switch is located a row of four switches which have the following functions (left to right).

1. Amplifier ON - OFF. Only one sound track can be reproduced at a time.
2. Picture lamp ON - OFF. The picture lamp will burn at reduced power during stand still of film transport.
3. Table lamp mode switch connected to the 220V A.C. outlet at rear of table. Output, 60 watts maximum.
   a) Up position - table lamp will dim during operation of film transport.
   b) Down position - table lamp will have full power at all time.
4. Exciter lamp ON - OFF. The exciter lamp will burn only when the picture lamp is on. At the same time the magnetic position of the amplifier is disabled.

The amplifier is located on the left front side with a slide attenuator. Exposure of the hinge mounted amplifier may be obtained by removing the single screw to the right of the slide attenuator.

Switching of the film transport is accomplished through the central lever switch located on the table top which will produce the following modes:

Slow speed is obtained by moving the lever with slight pressure to the right or left. The lever will return to stop automatically when released. It is possible through this feature to switch single fr
Moving the lever further to the first notched position, exact speed of 24 and 25 F.P.S., respectively is obtained. By moving the lever to the extreme right or ef. (2. notched position), approximately 100 F.P.S. is obtained. All total, the lever switch has 7 positions from left to right with zero or stop in the middle position:

1. High speed reverse
2. Synchronous speed reverse
3. Slow speed reverse
4. Stop
5. Slow speed forward
6. Synchronous speed forward
7. High speed forward

When switching to the zero or stop position, electric braking will stop the film motion accurately on one frame. Switching back and forth between synchronous and high speed is possible without any danger to the film. Safety features have been incorporated in the relay system to prevent film damage from abruptly switching into other modes. For example: the film transport will stop automatically, if switched from high speed to the opposite direction synchronous speed. It will automatically resume operation after approximately 2 seconds delay. The film transport will also stop automatically if switched from high speed to the opposite high speed. In this case operation may be resumed by first switching to the synchronous mode.

Two slide switches are located next to the lever switch which activate the clutches in the film and sound track paths. The film or sound track can be moved manually when the clutches are disengaged.

Threading of picture:

To open pressure rollers (2) at the picture head sprocket (1) depress simultaneously buttons (3) on the pressure arm assemblies (4) with slight pressure toward the operator. Place film between pressure rollers (2) and film guide (5). The perforations of the film are engaged in the picture head sprocket by slight back and forth motion. Now pull simultaneously on the film to the right and left of the pressure arm assemblies (4) which then will close and lock. This may also be accomplished by pulling the outer edges of the pressure arm assemblies (4) toward the operator. The knob (7) above the focus lever (6) is the frame line adjustment.
For reproduction of films with optical or magnetic striped sound tracks proceed as indicated above. Thereafter place film over tension idler (8), the impedance drums (9 and 10) as well as the sprocket (20). To change over from optical to magnetic striped sound turn the sound head carrier (12) by 90 degrees. Automatic picture to sound advance from optical to magnetic sound is provided. Film tension in the sound head is adjusted through sprocket (20). The tension idler (8) should be free floating and not resting against the stops in either extreme. To move sprocket (20) by hand, disengage clutch of sound track path then re-engage the same.

**CAUTION:** Both picture and sound path clutches must by engaged when reproducing composite prints. After viewing of prints with magnetic striped sound return sound head carrier (12) to optical sound tracks.

The picture projection housing may be removed for projection onto a wall. Picture lamp brightness is sufficient for projection of a picture of 32 inches in width in a darkened room.

**Threading of sound:**

Open pressure arm assembly (13) through button (14). Place magnetic film over sprocket (15) and close pressure arm (13). Guide sound track over tension idler (16), impedance drum (17) past the magnetic head (21) over impedance drum (18), tension idler (19) to sprocket (20). Pull film tight until the tension idlers (16 and 19) are fully expanded. Place film over sprocket (20) and release film tension to next closest perforation. Now close pressure arm assembly.

**Synchronizing points:**

Two synchronizing points are provided in addition to those located in the center of the film gate and magnetic sound head. (See threading diagram marked with X) The points are designed to cut picture and sound simultaneously.

**Picture lamp replacement:**

Lift over (22) near the left pressure arm assembly (4). The picture lamp is lifted from its socket with the special tool which is supplied and mounted on the left side of the chassis. Insert new lamp in tool and carefully press into lamp socket. The picture lamp holder is adjustable in 3 planes via knurled screws.
Exciter lamp replacement:
Remove exciter lamp cover. Loosen large screw in front of exciter lamp. (DO NOT remove the screw). Remove old lamp and insert new one. The filament should face toward the slit in the lens barrel. Adjust lamp for maximum brightness in the lens barrel. Tighten the screw and place cover over the lamp.

Adjustment of pressure arm assemblies:
Adjustment has been made at the factory for two thicknesses of film. Re-adjustment is necessary only when the main shaft of the assembly has been removed. Place 2 thicknesses of film over the sprocket. Loosen the two screws at the base of the assembly main shaft. Turn shaft until the rollers of the assembly make even contact with the sprocket. (By picture pressure arm assemblies roller and pointed guide end). Tighten screws. Now loosen single screw controlling blocking pin. Turn blocking pin assembly until there is no play between pressure arm assembly and sprocket. Tighten screw.

Replacement of sprockets (15 or 20):
First secure one sprocket for example (15). The second sprocket must be adjusted as follows so that when film is threaded through the sound path, the tension idler (16) must rest against the upper stop. The tension idler (19) should have some play to the right and the upper stop. The same holds true in reverse when tension idler (19) rests against the upper stop the other idler (16) must have some play to the left and the upper stop. This adjustment is important since the film could be damaged during starting and braking of the film transport.

Care of optical parts, front surface coated mirrors:
Clean only with soft surgical cotton. In extreme cases remove mirror and rinse under clear running water and wipe with cotton. Air drying is recommended. With the projection housing removed, the plastic cover (24) can be pulled out for easy access to the upper mirror, lens and prism.

Revolving prism (optional compensator):
Open pressure arm assemblies at the film gate. Cleaning is now possible with soft chamois, cotton or lens tissue. If heavily smudged remove plastic cover over prism, remove the two screws on top of the
optics carrier. Lift the whole carrier straight up. The entire prism is now exposed. On re-assembly, great care should be taken not to scratch the prism. The optics carrier must be perfectly seated so that the revolving prism and upper guide ring can move freely.

Screen:

The screen is sensitive to finger prints and scratches. It may be cleaned with a soft cloth and water. The screen is made of a composition material. Therefore, no solvents should be used.

Illumination path:

The upper prism (23) with its lenses can be unscrewed. For cleaning proceed as in the case of the revolving prism. The cold light mirror below the prism is held in place by a spring. The spring may be pulled back and the mirror removed for easy cleaning. Clean the mirror like the front surface mirror.

General Maintenance:

Remove dust and film scraps daily. After approximately 100 hours of operation clean pressure arm assemblies and guide rollers. After 500 hours of operation lubricate pressure arm assemblies and guide rollers with a thin non resinous oil. The support areas of the film plates are lined with a plastic material therefore no lubrication is necessary. Should noise develop between the flanges and film plates, lubricate the plastic liner with a very thin coat of grease.

Flanges:

Heavy cast flanges with film plates are used in the film take up and supply system on a friction principle. Remove the gray core center of the flange occasionally. Put a few drops of oil in the provided hole near the square shaft.

WARNING — The heavy cast flanges on friction discs which in turn are driven by the take up and supply spindles. Never place lubricant between the flanges and the friction discs. Flanges may adhere to lubricant resulting in film damage due to loss of proper or all friction.

The table top and film transport are hinged at the rear. In order to gain access to the interior of the editor, remove the two screws on the front right and left of the table top. Lift the table top until the stay snaps in place. Before closing the editor, care should be
taken that the coupling of the film transport is in the proper position to engage with the main gear. The table top must not be dropped or pushed or pushed down with force which would result in bent shafts and a damaged coupling.

To simplify closing of the table top, the following is suggested: Turn on main A.C. power switch and slide sound track clutch switch to lock position. Lower table top slowly. Turn the right sprocket (20) until it is felt that the coupling has engaged.

All reference numbers mentioned correspond to the drawing "Threading diagram ST 1600"
Operating and maintenance instructions for "STEENBECK" combined sound and vision film editing tables
ST 400W - ST 400C - ST 600W - ST 700W
ST 700C - ST 900W - ST 926 - ST 928

"STEENBECK" combined sound and vision film editing tables are functionally constructed and therefore easy to operate. All we ask you to do is to read the following instructions carefully before you use your "STEENBECK" film editing table for the first time.

After duly assembling the machine in accordance with the attached assembly instructions and connecting it to the main supply, you must now switch on the main switch, located on the right-hand-side of the front part of the machine (this is the single switch beneath the row of other switches). The lamp beside the main switch will then light up and indicate that the picture unit is ready for operation. There are 4 tumbler switches above the main switch.

The 1st switch (from the left) enables you to switch on the amplifier.

The 2nd switch is for the picture lamp, which burns with a decreased voltage when the picture is stationary. Full lamp voltage is automatically switched on when the film strip moves.

The 3rd switch enables the table lamp to be adjusted. In the one position the lamp burns at full power, whereas in the other it is altered by switching the power to less brilliance. The series resistance is designed for a 60-watt bulb. The lamp can be switched off altogether by means of a push-switch fitted to the lamp-shade.

The 4th switch enables the focusing screen on the table top to be illuminated from underneath.

On the left-hand side of the front part are amplifier cassettes with regulators for the various light and magnetic sound channels. Each sound scanner can be separately adjusted. By means of the regulator on the far right high frequencies can be increased from 4 kilocycles per second by some 8 decibels. There are slide switches above the regulators for switching in the sound lamp.

The film is driven by means of a central selector switch on the table plate. The switch can be operated as follows:

Slight pressure to the right or left starts up the drive motion and sets the film going, either forwards or backwards at a speed of roughly 4 pictures per second. The switch does not engage and reverts to zero position as soon as it is released. If you move the switch further along till it engages in the first notch, then the film moves at a precise speed, namely 24 and/or 25 pictures per second.
If the switch is moved to the right or left as far as the stop (2nd notch), then the speed is increased roughly four-fold, i.e. some 100 pictures per second. To sum up, there are 7 positions in which the switch can be set, in series from left to right; zero position is in the centre:

1. high-speed backwards
2. 24 and/or 25 pictures per second backwards
3. slowly backwards
4. zero position
5. slowly forwards
6. 24 and/or 25 pictures per second forwards
7. high-speed forwards

In the zero position the drive is electrically braked, so that if you switch from 24 and/or 25 pictures per second to zero, the film is stopped exactly on a picture.

Near the selector switch on the table plate there are slide switches for the magnetic clutches, enabling each strip of film to be individually disconnected from the drive unit. On standstill the disconnected strips can be pulled backwards and forwards by hand by means of the knobs on the sprockets. During operation of the 6-plate editors the sprockets are braked and this prevents the film strip from moving forward.

Along the front edge of the assembling plate is a graduated scale with 2 push buttons. By pressing either the left-hand or the right-hand one the tape (in the case of 6-plate tables the front tape) can be moved backwards or forwards while still coupled to the drive unit, which can be either running or stationary. The scale records the number of picture fed through, the maximum recording being 50 pictures. The range of feed selection is infinite, and the scale can be re-set to zero by hand.

**Threading the film 16 mm**

Open the pressure rollers on the film scanner by pressing the knobs on the pressure arms and applying slight outwards pressure at the same time. Insert the film strip between the pressure rollers and the feed mechanism. Check by a slight forwards and backwards motion when the spurs of the toothed wheel engage in the sprocket holes. Then pull the film gently to right and left against the rollers on the pressure arms, which will then close and engage. It is also possible to close the pressure arms by exerting pressure on the outer edges. On the film scanner there is a focussing lever. The knob underneath the screen is for frame adjustment. The sprocket located on the right beside the film scanner is only used for monitoring combined sound and vision tapes. To do this, you insert the strip of film in the scanner and then wind it round the tension roller located on the right nearby, then round the two sound roller and finally round the sprocket. To obtain the correct tension, first hold the film taut when you wind it round the last sprocket, and then allow it to slide slowly back until the notches engage in the sprocket holes. The pressure arm is then simply pressed against the film till it engages. You can thread films with either magnetic or optical sound marginal tracks.
The sound-scanning devices are swivel-mounted on a bracket. If the bracket is rotated in clockwise direction, the magnetic head is in the scanning position. If you move the bracket in anti-clockwise direction until you feel it engage, then the optical sound scanner is in the scanning position. Both scanners are set to an interval of 2 pictures, so that the space between sound and vision is 26 pictures in the case of optical sound and 28 pictures in the case of magnetic sound.

Caution!
In the case of optical sound prints never leave the magnetic head in the scanning position, otherwise the sound track will be destroyed by it.

Feeding in the sound track 16 mm
Open the pressure arms on the sound sprockets by pressing the knobs on the arms. Wind the tape first of all round the lefthand sprocket so that the teeth engage in the sprocket holes. Then close the left-hand pressure arm by pressing it against the sprocket. Next guide the tape over the self-aligning and sound rollers as depicted in the illustrations showing the feeding-in process. Now pull the tape over the right-hand sprocket until it is taut, and then let it slowly slide back until the teeth of the sprocket engage in the nearest sprocket holes. Now close the right-hand pressure arm in the same way as you did the left-hand one. If the tape has been correctly fed in, the self-aligning rollers must be able to move freely to both sides. Pay attention to the following: when the left-hand self-aligning roller is forced along to the right as far as the stop, there must still be some clearance between the right-hand roller and the right-hand stop. Conversely, the left-hand roller must still have some clearance to the left when the right-hand roller is forced to the left as far as the stop. This adjustment is important, in order to enable the rollers to revolve when the machine starts up until the flywheels attain their full speed and thus prevent the film tearing or the perforations being damaged.

The machines are so designed as to prevent any mistake occurring when normally shrunk or stretched film is used. However, if specially shrunk or stretched material is used and the tape is taut, is may happen that the sprocket teeth engage right away in the sprocket holes. If this occurs, the film must be allowed to slide one hole further back. Only by so doing can you, firstly, ensure that the tape will run smoothly (5%) and secondly, that the tape itself will not suffer any damage.

Threading the film 35 mm
Open the pressure arm on the film scanner by pressing the appropriate knobs on the arms. Wind the film round the left-hand sprocket. Then close the left-hand pressure arm by pressing it against the sprocket. Now feed the film over the guide rollers of the film scanner and pull it to the right as far as the stop of the left-hand springy sprocket. Hold the film with the left hand at the guide roller and wind the short end of the film round the right-hand sprocket until the teeth engage in the sprocket holes. Close the right-hand pressure arm by pressing it against the sprocket. The film is now stretched between the two sprockets
and touches the guide ring of the polygon prism. Check that the film is correctly guided outside the sprocket in accordance with the enclosed illustrations showing how this should be done. The only way to ensure faultless running and avoid damage to the film is to make certain that it is correctly guided throughout.

On the film scanner there is a focusing lever and a knurled knob for frame adjustment. In the stop position of the drive or with decoupled picture the frame adjustment can be carried out with the knurled knob above the polygon by pressing a push button which is situated next to the switch of the sound exciter lamp. When the picture track is in operation picture frame adjustment can be accomplished simply by pressing the push button next to the switch of the sound exciter lamp. The picture frame adjustment is activated as long as the push button is pressed.

If you wish to monitor a combined sound, first insert the film in the manner as described above, and then feed it through the tension and guide-rollers in accordance with the appropriate film-threading illustrations.

Caution

Once you have inserted the film, and before you operate the selector switch, check that the coupling switches of the sprockets you are to use have been switched on. It is also advisable, when inserting magnetic sound print, to place the film in the scanner first.

Feeding in the sound track 35/17.5 mm

Check first of all that the guide rollers, self-aligning arms and pressure arms have the correct rollers for your width of tape, and also that the top part of the sound rollers is the right one.

Open the pressure arms on the sprockets by pressing the knobs on the arms. First wind the tape round the left-hand sprocket so that the teeth engage in the sprocket holes. Then close the left-hand pressure arm by pressing it against the sprocket. Now guide the tape over the self-aligning and guide rollers in accordance with the film-threading illustrations. Now pull the tape over the right-hand sprocket until it is taut and then let it slide slowly back a distance of roughly 1 1/2 sprocket holes. Then close the right-hand pressure arm as you did the left-hand one. If the tape has been correctly threaded, the self-aligning rollers must be able to move freely to both sides.

Pay attention to the following: when the left-hand self-aligning roller is forced along to the right as far as the stop, there must still be some clearance between the right-hand roller and the right-hand stop. Conversely, the left-hand roller must still have some clearance to the left when the right-hand roller is forced to the left as far as the stop. This adjustment is important, in order to enable the rollers to revolve when the machine starts up until the flywheels attain their full speed. If the rollers were unable to do this the film would tear or the perforations would be damaged. Only by so doing can you:

1. ensure that the tape will run smoothly (< 0.5 %)
2. ensure that the tape itself will not suffer any damage.
Changing the picture lamp 16 mm
Raise the lid beside the left-hand pressure arm, raise the old lamp by means of the tool supplied, insert the new lamp in the tool and carefully press it into the holder.

Changing the picture lamp 35 mm
Remove the front casing underneath the table top by loosening the locks on the left and right (about knee-height) and pushing them towards the middle. The front metal panel can then be pulled forward and removed.

The old lamp underneath the condenser can now be removed from its holder and the new one inserted. When doing so, the protective covering over the lamp should not be removed until the lamp has been placed in position, otherwise the fingermarks will be imprinted on the glass globe.

If it is necessary to re-adjust the positioning of the newly inserted lamp, the holder can be moved in three planes by means of knurled screws.

Changing the sound lamp
Remove the protective cover, loosen the screw behind the lamp and remove the old lamp. Insert the new lamp, press it down and turn it so that the recording slit has maximum illumination. Then gently tighten the screw which was previously loosened and replace the cover.

Adjusting the two pressure arms
Place 2 strips of film across the sprocket. Exert pressure against the arms, loosen the screws on their bearing spindle and move the arms until both rollers fit evenly (in the case of 16 mm arms move rollers and the tops of the guide mechanism.) Then re-tighten the screws, loosen the set screw on the retaining pin and re-set the pin by altering its position in such a way that there is no longer any clearance between the film and the rollers. Then re-tighten the set screw. As the pressure arms are adjusted in our works to two film thicknesses, it is only necessary to make this adjustment if either the bearing spindle or the retaining pin has been removed.

Treatment of the optical parts

Surface-coated mirror
Cleaning must only be carried out with soft cotton-wool. If it is very dirty, remove the mirror and clean it with clear water and cotton-wool.

16 mm polygon
If it is only slightly dirty, the polygon can be cleaned from the front with a soft leather cloth, cotton-wool or optical paper, by opening the two pressure arms. If it is very dirty the plastic cover can be removed and the two screws on the lens carrier loosened, this enabling the carrier, together with the lens and the upper film feed mechanism, to be withdrawn. The polygon is then completely free. When replacing, ensure that the base is absolutely clear, otherwise the upper film feed will not be flush with the sprocket row.
35 mm polygon

After removing the lighting prism clean the polygon with a soft leather cloth, cotton-wool or optical paper. If it is very dirty clean it with spirits, ether or alcohol.

Screen

The surface of the plastic screen is sensitive and can be easily scratched. If it gets very dirty, it can be cleaned with a soft cloth and water. If this is done, it is advisable to unscrew the screen from the frame.

Caution! Do not use any chemicals !!!

16 mm lighting system

The upper prism and its lenses can be unscrewed and cleaned in the same way as the polygon. The cold light mirror underneath the prism is held in position by a spring only. You can remove the spring and take out the mirror (clean it in the same way as the surface-coated mirror).

35 mm lighting system

The upper prism can be unscrewed, as can the condenser unit underneath the prism. Both can be cleaned in the same way as the polygon.

Maintenance

Clear the table every day of dust, pieces of fluff and scraps of film. After the machine has been in operation for about 100 hours remove any old scraps of film from the rollers and clean the pressure arms and sprockets. The base supporting the film plates is fitted with plastic washers and does not require oiling.

After the machine has been in operation for some 500 hours oil the roller bearings each time with highly fluid, non-resinous oil.

Oil

The gear mechanism is filled with GASOLIN Spezial B G 4 type oil. Topping-up is unnecessary. Under normal operating conditions it will be necessary to change the oil after about 1 year. An equivalent type of oil, for example SHELL x 100 2/w/20, can also be used.
The motor used for the cutting table drive is a D.C. motor. It is controlled by an electronic circuit, which sets the synchronous film speed, selected by the selector switch (W). The synchronous film speed at the cutting table can be set at either 24 or 25 frames/s as desired. The speed is easily changed by moving two link switches (printed circuit B).

The requirements for these are:

<table>
<thead>
<tr>
<th>Switch position</th>
<th>1</th>
<th>1</th>
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</thead>
<tbody>
<tr>
<td>Speed</td>
<td>24 frames/s</td>
<td>25 frames/s</td>
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</table>

An important condition for this switching, however, is that the table shall be fitted with the necessary printed circuit boards C1 and C2. Slow and fast speeds can be set up in addition to the synchronous speed. The circuit is on printed circuit boards, which are plugged into cassettes. This method ensures the greatest possible uniformity in manufacture and allows simple control of construction. The frame, with the whole of the wiring and the plug-in cassettes, is connected to the machine by a 30-pole-plug.

The structure of the electronic system is shown in the circuit diagram (4027.0014.00). The relay control conditions can be seen from the circuit diagram 4027.0002.01. The connections to the various cassettes are shown in wiring diagram 4027.0015.00 and the wiring on to the machine in the special wiring diagram of each equipment.

The numbers shown on the wiring diagrams are identical to the designations of the plug connections, or represent the numbers of the terminal strips. The printed circuits are designated (A), (B), (C1), (C2) and (D). There is a separate circuit diagram for each printed circuit. The components in the motor control system are numbered according to the printed circuit or wiring system.
to which they belong, as follows:

<table>
<thead>
<tr>
<th>Section</th>
<th>Drawing no.</th>
<th>Part. no.</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Wiring</td>
<td>4027.0015.00</td>
<td>1 - .....</td>
<td>(Rectifier board)</td>
</tr>
<tr>
<td>Printed circuit A</td>
<td>4027.0016.00</td>
<td>100 - .....</td>
<td>(Pulse generator and shaper)</td>
</tr>
<tr>
<td>Printed circuit B</td>
<td>4027.0017.00</td>
<td>200 - .....</td>
<td>Frequency comparison-24 frames/s)</td>
</tr>
<tr>
<td>Printed circuit C1</td>
<td>4027.0019.00</td>
<td>300 - .....</td>
<td>Frequency comparison-25 frames/s)</td>
</tr>
<tr>
<td>Printed circuit C2</td>
<td>4027.0020.00</td>
<td>400 - .....</td>
<td>Frequency comparison-25 frames/s)</td>
</tr>
<tr>
<td>Printed circuit D</td>
<td>4027.0021.00</td>
<td>500 - .....</td>
<td>Relay board</td>
</tr>
</tbody>
</table>

**Functional description:** (see circuit diagram 4027.0014.00)

The speed of the drive motor (5) is controlled by phase gating of the controlled rectifier (3). The pulsed direct voltage required for this purpose is obtained from the A.C. circuit (Transformer 1, winding I) by means of a bridge rectifier (100-103). This voltage also feeds the shunt field winding of the motor (5) via a choke (2) and a smoothing capacitor (114). The motor armature is connected through relay contacts (Ia, IIa, Ib, IIb) for the direction of rotation chosen by means of the switch (W). A diode connected in parallel with the armature (512) prevents voltage surges when the armature is switched; such surges could damage the controlled rectifier (3). Further protection for the controlled rectifier and also for the bridge rectifier (100-103) is provided by the circuit (116, 118, 120, 117, 119). Braking of the motor is effected by short-circuiting the armature on relay contacts (Ib, IIb). The stopping distance can be lengthened by replacing the link by a resistor.

A transistor circuit generates pulses which cause the silicon controlled rectifier (3) to conduct at the correct instant. For this purpose, a transistor (202) is used in the following way: its base is supplied through a resistor (226) with the voltage at the collector of transistor (201) (see below). Across the emitter resistor (206, 215) of transistor (201), approximately the same voltage is developed as that which exists at transistor (201). The value to which the emitter resistors (206, 215) are adjusted determines the current flowing in transistor (202), if the collector is at a sufficiently high voltage (Constant - current circuit). The collector voltage of transistor (202) is not constant...
however, but is taken from the mains circuit (rectifier 104) as a pulsed D.C. voltage, via the resistor (228). The rise of this voltage produces an increasing voltage drop across the resistor (228), until the constant current determined by the emitter resistors (206, 215) is reached. From this instant, the voltage drop across the resistor (228) does not change, but now the collector-emitter voltage of transistor (202) increases with the rising voltage, taking up the further voltage rise until the voltage again falls. In this way, a section is obtained from the supply voltage waveform, the width of which is determined only by the setting of the resistor (215), i.e., by the value of the current in transistor (202). This current can be influenced by the value of the voltage on transistor (201) (see below). This process produces at a definite time in the period of a half cycle of the supply voltage beyond the resistor (229) and the diode (208), at the base of transistor (203), a voltage pulse of a definite length. During this time the transistor (203) is forward conducting, short circuiting the voltage existing across the diode (207). (The other transistor in the circuit (204) need not be considered for the moment, since it is fully conducting.) This discharges the capacitor (241). At the end of the voltage pulse at the base of transistor (203), this transistor is cut off and the voltage at its collector jumps from almost zero to the value determined by the Zener diode (207). This step voltage is applied via capacitor (241) to the base of transistor (205), which is thereby caused to conduct for a short time, until the capacitor (241) is again charged to the changed voltage. With transistor (205) conducting, there is a voltage drop across the resistor (236) which is used, via the diode (210) and resistor (213) to fire the controlled rectifier (1).

For a low motor speed (5), only a small voltage needs to be produced, that is to say control must give a large phase gating angle. This is achieved by cutting off the transistor (202) by means of the selector switch (w) (+ve voltage on the base). A broad voltage pulse is then produced at the base of transistor (203), which is equivalent to a large firing angle for the controlled rectifier (3). If the transistor (202) is fed with the voltage from transistor (201) (as described above), the current in transistor (202) is increased, i.e., the firing angle of the controlled rectifier (3) is reduced. The direct voltage then available for the armature of the motor (5) gives a
speed of about 25 frames/s. Applied through resistors (110, 227, 220 and 15 or 16), the armature voltage of the motor (5) affects the base circuit of the transistor (201) in such a way that an increase of armature voltage gives a larger firing angle, i.e. a smaller voltage for the controlled rectifier (3) and conversely. The change in the armature voltage arises firstly from a change in the motor speed, but also because of variations in the supply voltage. Both causes are compensated by the feedback of the armature voltage to the control circuit.

If the motor lead exceeds a certain value, transistor (204) is cut off by the voltage which then exists across the capacitor (239). This prevents the voltage on the capacitor (241) from changing further, for the transistor (203) can no longer short circuit the voltage on the Zener diode (207). The cutting off of transistor (204) thus blocks the application of the control pulses to the controlled rectifier (3) for the duration of the overload.

The measures for the stabilisation of the motor speed described are not sufficient to ensure satisfactory synchronous running of the motor. A small A.C. generator (6) is therefore coupled to the motor (5), which supplies a voltage at a frequency which exactly corresponds to the motor speed. This frequency is doubled in a transistor circuit (302, 303) and converted, in a discriminator filter (Printed circuit C1 or C2) into a frequency dependent control voltage (at 306 and 307 or 406 and 407). After amplification in transistor (200, 201) this control voltage affects the base of the control transistor (202) in such a way that when the speed is either too high or too low, it is compensated to the synchronous speed.

With the method described above of generating a control pulse for the controlled rectifier (3), it is not possible to produce a firing angle of more than 90°. In order to make full use of the given mains voltage for a high motor speed, instead of using, as has been done so far, the trailing edge of the pulse at the base of transistor (203), the leading edge is used. This is effected by means of the selector switch (W) which switches the switch M4 from the emitter of transistor (204) directly to the base of transistor (205). The transistor is thus already conducting when transistor (203) starts.
conducting. This switching of the pulse route is associated with a jump of the firing angle from large to small values, hence with a sudden increase of the armature voltage of the motor (5). The sudden sharp acceleration of the motor is definitely damped by the action of transistor (204) which has already been outlined, and gives a smooth run-up which protects the film.

**Relay control: (see circuit diagram 4027.002.01)**

The direct voltage required for the relay coils is obtained from the A.C. supply section (Transformer 1, winding III) via the bridge rectifier (105 - 108). When the main switch is turned on, the coil of relay III obtains voltage via M II, vb and resistor (503). The relay is energized and its contacts IIIa close. Only IIIa when is closed can relays I and II be energized via M 6 or M 3 respectively. Since M II is closed only when the selector (w) is in the zero position, relay III can only operate, on switching on by the main switch, if the selector switch (w) is in the zero position. This prevents undesired starting of the motor when the main switch is turned on. Once relay III has operated, it is held on via IIIa, vb and (503), even if M 2 opens.

The action of the individual contacts M 1 to M 6 when the selector switch (w) is operated will be seen from the diagram (4027.0022.00). If for example the selector switch is moved to the right, M 2 first opens, then M 5 is momentarily opened, and finally M 6 changes over, and the coil of relay I is fed via IIIa, M 3, M 6 and IVb. Relay I is energized and contacts Ia and Ib operate. Voltage will be put on the armature of the motor via Ia and Ib. (Movement of the key to the right gives and low forward speed). At the same time relay X will be energized via diode (522). The functions of the relay are as follows: Contact Xa switches off the relay - capacitor which is then short circuited by resistor (513). The resistor in series of 100 ohms of the picture lamp transformer is short circuited by Xb during operating of the editor (viewing lamp at full voltage). Xc in resting position short circuits the resistor in series 500 ohms for the table lamp which burns at full power on standstill. During operation the working contact Xc switches on the time lapse counter (supplied on request). Then the table LAMP IS FED THROUGH A RESISTOR in series giving reduced brightness. In the resting
position the ignition pulse of the thyristor is short circuited by Xd. If the selector switch is moved Xd is opened so that Ia/Ib or IIa/IIb close. The current of the armature will first pass through after Xd is opened. Returning the selector switch to zero position relay I or II drops out while Xd short circuits the ignition pulse without delay and cuts down the current of the armature.

A further movement of the selector switch (W) to the first detent opens the contacts M1 and the chosen synchronous motor speed is established. If the selector switch is moved still further until the stop is reached (second detent), M4 closes and the armature of the motor (5) reaches its maximum speed (fast motion).

Returning the selector switch (W) to the centre position returns the contacts M1, M2, M3 and M6 to their original positions. Relay I and X drops out, and the armature of the motor (5) is disconnected from its supply and short circuited through contacts Ib, IIb. This reduces the motor speed to zero in the fastest possible time. If the selector switch is now moved to the left, first M2 is again opened and M5 opened momentarily. M3 then changes over. Voltage is applied to the coil of relay IV via IIIa, M6, M3 and resistor (501). It will however only operate if the capacitor has been charged, via resistor (501) to the energizing voltage. When relay IV operates, contacts IVa are closed and IVb open. Voltage is applied to relay II and X via IIIa, M6, M3 and IVa. Relay II is thus energized and voltage is applied to the motor armature via IIa, IIb. When the selector switch is again returned to the centre position, relay II drops out as soon as M3 has changed over. Relay II, however, drops out only when the capacitor of (105) has discharged through the coil of relay IV to a voltage below the holding voltage of relay IV. The operating and dropout delays of relay IV prevent rapid switching from one motor direction to the other (film protection).

Relay functions in the "automatic feed method"
(see circuit 4027.0002.01)

Relay V with its contacts Va and Vb, contacts M5, M7 and Q, the diode (500), the capacitor (506) and the resistors (502 and 504) are necessary only for the "automatic feed method". On operation of the contact M7 on the selector switch (W) (separate key in the
moulding of the selector switch), relay V is energized by the charge on the capacitor (506). Contact Va closes and Vb changes over, relay III drops out. IIIa and IIIb open (see 4027.0014.00) and relay I is supplied with voltage via M5, Q, Va, diode (500) and IVb. Relay I is energized and the motor runs in the forward direction at synchronous speed. Since the selector switch (W) is at zero, the contact M1 (see 4027.0014.00) is closed. To enable the film to run at synchronous speed in spite of this, this circuit is broken by relay contact IIIb. If now a control tone recorded on the tape energizes relay Q (in the amplifier), the contact Q opens and relay I drops out. The motor is braked via Ib and IIb. If the drive is to be stopped before the appearance of the control tone, there are two possibilities:

1. By moving the selector switches from the centre to either side, the contact M5 is momentarily opened. The stopping process is as above, when Q opens. Since relay III has dropped out and cannot again be energized until the selector switch is again at zero and M2 is closed, neither relay I nor relay II can be energized again. Normal conditions are established again only when the selector switch (W) is back to zero.

2. By again operating the contact M7 on the selector switch (W), the voltage across the coil of relay V is momentarily shorted through the capacitor (506), and relay V drops out, IVa opens and relay I drops out. Even if M7 is held longer, relay V is not again energized, because the current – fed only through resistors (503),(504) – is too small. The contact M7 can be operated at any other position of the selector switch (W), the drive then being automatically switched to forward synchronous speed.

Relays XI, XII and XIII are situated on a special relay board (2927.0006.01 or 4027.0009.01) and operate the clutch and brake system.

Special circuit:

On operating with electronic digital counter Z 2000 or cut-marking system ST 64/65 the supply voltage will be led via the corresponding contacts of these units. When operating these units the machine will be switched off.
Setting up procedure for the motor control

Concerning adjustment no. 1

It has been found in practice that setting up the voltage of 4.8 V at points A-A does not always give the maximum control efficiency. This is because the components which govern this voltage sometimes have large manufacturing tolerances, giving incorrect values. In this case, nevertheless, the adjustment should first be carried out as instructed. The following measures should then be taken:

The potentiometer 215 is rotated clockwise (as seen looking at the slot in the spindle) to the stop (1). The selector switch is set for 24 or 25 frames forward. Although the main switch is on and all fuses are in, the drive does not yet run. By slowly turning back potentiometer 215, a point is reached at which the drive starts to run jerkily. With a slight further rotation of the potentiometer, it will be found that the drive runs smoothly. The position of the wiper (2) on the potentiometer is noted and then the potentiometer is rotated counter-clockwise to the stop (3). If the table is now switched to normal forward running, it will be noted that the speed is either very slow or very dependent on the load. By slowly turning back the potentiometer (clockwise) and slowing down a spindle, it will soon be possible to feel the point at which the drive is working at its correct speed with a regulator characteristic. This potentiometer position (4) must also be noted. The correct setting of the potentiometer is then found between the two positions (5). The control can now compensate both overvoltages and undervoltages. The potentiometer setting first found is that for the adjustment which determines the lower voltage. If it is possible to vary the supply voltage by means of a variable-ratio transformer, a simplified procedure can be adopted, in which the
transformer output voltage is adjusted to the expected lowest supply voltage and then only the first adjustment carried out, until correct running is achieved. The potentiometer 215 can then be left in this position. All higher voltages, up to the higher limit of +5%, will then be compensated by the control system. When the above adjustment have been made, the null at points D-D must still be set up by means of potentiometer 15 or 16.
Setting-up procedure for the motor control system
(see circuit 4027.0014.00)

Setting up the motor control system involves three measurements.
For these, a D.C. voltmeter with an internal resistance of at
least 10 kOhm/V is required. For the third measurement it is an
advantage to have a meter in which the zero position of the
pointer can be adjusted to the centre of the scale.

Adjustments 1 and 2 are carried out on each printed circuit B in
the works. Re-adjustment should only be necessary when a component
on this board is changed. Adjustment 3 must always be made if
circuit B is changed.

1. The potentiometer (215) (Board B) must be adjusted to give a
voltage of 4.8 V at the point A-A. For this, the fuse (18)
must be removed and the selector switch (W) must be in the
forward or backward synchronous speed position (first detent).
This applies also to the second measurement.

2. The potentiometer (214) (Board B) is adjusted so that the
voltage between points B-B is zero or as small as possible.
(Balancing of the differential amplifier). For this, the points
C-C must be short circuited. When the differential amplifier
has been balanced, measurement 1 must be corrected, without
disturbing the potentiometer (214). The selector switch must
now be returned to zero and after switching off at the main
switch the fuse screwed in (18).

3. After turning on the main switch and setting the selector
switch to the forward synchronous position, connect the meter
to the two plug contacts on the base of the motor control
system. According to the markings either the plug contact
for 24 frames/s or 25 frames/s should be used for null reading.
The voltage on these measuring points should be null, adjust-
ments can be made with the corresponding potentiometer close
to the plug contacts.
Warning!

If the film speed is much too low or high compared with the desired synchronous speed, a null can still be obtained on the meter. At the correct balance, the pointer will deviate from the null point for a very slight increase or decrease of speed, to +ve and -ve values respectively. Only this setting gives the correct speed.

The potentiometers (15) and (16) are mounted on a pertinax board close to the controlled rectifier (3) and are designated 24 B and 25 B respectively.
* Nur bei Geräten mit 2 Bildabtastungen
K
Kupplungsschalter

W
Wahlschalter

in 0-Stellung gezeichnet

Ersatz für

W. Steenbeck & Co
Hamburg 22
* Nur bei Geräten mit 2 Bildabtastungen
Kontakt geschlossen
T1 = BC 109
T2 - T6 = BC 149
T7 = 2N 3053
I) Klammerwerte für 35mm-Magnettonfilm

W. Steenbeck & Co
Hamburg 22

MAGNETIC SOUND Magnetton-Verstärker
L-903

T1: BC109
T2/3/4/5: BC149

ohne Regler
mit Regler

100/3

1k2
10k
100
100
100

C4
R8
C1
R10
31

220k
R2

150k
R3

47k
R1

W. Steenbeck & Co
Hamburg 22
Alle Widerstände 1/8W
Alle Transistoren BC149
K1 nur bei ST400W/400CW/700/700C/900

Nur bei autom. Anlegeverfahren

R

H

0,25 μF

V

0,1 μF
Relais IX und X, Kontakte Aut. a, b, c und y nur bei automatischem Anlegeverfahren

<table>
<thead>
<tr>
<th>IX</th>
<th>X</th>
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<tr>
<td>220V</td>
<td>8V</td>
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Bei 500 W/1000 Kupplungshebel auf "Bild-Tor"

Änderung vorbehalten

nur bei

Motorumroller