MODEL 400 AND 401

MECHANICAL ADJUSTMENT MANUAL

AMPEX MODEL 400

MECHANICAL ADJUSTMENT MANUAL

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AMPEX MODEL 400 MAGNETIC TAPE RECORDER

MECHANICAL ADJUSTMENT MANUAL

SECTION I - GENERAL

Each Model 400 recorder has been very carefully adjusted before leaving the factory. Under normal conditions, these adjustments are quite stable and should not be altered. However, if the machine should get out of adjustment through unusually rough handling or accident, it may require attention. A complete description of all adjustments is contained in this manual.

DESCRIPTION OF OPERATION

The Model 400 machine uses a mechanical linkage to control its various functions. Two motors are used, one for the capstan drive, the other for takeup and rewind of tape on the turntables. The latter one is engaged with the proper turntable by a mechanical linkage and drives it through a rubber tire on the motor pulley. Proper tape tension is maintained by a friction holdback device using felt pads. Braking to allow rapid stopping of tape motion is performed by an additional set of felt-lined mechanical brakes.

The mode selector switch, together with the Play button, serve to control tape motion in the machine. The former positions the mode change cam into either Forward, Rewind, or Off positions. Setting this cam into the Forward position performs the following functions (directions of movement are those observed when viewing bottom side of top plate).

1. Bell crank (Fig. 2-5) is rotated counterclockwise, moving turntable motor link (Fig. 2-6) to left and thereby causing motor pulley to engage takeup turntable. Simultaneously, rotation of bell crank shaft positions turntable reversing switch (Fig. 2-3), connecting motor windings so that rotation in desired direction is produced.

2. Cam follower (Fig. 1-2) is moved to left, causing cam follower lever (Fig. 1-3) to rotate slightly in a clockwise direction about its pivot (Fig. 1-6A). This motion is imparted to the brake release arm through its pivot (Fig. 1-7A) causing this part to move to the right. If the takeup tension arm is in operating position (either by tape being properly threaded or by being held over in some other manner against spring tension), the trip lever (Fig. 1-5) will catch the trigger end of the brake release arm (Fig. 1-7) and thereby cause position to be imparted through the brake release rods to the brakes (Fig. 1-10, 1-15). A collar (master switch actuator, Fig. 1-17) on the rewind

brake rod (Fig. 1-11) also will operate the master switch (Fig. 1-19), energizing the turntable motor. Fast Forward operation will then occur. If the takeup tension arm is not in operating position, the brake release arm will rotate counterclockwise about its pivot. No motion will be imparted to the brake rods, brakes will not release, and master switch will not close. In addition, the mode selector will not latch in an operating position.

If the mode selector cam is placed in Rewind position, the motion of bell crank and turntable reversing switch will be in a clockwise direction. The motor will rotate in opposite direction to that described above and will be engaged to the rewind turntable. The action of brake linkage will be the same as for Forward operation.

Should the Play button be depressed prior to placing mode change cam in Forward position, an additional function occurs. The play engage dog (Fig. 2-2) will catch the end of the play engage lever (Fig. 2-4) causing it to rotate in a counterclockwise direction. This motion in turn will be imparted to the play engage tie rod (Fig. 2-22), moving it to the left. Since it is attached to the capstan idler adjustment arm (Fig. 2-21), the idler assembly will rotate bringing the idler against the capstan. In addition, a pin affixed near the center of the play engage tie rod will operate the play holdback actuator (Fig. 2-12), thus increasing the holdback effect to maintain proper tape tension. Simultaneously, movement of the play holdback actuator positions the record interlock switch (Fig. 2-13), and the play resistor switch (Fig. 2-10). The former interlocks the Record button on the electronics unit, while the latter reduces voltage on the turntable motor and consequently reduces its torque to the amount needed for proper tape tension in the Play mode.

Other controls provided are the power switch, which turns on the electronic units and energizes the capstan drive motor, the reel size switch (this unit is a switch in name only; it serves as a mechanical linkage to control pressure on play holdback), and tape speed switch which controls speed of the drive motor by varying connection of its windings.

SERVICING:

Before proceeding with adjustments, the tape transport mechanism and electronics should be removed from the cabinet and the tape transport mechanism should be placed upside down in the cabinet with its front toward the front of the cabinet. Most of the adjustments can be made with the machine in this position.

The recorder was designed for use either in the horizontal position or for rack mounting. The only adjustment affected is the takeup tension arm tension. See takeup tension arm tension adjustment.

AMPEX MODEL 400

MECHANICAL ADJUSTMENT MANUAL

SECTION II

OPERATIONAL IRREGULARITIES AND THEIR CORRECTION

"Snapping" the mode selector into Forward position with Play button depressed may cause the machine to trip off.

If the machine trips off with normal operation of the mode selector, check the following:

1. Play engage and master switch adjustments. (See Section III)
2. Take-up tension arm tension. (It may be too high.)
3. Power boost switch adjustment.
4. Possible failure of master switch or turntable reversing switch.

When starting in Play mode, if excessive slack develops in tape between capstan and holdback reel thereby causing tape to track out of the capstan engagement and possibly break, the cause is insufficient play holdback.

Check the following:

1. Large reel on pay out turntable with reel size switch in small reel position.
2. Play hold back adjustment.

If takeup tension arm continues to oscillate after machine is started in Play mode, check the following:

1. Fast forward and rewind holdback adjustment.
2. Takeup tension arm for excessive tension.

If machine fails to trip off when tape runs out or breaks, check the following:

1. Takeup tension arm tension (will be too low).
2. Takeup tension arm shaft may be binding due to gummy condition. If so, remove, clean, and replace. Lubricate with a few drops of light oil.

If tape consistently scrapes the flanges of either reel, check the following:

Reel for bent flanges.

2. Different rolls of tape. Some tape may have internal strains or be improperly slit, causing it to wind improperly.
3. Turntable height.

If tape does not track properly in reel idler groove, check reel idler height. Tape should not bear heavily on either edge of guide groove.

If the machine fails to go into Play mode when properly operated, but goes instead into Fast Forward, the cause is probably a gummy condition between the Play engage dog and the mode change cam. Remove the mode change cam and wash the sticky parts with solvent. Place a drop or two of light oil on the dog pivot when replacing.

If machine fails to operate when mode selector is turned to an operating position and when mode selector returns to off when released, check the following:

1. Trip lever. If gummy, remove, clean, and replace. Be sure that spring is attached.
2. Trip lever stop adjustment.

If machine fails to operate when mode selector is turned to an operating position and mode selector remains in that position, check the following:

1. Master switch and its adjustment.
2. Turntable reversing switch and its adjustment.
3. Top plate fuse.
4. Power switch and top plate wiring.

If braking is too severe or irregular the cause is probably a foreign deposit on the brake drums. Clean drums with carbon tetrachloride or other solvent. The felt linings should function properly after the drums have been cleaned. However, if they have in some way picked up oil they should be replaced.

If the rubber tired turntable drive wheel slips on the brake drum in any mode, the situation should be corrected immediately as the rubber tire will be injured, and rubber will be deposited on the brake drums causing brake and holdback problems.

Check the following:

1. Presence of oil on brake drums or tire.
2. Turntable motor centering (if slippage occurs in only one direction.)
3. Master switch adjustment.

If tape tends to wander up or down from engagement between capstan and capstan idler, check the following:

1. Capstan idler height.
2. Capstan tape guide height.
3. Play holdback tension (either too great or too light).
4. Play resistor switch (not cutting in).
5. Power boost switch adjustment.

With the machine in play mode there should be an extra surge of power as the takeup tension arm is forcibly moved in against the tape. If this surge does not occur before the machine shuts off due to the takeup tension arm being pushed toward the rest or off position, then the machine cannot operate satisfactorily. Check the play resistor switch and power boost switch for proper adjustment and if necessary make further check to determine that the switches are functioning.

SECTION III

A. BRAKE LEVER PIVOTS - FIG. 1-20

If for any reason the brake levers are removed, replace in same position from which they were removed. Tighten locknut, Fig. 1-20, until it bottoms on the brake lever, then back off approximately 1/4 turn. Allow no drag on the brake lever at this point.

B. BRAKE RELEASE ARM RESET STOP - FIG. 1-8

1. Place mode selector in off position.
2. Loosen securing screw, Fig. 1-8A and set stop so that the triggering end of the brake release arm, Fig. 1-7, is approximately 1/16" from the brake release arm trigger end stop, Fig. 1-7B.
3. Tighten securing screw using care to avoid moving stop as screw is tightened.

C. TRIP LEVER STOP - FIG. 1-4

1. Fasten takeup tension arm in operating position with Scotch tape.
2. Loosen stop securing screw, Fig. 1-4A, and turn stop to a position that will allow 3/64" to 1/16" contact between the trigger end of the brake release lever, Fig. 1-7, and the trip lever, Fig. 1-5, as the mode selector is turned from off toward either operating position.
3. Tighten stop securing screw.

D. FAST FORWARD AND REWIND HOLDBACK - FIG. 2-8 and 24

1. Remove brake drums. (Note position so that each drum may be replaced on the shaft from which it was removed.)
2. The rewind and fast forward holdback arms, Fig. 2-8 and 24, should have a rest position 2-3/4 inches from the turntable shaft. Bend at a point close to their mountings to correct any misadjustment. Be sure that linings contact drums evenly and do not bear heavily on heel or toe of lining.

E. BRAKES - FIG. 1-10 and 15

1. Swing takeup tension arm on top plate to operating position and fasten it there with Scotch tape.
2. Turn mode selector to either operating position.
3. Loosen set screw on rewind brake adjustment collar, Fig. 1-9, and adjust brake shoe to have minimum clearance from drum. Tighten set screw. Check to determine brake does not drag.
4. Loosen set screw on takeup brake adjustment collar and adjust brake shoe to clear brake drum by 1/32". Tighten set screw.

F. MASTER SWITCH ADJUSTMENT - FIG. 1-19

1. Fasten takeup tension arm in operating position with Scotch tape.
2. With the Play button depressed, move mode selector in forward direction until master switch timing line on cam follower arm lines up with the edge of the mode change cam as shown in Fig. 1-21.
3. Set master switch to "click" at this point by adjusting position of the master switch actuator, Fig. 1-17. Fine adjustments may be made by bending the master switch tongue, Fig. 1-18, slightly.
4. Tighten set screw in the master switch actuator and recheck to see that the master switch clicks just as the edge of the cam lines up with the master switch timing line. (Always perform this check in play mode.)

G. PLAY ENGAGE ADJUSTMENT

Always check master switch adjustment (see preceding paragraph) before making this adjustment.

1. Fasten takeup tension arm in operating position with Scotch tape.
2. Adjust capstan idler adjustment clamp screw, Fig. 2-19, to give medium drag between capstan idler adjustment arm, Fig. 2-21, and capstan idler arm shaft.
3. Depress Play button and move mode selector in forward direction until master switch "clicks". Shift the capstan idler arm, Fig. 2-20, with respect to the capstan idler adjustment arm, Fig. 2-21, so that the capstan idler Fig. 2-17 is about 1/64" from the capstan, Fig. 2-16, as the master switch clicks.
4. Securely tighten capstan idler adjustment arm clamp screw, Fig. 2-19.
5. Recheck by depressing Play button and moving mode selector in forward direction. The master switch should click as the capstan idler reaches a point about 1/64" from the capstan. Do not allow the capstan idler to touch the capstan before the master switch clicks

H. TURNTABLE REVERSING SWITCH - FIG. 2-3

1. Loosen clamp bolt on bell crank, Fig. 2-5A.
2. With mode selector in "Off" position, rotate switch shaft until the switch rotor blades are centered in the switch.
3. Tighten bell crank clamp bolt.

If the mode selector does not securely lock in both positions when the takeup tension arm is held in operating position, it is probably because of misadjustment of this switch. The stop on the switch is causing a premature stoppage of the cam. Readjust slightly to correct this condition.

I. TURNTABLE MOTOR CENTERING - FIG. 2

1. Remove turntable motor link, Fig. 2-6, from bell crank, Fig. 2-5.

2. Hold the turntable motor centered accurately between the brake drums. A simple centering jib could consist of two pieces of 1/16" thick metal inserted between brake drums and turntable motor tire.
3. Revolve the turntable motor link, Fig. 2-6, until it lines up with the outside hole in the bell crank, Fig. 2-5.
4. Insert turntable motor link from casting side and install new retaining ring.

J. POWER BOOSTER SWITCH ADJUSTMENT - FIG. 1-16

1. Move the takeup tension arm from its rest or off position toward the reel idler. The power boost microswitch should "click" or open as the arm guide passes through a line drawn between the center of the reel idler and the center of the takeup tension arm bearing.
2. If necessary, adjust by bending the microswitch arm slightly.

K. TAKEUP TENSION ARM TENSION - FIG. 1

The amount of tension given to the takeup tension arm is important. An amount just sufficient to trip the mechanism should be maintained. If excessive it will cause the machine to shut off during rewind or fast forward and cause starting difficulties. For rack mounting, additional tension has to be provided to compensate for the weight of the tension arm.

Adjustment is accomplished by loosening the locknut at the cam following arm pivot, Fig. 1-6A, and moving takeup tension arm adjustment lug, Fig. 1-6, to obtain correct tension. For rack mounting it may be necessary to shorten spring to secure sufficient tension.

L. PLAY RESISTOR SWITCH, RECORD INTERLOCK SWITCH AND PLAY HOLDBACK ADJUSTMENT

1. Fasten takeup tension arm in operating position with Scotch tape.
2. Connect ohmmeter across the outside terminals of play resistor, Fig. 2-15, using a low resistance range, to determine exact time of play resistor switch action.
3. Play holdback actuator, Fig. 2-12, should be in approximately normal position on shaft.
4. Loosen clamp screw on switch actuator, Fig. 2-25, but maintain slight drag.
5. Move switch actuator, Fig. 2-25, on the switch shaft so that the resistor cuts in after the master switch "click" as the mode selector is moved in the forward direction with the play button depressed. Resistor should cut in when position of the mode change cam and cam follower are as shown in Fig. 3.
6. With machine in Play mode, readjust play holdback actuator as shown in Fig. 2-12 until it presses the entire surface of the play holdback felt evenly on the holdback brake drum. Play holdback

should be 4 oz. measured with recorder in Play mode and from N. A. B. hub. Reel size switch should be in large reel position. Securely tighten clamp screw when adjustment is completed.

7. Recheck play resistor and record switch. Be sure the play resistor switch is correctly adjusted as in Paragraph 5, above. Record interlock switch adjustment is also accomplished by this procedure.

M. PLAY TAKEUP ADJUSTMENT

The slide on the play resistor, Fig. 2-15, adjusts the play takeup. Moving the slide toward the top plate increases the takeup.

To check for proper tension:

1. Fasten takeup tension arm in operating position with Scotch tape and with transport mechanism in normal position and power connected.
2. Attach a short piece of string (about 30") to the takeup reel hub (N. A. B.) with the other end attached to a spring scale (0-16 oz. preferred).
3. Place the machine in Play mode.
4. The tension should be 8-1/2 to 9 oz. as the scale is allowed to move slowly in the direction of pull of the reel.

N. REEL IDLER HEIGHT

The height of the tape above the top plate is determined by the tape guides in the head housing. It should be approximately 3/4 inches, measuring from the bottom of the tape to the surface of the top plate.

Adjustment of reel idler height is made by loosening the set screws (top plate casting), holding the reel idler housing and adjusting to correct height.

Adjust initially so as to guide the tape 3/4" above the top plate. Observe if there is any misalignment between the idler guiding and payout head guides. If misalignment is observed, adjust the idler a slight amount up or down to correct. Be sure to tighten set screws.

O. TURNTABLE HEIGHT

Correct turntable height is 0.635" measuring from the top surface of the turntable to the surface of the top plate.

Adjustment is made by loosening the set screws (top plate casting), holding the turntable bearing housing, and adjusting to correct height. Be sure to tighten set screws.

P. REEL SIZE SWITCH ADJUSTMENT - FIG. 2-14

Switch should be set so that the spring connecting arm to play holdback (Fig. 2-11) will just pull play holdback clear of drum when mode

switch is in off position and reel size switch is in large reel position.

If adjustment is needed, loosen locknut securing switch, position as described above, and tighten locknut.

Q. CAPSTAN IDLER HEIGHT - FIG. 2-17 and 26

If the tape exhibits a tendency to wander from its proper position between capstan and capstan idler, the cause of the difficulty is either improper adjustment of capstan idler height or of capstan tape guide height (see paragraph R). The tape should be centered on the idler when properly passing over tape guide and properly entering head assembly. If it shows a tendency to ride up or down during operation, the capstan idler height may be varied by loosening set screw in idler arm and raising or lowering idler desired amount.

R. CAPSTAN TAPE GUIDE HEIGHT - FIG. 2-23

If, as in preceding paragraph, tape tends to wander from proper position, the cause may be the adjustment of capstan tape guide height. This adjustment may be varied in small increments by adding or removing shims (Ampex Stock No. A-923) between tape guide and supporting spacer.

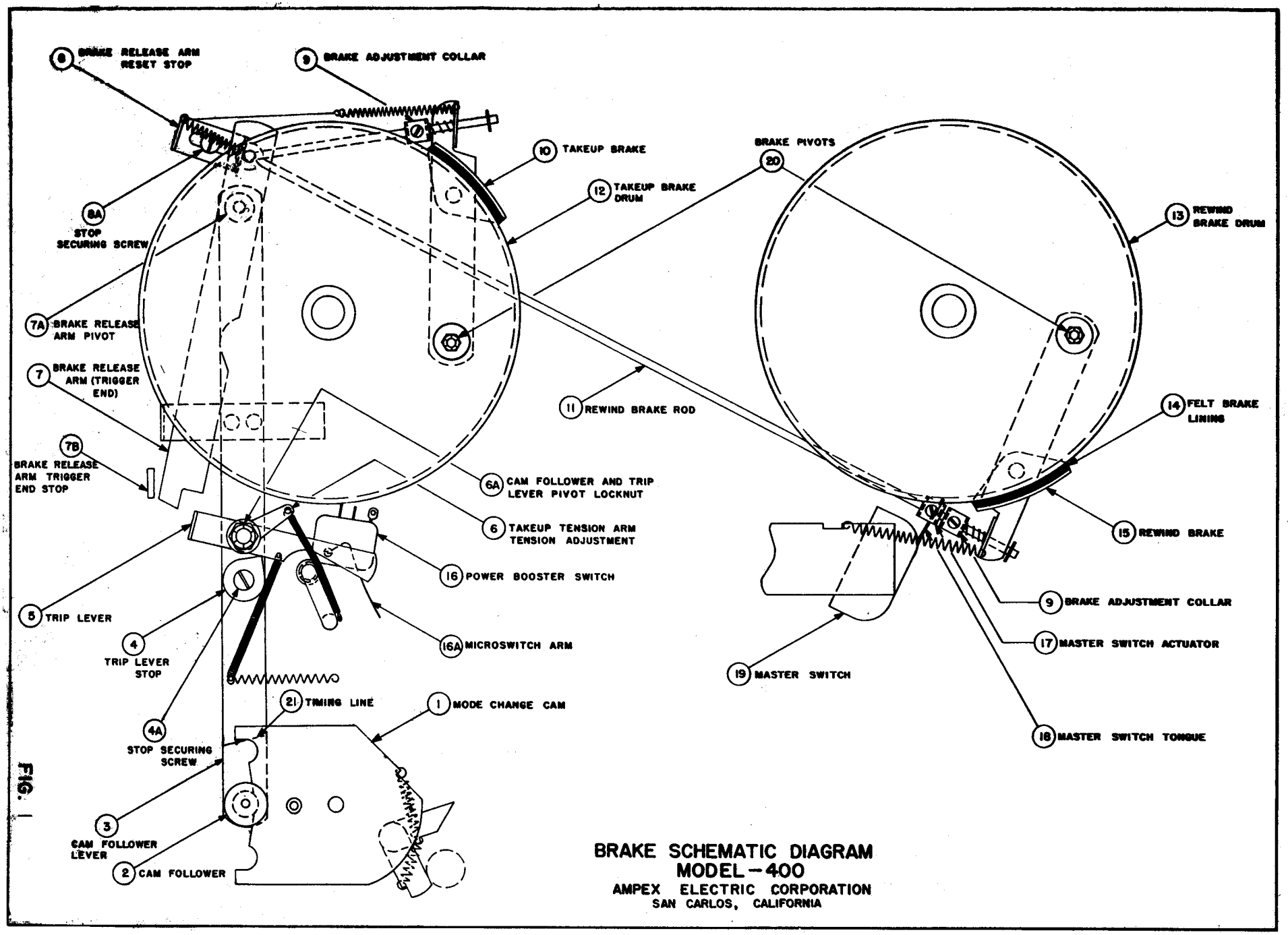

FIG. 1

BRAKE SCHEMATIC DIAGRAM
MODEL-400

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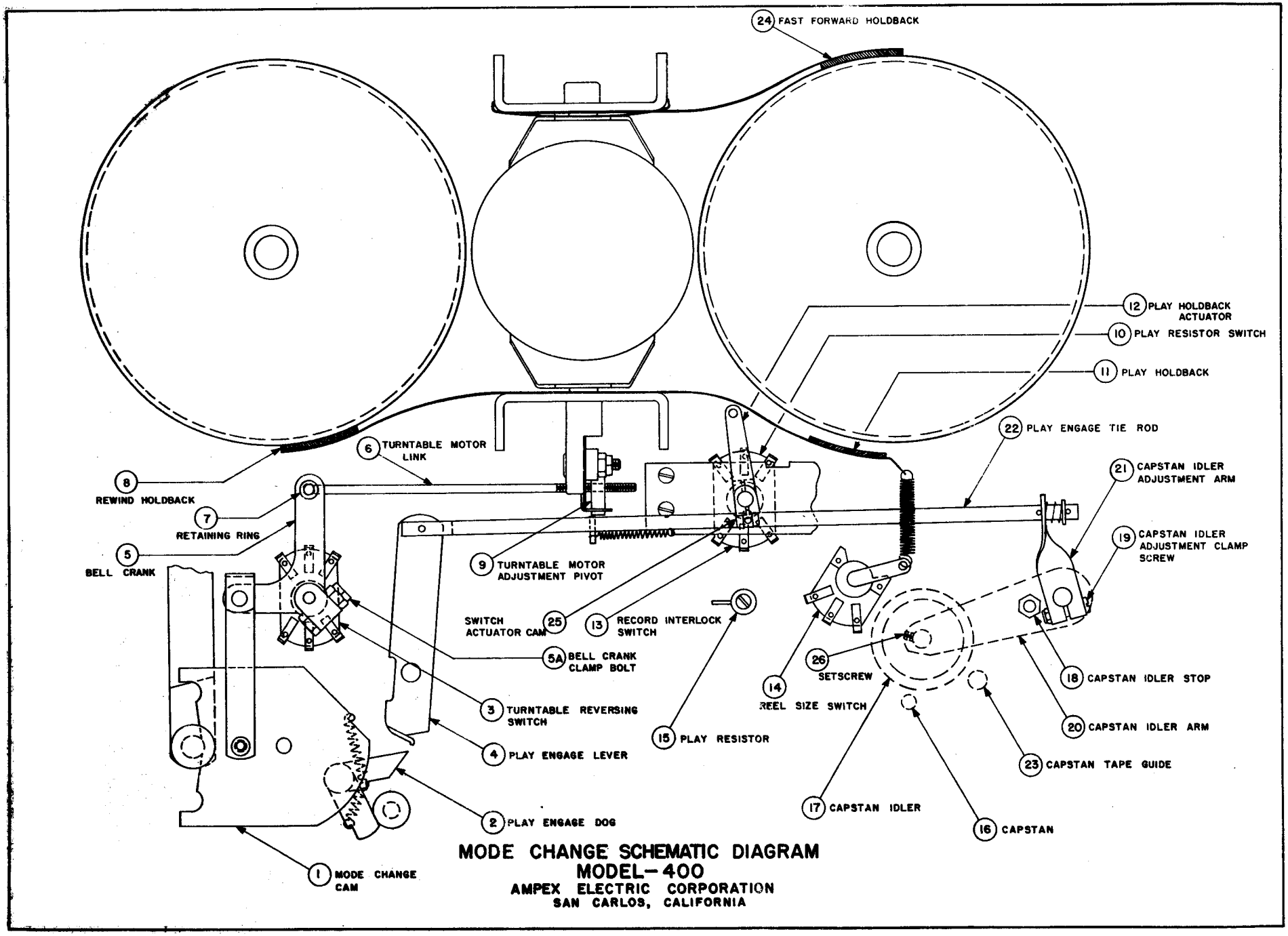
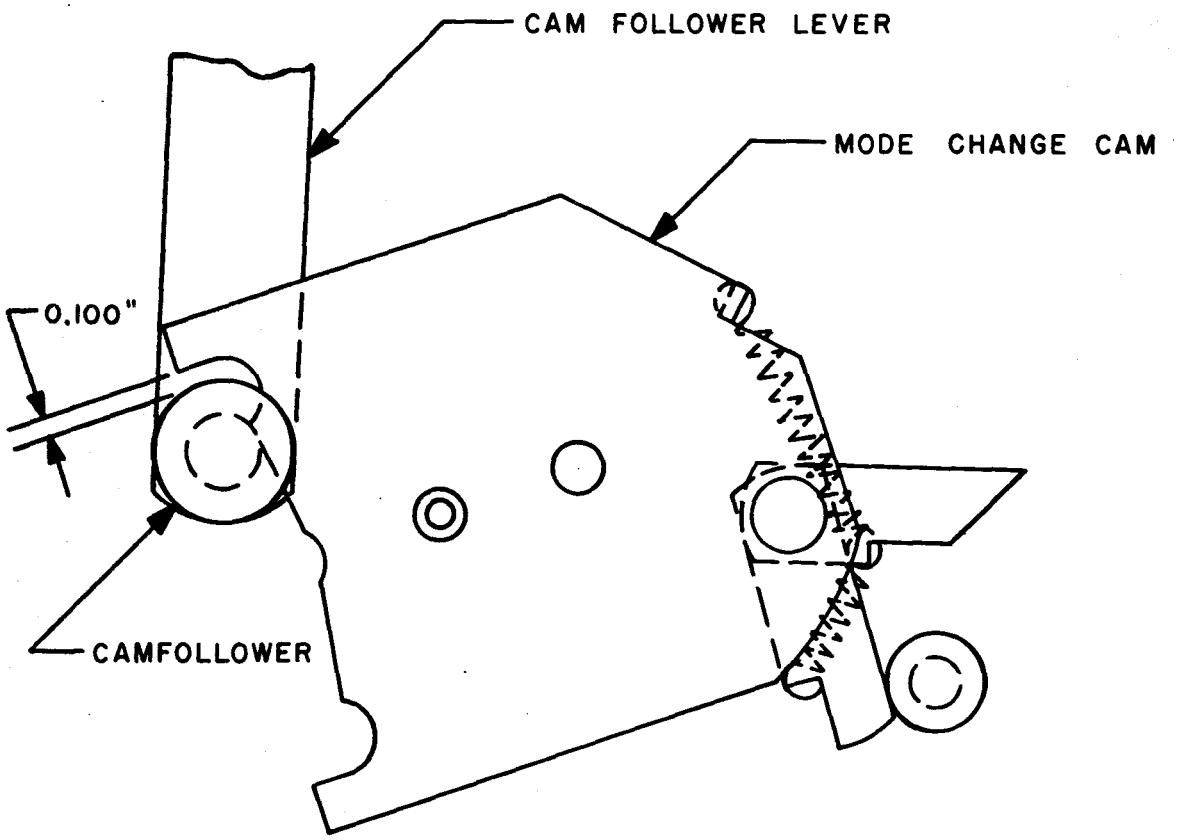


MODE CHANGE SCHEMATIC DIAGRAM
MODEL-400
AMPEX ELECTRIC CORPORATION
SAN CARLOS, CALIFORNIA



MODE CHANGE CAM POSITION
FOR PLAY RESISTOR SWITCH ADJUSTMENT.
MODEL 400
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