Linecasting Machine Maintenance Basics

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WHAT HAS GONE BEFORE

Information compiled in this booklet is for those interested in linecasting machine maintenance at the 12th Biennial American Typecasting Fellowship Conference in Sunnyvale, California, October 1 to 5, 1998.

Ottmar Mergenthaler persisted in developing the idea of the circulating matrix method of overcoming the tedious process of hand setting foundry type a character at a time.

From my more than 60 years of experience operating and taking care of linecasting machines from primitive versions to high–speed Elektrons, I have great respect for Mergenthaler's development of the fundamental principles of mechanics involved.

One important feature is the size of the holes in the mouthpiece–if they are bigger, breakaway from the mouthpiece and mold becomes a problem. The number 52 drill bit size is the standard today–always has been.

Another is the foresight in development of linecasting matrices. Early Linotypes had but one face of type in one size, but the early designers must have expected sizes as large as 60 point and two-letter characters as large as 24 point as they were developed without any change in the basic size of the matrices.

–Leonard Spencer, Doctor of Linotypes

MACHINE ADJUSTMENTS

Main Clutch–Allow $^{15}/_{32}$ inch between collar and machine bearing.

Automatic Pawls–(Stopping and Safety)–Set $^{15}/_{16}$ inch from edge of cam.

Automatic Stopping Pawl–Set ¼ inch on upper stopping lever.

Lower Stopping Lever–Allow $^{1}/_{32}$ inch between lower stopping lever and forked lever.

Vertical Lever–Should force automatic pawls $^{1}/_{16}$ inch clear of stopping pawl.

Starting Lever–Allow $^{1}/_{32}$ inch between eccentric screw and vertical lever lower lug.

Tie Rod–The head of this bolt should bear snugly against the cam shaft bracket cap when machine is in normal position.

Mold Turning Cam–Steel shoes should take up lost motion in pinion. Adjust by screw bushings in cam.

Mold Disk Turning Bevel Pinion–Set screw should be on top when cams are in normal position.

Mold Disk Locking Stud Blocks–Blocks should be adjusted so that studs do not bind and ejector blades are in correct relation to mold body.

Oil locking stud blocks on vise by squirting a small amount of oil on finger and then rubbing that oil on top part of stud block. Grease does not work as it will get on spacebands.

Gibs On Vise Frame–First elevator should stand square with mold. Test by placing thin matrix in each end of first elevator jaw, pull mold forward over toes of matrices, raise elevator by hand. If matrices are tight on bothends, alignment is correct. If not, the head has to be brought into parallel condition with mold. On Linotypes this is done by peening and filing the key in the first elevator head. Intertype has a built in adjustment in first elevator head to make this alignment.

First Elevator–Adjust gibs on the vise frame so that first elevator just clears transfer and delivery channels. .002 On lockup the first elevator head should bank squarely against the vise cap.

First Elevator Connecting Link–Allow ¾ inch at top and $^{13}/_{16}$ inch at bottom from holes to shoulders on Linotype with the adjustment at the bottom of the link. Intertype is different with $^{7}/_{8}$ inch from bottom of eyebolt hole to top of barrel. Bottom should be $^{5}/_{8}$ inch from edge of eyebolt hole to bottom of link. These adjustments provide compression for alignment of matrices. When these settings are made, further alignment of delivery channel is made by adjusting stroke of first elevator with adjustment settings below first elevator cam.

First Elevator–The center screw at top of elevator should be adjusted (with 30 em line of matrices without spacebands in position so that toes are in mold) to allow .010 inch between adjusting screw and vise cap when elevator is lifted for alignment. When display matrices in the 45-point alignment and the auxiliary position of duplex display matrices are used, clearance should be adjusted to approximately .005 inch.

First Elevator–Adjust elevator jaws slightly lower than delivery channel.

Mold Slide–Clearance between mold slide and vise jaw should be .003 to .005 inch.

Second Elevator–When at transfer point, roller should be free of cam, and when at upper position the connecting bolt should be loose.

The second elevator bar on Intertypes do not have a stop on the right end of the bar. The stop is built into the transfer channels.

Distributor Screw Matrix Guard–Adjusted to clear screws and matrices.

Elevator Transfer Lever–Should be 5 and $^{5}/_{8}$ inches from transfer channel to slide finger.

Spaceband Lever–When properly adjusted, the spacebband lever pawl passes point of spaceband box rails. Adjust turnbuckle attached to transfer lever.

Transfer Slide–Allow $^{1}/_{8}$ inch between slide finger and end of slot in spaceband lever pawl.

Transfer Slide–Cut in slide should be flush with right-hand end of first elevator back jaw.

Delivery Slide–Slide should go far enough back to just catch second notch on delivery pawl.

Delivery Slide–Should stop 13/32 inch inside of first elevator.

Delivery Slide–Machine should start when slide stops against the stop screw on face plate.

Mold Driving Pinion Shaft Friction Clamp–Adjust screw to take up lost motion in mold disk. Replace leathers if they are soaked with oil. Intertype made a substantially better brake with leather between two circular castings to form the brake under spring pressure.

Vise Automatic Disk Dog or Plunger–Should just clear automatic stop rod. Adjust by screw at right on top of first elevator.

Metal Pot–Adjusted so that mouthpiece holes align with smooth side of slug and be flat against mouthpiece. All adjusting is done with square headed screws in pot legs.

Pot Lever Eyebolt–Allow $^{3}/_{16}$ inch between nut and pot lever when spring is compressed.

Back Knife–Should be adjusted to trim bottom of slug, without damaging molds, as close to .918 inch as parts permit.

Second Elevator Transfer Safety–Adjust screw in second elevator lever to allow releasing lever to clear the transfer slide by $^{1}/_{32}$ inch.

First Elevator Intermediate Bar–When pawl is raised it should be flush with bottom of second elevator bar.

Ejector Blades–When properly adjusted, they should project slightly beyond lower liner in knife block.

Ejector Lever–Use of shear pin in ejector lever will prevent ejector lever breakage.

Assembling Elevator–Adjust to return by its own weight.

Matrix Delivery Belt–Adjust idler pulley to keep belt tight.

Spaceband Box–Pawls should go 1/32 inch beyond box rails on the down stroke on Linotype. Intertype box is different. Bands are release by pushing them sideways over a stop.

Spaceband Box Center Bar–Adjust screw in center bar to release one spaceband at a time. Intertype adjustment is in back of box.

Assembler Slide Brake–Should release just before line delivery starts.

Distributor Box Lift–Adjust to lift matrices $^{1}/_{32}$ inch above distributor box rails.

Distributor Box–Matrices should pass freely from rails to bar.

Distributor Beam–Adjust vertically to allow about .043 inch between bottom of matrix and top of channel entrance partitions. Adjust horizontally so that mats do not hang up when they drop.

Trimming Knives–Should be adjusted for slug size and parallelism.

Vise Jaws-Should bring face of type flush with each end of slug.

Pump Stop-Allow $^{1}/_{32}$ inch between stop lever and stop. Adjust by screw in pump stop operating lever. For self-quadder machines this adjustment should be $^{1}/_{64}$ inch. Intertype pump stop is different. It works from action of justification lever. Quaddersd have critical safeties, many of them microswitches in left hand vise jaws.

Vise Locking Screws-Always make a habit of frequently checking these to make sure they are tight. When worn, the tend to loosen. When that happens, the vise will be out of square with molds and quadders give trouble.

KEYBOARD AND MAGAZINES

Keep Keyboard Parts Clean

Parts should be washed in white gas, as used in camp stoves. Cams should be oiled sparingly with sperm of clock oil. Corrugated rubber tollers usually work better under other than best conditions of heat and humidity. Keyboards that work right are a joy to operate.

Mats and Magazines

Cleanliness is essential to have mats slide down channels in magazines-both magazine and toes of mats. Keep the verges clean and working properly. Do not use any oil or graphite in these areas-only white gasfor clean-

ing. There is a special brush for cleaning magazines.

Repairing Damaged Matrices

Special tools and gauges are necessary to be sure matrices are not out of specifications. Mat files are sold so companies can sell more mats. Hammer the toes back into shape and save the brass. Be careful not to get either toes or body of matrices oversize or you will have troubles.

CASTING REQUIREMENTS

Locking Stud and Block Replacement

Pot leg bushing wear will cause side wise and vertical shifting of the pot and vise frame. This, in turn, affects side knife trim and general lock up of the vise frame. When either the inside diameter of the bushing or the vise shaft is worn, the pot is then free to "float," which will cause problems in both front and back lock up. It is possible to detect worn shaft or bushings by placing a finger near the lower part of the pot leg and the vise frame. If either the bushings or
the shaft have considerable wear you will be able to feel am up-and-down movement when the pot moves forward for lock up.

If you have any doubt about the original size of the right hand bushing, there is a simple test. Remove the mold disk slide, and the knife block. Place a piece of $^{5}/_{8}$ inch round stock in the dovetail of the column where the ejector slide fits and then close the vise. The rod should just touch the machined side of the vise frame. Fit new bushings to bring the vise frame in line with the rod as described above. When doing locking stud job, you get to point of putting left hand knife on vise and find that the slug coming out of mold hits on vise frame. That's too late to check for this problem.

Too much play between the mold disk hub and disk will cause the back knife to damage the oposite mold at ejection. It is wise in most cases, when replacing a mold disk, to replace the hub as well. The hub can be built up with bronze and machined to fit the disk or a collar can be fitted over the hub and machined to fit mold disk. On early machines, a shaft was fitted in the mold slide casting for the disk to ratate which had nuts on each end. Intertype still uses this principle with special washer on back to compensate for end play wear.

First elevator head grooves for toes in molds must have same clearance end to end. If not justification will not be right and quadders will not position matrices properly. This is fixed by making the first elevator parallel with molds by peening and filing the key in first ele-

vator heads on Linotypes. Intertype has an adjustment for this tilting of the parts. All lower toes of mats should measure .125 inch or binds will occur in justification.

When a line is seated on the vise cap with mold forward on locking studs there should be .010 inch lift between toes of mats and mold groove. Adjust using feeler gauge underscrew in first elevator head. Check action of the vise automatic safety at this time. It should stop the mold disk from advancing onto the toes of matrices before the mold comes in contact. This safety is set so the machine will throw out the clutch when two point lead is placed under the elevator slide adjusting screw on top of the part of rod protruding from vise cap.

Always bear in mind that you are working in thousandths of an inch, and if there is wear in the hub, disk, studs or blocks, replace them and start over.

Mold Cleaning and Polishing

Mold abuse causes problems. Elektron machines were the worst when operated at high speed without proper care. Recommendations from books say not to put any oil or polish on the mold wipers. From experience, something to lubricate the molds is necessary abd the front of the molds have to be free of excess metal to have a flat surface on the typeface. Anyone who has operated an Elrod strip casting machine knows that when the oil tube is plugged up the material becomes scored.

Suppliers sold a stick mold polish that was not as abrasive as the type sold in cans. One of the company machinists had some homemade sticks containing mutton fat and graphite. Used sparingly it did a good job. A few drops of kerosene a couple of times a day will lubricate molds so that hard ejection is prevented. It is not a good idea to remove molds from the disk for cleaning, but this is necessary when problems get too bad. When doing a bench cleaning of molds, use a flat pine block of end grain only one by two by three quarter inch lumber and the can mold polish for the flat surfaces. Ribs of the mold caps, and especially recessed molds, cause much of the trouble. These need polishing and the pine handles of ice cream bars work good for this. Grind them to fit the contours of the mold and polish until the steel is smooth again.

Keep liners clean and use brass rule to remove metal from the face and ends of the mold before inserting liners.

Intertype mold cap is held by swivel bolts and nuts on each end, so cap can be taken off without removing bottom part of mold.

Seating a mold in disk pocket is an exacting job. If not done proplerly this will cause many problems. Matrices will not justify properly, or toes of matirces will be sheared preventing alignment of characters.

First clean the mold and mold pocket. Insert mold in the disk and always position it to the right edge of the pocket-that is the constant point so that they will all be properly aligned. Tighten four screws in mold body, then three in cap (or two nuts, if Intertype). Then loosen four, tighten four. Loosen three, tighten three (or two). Use properly fitting tools so that you do not damage the parts.

Damaged liners are another cause of trouble. Many times they can be made usable in an emergency by straightening using leverage of paper cutter clamp and slugs under the bent parts. It would be nice to have hydraulic press to do this. Then file and hammer it back to shape so it fits mold properly-no play or extra thickness. Straightening molds requires special skills and proper heat traeatment, but emergency measures sometimes help.

Font Mold to Vise Jaw Lock Up

To start, the plate behind the first elevator on the vise cap should not be too badly worn. It should measure .240 inch as standard. This changes seating of first elevator in vise cap. Back jaw thickness is important. Measurement should be .687 inch. There is a special gauge for this. There is a hardened aligning plate on back of first elevator head which should not have excessive wear of warpage. Do not have first elevator gibs too tight as front side of first elevator head banks against vise cap when lock up occurs.

Molds have to be parallel with first elevator at lock up. This problem is remedied by adjusting the vise locking studs with special shims. Follow through by checking line delivery and transfer channels for changes.

Mold banking blocks above and below the trimming knives have a relationship with front lock up. They should not touch at casting position, but both should show on ejection. Use red lead to check. If these parts touch when lock up occurs there will be problems.

There are two justifications during which spacebands are driven upward or justified. The mold advance must not be too tight or it will prevent this spreading action of the line of mats and spacebands. To check remove the plunger pin, set a line of mats about 26 ems long using about 10 spacebands for a 30 em measure. The spacebands will be driven upward during justification. Stop the machine at this point, and turn off the motor. Have someone turn the clutch forward until the justification

lever comes down. At this point you should be able to push the spacebands down. Try pushing one spaceband down, and the balance will fall by themselves. If they do not fall, the mold advance is too tight. It is that simple.

Plunger Action Is Critical

Proper fit of plunger is necessary to cast solid slugs. If plunger is too tight the stroke will be limited and stuck plunger will result. If too loose, plunger will go to bottom of well and metal will recede down throat causing hollwo slugs. Special tools are necessary to to ream or hone the crucible and fit an oversize plunger to the well. With a proper fitting plunger, plunger will not have the proper stroke unless it is vented by making sure enough metal gets throught he plunger vent to permit plunger to descend far enough to be picked up by cam before mouthpiece-mold breakaway. Otherwise a backsquirt will result.

Reason for hole in plunger is to permit the plunger to descend to a point where the pot pump cam is starting to lift plunger at time of pot-mold breakaway. Start with a number 52 drill bit and go larger if necessary to get proper stroke. Some plungers have adjustable vents, but most of the time they are plugged with dross.

Keep plunger and well clean so that dross buildup will not prevent plunger action.

Many of the linecasting machines in use today have heavy springs on the pot pump lever, especially if they have been used for reproduction proof quality. They are much harder to put back on Linotypes if they have to be taken off to remove plunger lever or pot cover. It helps to have plunger arm in down position when installing spring. Intertype kept the original pot pump spring above the casting which makes adjusting plunger pressure much easier.

Take Care of Molds

Maolds are critical. Warpage is caused by too much heat. Never leave a machine on lock up with the heat on, or have mouthpiece that is not flat, or pot legs that are misadjusted. Damage occurs at ejection when wear in mold disk and/or hub and misadjusted mold bankming blocks permit the disk to move during ejection by slamming the opposite mold against the back knife. Bent mold posts, bad liners and loose clamping screws, or nuts on Intertype molds, cause troubles.

ADDENDA

Do Not pull back the distributor shifter lever when matrices are feeding into the box. If timing happens as mat is being lifted, the mat will slip off the lift and become bent before it gets high enough to get onto the screws

Roller and lever that rides on back side of first elevator at level of vise automatic dog get neglected-especially after a squirt happens. Make sure it is kept in operating order or a clutch throughout stop will occur at the transfer position.

Keep square-head screw tight in cam nearest the clutch end of main cams, which controls line delivery and transfer levers. Later machines have a flat plate to prevent too much movement in this cam.

Keep set screw in square pinion, which rotates mold disk, tight. Late machines have two screws here, so remove it to be sure.

Use kerosene to lubricate first elevator and gibs. Oil will collect metal from saws and just generally become sticky.

Keep all parts of machine clean. Oiling and wiping should be done on schedule. In one machine shops, Monday morning is a good time to do this.

COLOPHON

Composition for this treatise was done on a Model 21 Linotype of 1925 vintage. Faces used are Optima and Optima Bold, designed by Herman Zapf, for test matter, and Metromedium, designed by W.A. Dwiggins, for the cover display. Presswork was done on an 1895 Golding Pearl 7 by 11 size. Printing was done at Gladstone Press, private press of Leonard and Alnora Spencer in September of 1998.