The Matrix

The Matrix is a piece of hard bronze .2″ square and .450″ high, in the lower end of which is driven, to a depth of .030″, the character it is to produce. In the upper end is the cone hole in which the Centering Pin seats to accurately position the Matrix over the opening in the Mold, and hold it firmly upon it while the type is being cast. Two hundred and twenty-five of these Matrices, arranged in rows of fifteen to a row, are carried in the Matrix Case upon combs passing between them. The Case may be moved horizontally in two directions, at right angles; in order to bring any Matrix to casting position. In addition, it has a vertical movement to seat the Matrix upon the Mold and raise it after the character has been cast, to remove the Matrix from the type; so that the type may be pushed forward out of the Mold into the Type Carrier.

Two correlated units of identical functional purpose are provided to move the Matrix Case horizontally. The "B" block mechanism moves the Matrix Case from left to right, and the "C" block mechanism moves the Matrix Case from front to rear. Fifteen Air Pins in each block, spaced .2 of an inch apart (the width of a Matrix) serve to bring the desired Matrix over the Mold opening.

Air Pins in the "B" block are symboled 1 to 15, inclusive. Air Pins in the "C" block are symboled A to O, inclusive. Any combination of signal perforations in the control ribbon will activate the air pins and the signaled Matrix will be moved to position. Example:- Ribbon perforations 14-J will activate 14 pin in the "B" block and J pin in the "C" block, moving the Matrix Case into position.

Arrangement C

ROMAN CAPS, SMALL CAPS, and lower case; *ITALIC CAPS and lower case;* Roman and Italic figures and Roman fractions

Row	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Unit Value
1	■	■	*l*	*t*	'	'	.	,	■	l	i	]	[	′	|	5
2	*j*	*f*	*i*	!	:	;	-	j	f	I	/	:	;	■	■	6
3	*c*	*r*	*s*	*e*	)	(	'	'	r	s	t	J	*v*	°	*z*	7
4	‡	*q*	*	*b*	*g*	*o*	?	I	z	c	e	Z	S	†	*?*	8
5	*I*	■	*9*	*7*	*5*	*3*	*1*	*0*	.	9	7	5	3	1	0	9^1
6	C	■	■	*8*	*6*	*4*	*2*	*$*	–	$	8	6	4	2	■	9^2
7	*x*	*k*	*y*	*d*	*h*	*a*	x	J	g	o	a	P	F	L	T	9^3
8	A	*fi*	*u*	*n*	.	S	v	y	p	u	n	Q	B	O	E	10^1
9	D	■	*fl*	*p*	fl	fi	q	k	b	h	d	V	Y	G	R	10^2
10	H	&	*J*	*S*	*æ*	*æ*	*ff*	■	Z	■	ff	X	U	K	N	11
11	*O*	*L*	*C*	*F*	*w*	£	æ	L	P	F	¶	M	*Z*	*Q*	*G*	12
12	*E*	&	Q	V	C	B	T	O	E	A	w	*P*	*T*	*R*	*B*	13
13	*D*	*A*	*Y*	*ffl*	*ffi*	*m*	œ	Y	U	G	R	Œ	Æ	W	*V*	14
14	*K*	*N*	*H*	ffl	ffi	X	D	N	K	H	m	*&*	℔	*X*	*U*	15
15	Œ	Æ	¾	¼	½	*W*	*M*	—	..	M	W	%	*Œ*	*Æ*	■	18
Row	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Unit Value

LEFT
Keybank C—Keybars C
3 Keybutton Clips

Stopbars S5

RIGHT
Keybank C—Keybars C
1 Keybutton Clip

These Characters are carried in the Matrix Case in this Arrangement

ABCDEFGHIJKLMNO
PQRSTUVWXYZ&ÆŒ
ABCDEFGHIJKLMNOPQRST
UVWXYZ&ÆŒ
abcdefghijklmnopqrstuv
wxyzæœfiffflffiffl.,-:;''!?
ABCDEFGHIJKLMNO
PQRSTUVWXYZ&ÆŒ
abcdefghijklmnopqrstuvwx
yzæœfiffflffiffl:;!?
*†‡¶|%£℔ [ ] ( )
$1234567890½¼¾
$1234567890

To determine which Matrix the perforations 14-J will position over the Mold opening; refer to the above chart and note:- Vertical rows as designated by letter symbols and Horizontal rows are designated by number symbols; at the convergence point of row 14 and row J we will find the character; Roman Cap H.

Air Pins 15 and 0 are stationary and do not require perforations in the control ribbon.

A single perforation in the control ribbon, say E, will position the fraction ½. Single perforation 12 will position the Italic Cap B.

Total absence of perforations will bring the blank Matrix 15-0 into position.

Function of Front Air Pin Block

To determine the functional action of the front block mechanism, for a complete revolution of the machine, it will be necessary to establish a starting point to study the movement of its component parts. Since function is determined by the rising of a signaled Air Pin, it is important that the starting point be established when the Pin Jaws are in an open or spread position. This position can be established by turning the machine hand wheel until the Vernier Scale registers 120 degrees. The following mechanical action ensues as we slowly turn the hand wheel for one complete revolution:

1. The signaled Air Pin rises in the path of the right Pin Jaw before the jaw starts moving to the left.

2. The left Pin Jaw is restricted in its movement to the right by a spring mechanism, until the right Pin Jaw moves to the left and stops against the signaled Air Pin. The left Pin Jaw then travels to the right until both Pin Jaws meet. As the Pin Jaws move to closed position they carry the Stop Rack by contact with the lug of the Stop Rack, into approximate functional position. Note:- the Matrix Jaws are moving to an open position as the Pin Jaws close.

3. The Locking Bar moves forward to engage the tooth of the positioned Stop Rack and accurately locates and clamps the Stop Rack in position, so that its lug serves as a stop to position the Matrix Jaws. This locking of the Stop Rack takes place while the Pin Jaws are in a closed position.

4. Aside from the observation of the Pin Jaws as they start moving to their open position, we will transfer our attention to the function of the Matrix Jaws. As the Pin Jaws start moving to open position, the signaled Air Pin descends and the Matrix Jaws start moving to a closed position. The Matrix Jaws are not restricted like the Pin Jaws in this travel, so:- both Matrix Jaws are free to travel until they are stopped by the lug of the locked Stop Rack. As the Matrix Jaws close they accomplish a three-fold purpose:- they carry the Normal Wedge and Matrix Case into approximate position at each revolution of the machine; and before the start of the next line of type, they carry the Justification Wedges into a signaled position. It is important to point out that each of the following parts are provided with rack teeth .2 of an inch pitch, the same width as a Matrix:- Stop Rack, Normal Wedge, and the Justification Wedges.

The Normal Wedge is accurately located by the Normal Wedge Locking Pin. The signaled Matrix is accurately located by the Matrix Centering Pin and the Justification Wedges are positioned accurately by the Justification Wedge Centering Tooth. The accurate location of these parts is accomplished before the Matrix Jaws start to open. Note:- The Pin Jaws have returned to their open position and the cycle is completed.

Motivation

The Jaw Tongs are compound levers designed to import dual motion to each of the Pin Jaws and Matrix Jaws; as they travel within a given range the bottom jaw tongs service the Matrix Jaws and the top jaw tongs service the Pin Jaws.

Each set of jaw tongs is mounted on two fulcrum studs. The movable stud, an integral part of the Jaw Tongs Bell Crank, imparts motion to the pin and matrix jaws through this respective tongs. The matrix jaws must move to an open position, while the pin jaws are closing, and conversely; the pin jaws must move to an open position while the matrix jaws are closing to complete the cycle of action.

This opposed action of pin and matrix jaws through the jaw tongs is readily understandable when we compare the position of the pin and matrix tongs fixed studs in relation to their common motivating bell crank stud. The fixed pin jaw tongs stud is mounted to the right of the bell crank stud and the matrix jaw tongs fixed stud is mounted to the left of the bell crank stud.

A study of this action is possible by turning the machine slowly for one complete cycle:- The complete functional cycle starts with the raising of the signaled air pin, about 120 on the Vernier Scale. The moving bell crank stud moves from left to right toward the fixed pin jaw stud carrying the pin tongs to a closed position; simultaneously the moving bell crank stud moves away from the matrix jaw fixed stud causing the matrix jaw tongs to move to an open position. When the bell crank stud completes its movement from left to right it starts the return action from right to left and the pin jaws start opening and the matrix jaws start closing to complete the cycle.

The Jaw Tongs Bell Cranks comprise the upper jaw tongs bell crank and the lower jaw tongs bell crank. They are coupled together in a manner that will permit each bell crank to oscillate, either in unison or independently, on the same fulcrum stud. In normal operation they oscillate in unison. However, in event of interference—interrupting the free travel of the pin and matrix jaws of either the front or rear air pin block—each bell crank can operate as an individual unit and oscillate, independent of the other bell crank.

These bell cranks are motivated by the Jaw Tongs Cams, and for the sake of clarity, it is easier to trace this action from the source of power: the Jaw Tongs Cams. These matched cams are keyed to separate parallel shafts that rotate in the same counter-clockwise direction in the Cam Shaft Stand bearings. The eccentric (not circular) shape of the cams impart motion to the Jaw Tongs Cam Lever. This action embodies a change from the rotary movement of the cams to reciprocating motion of the lever; the actual function of cams.

The Jaw Tongs Cam Lever is suspended on the Jaw Tongs Cam Lever Shaft, and oscillates on this shaft. The lower or roller end of this lever is in constant contact with the cams and is so suspended that the center of the lever roller and the centers of both cams are in a horizontal plane. As the cams revolve, the lever is forced to change position and reciprocating action is imparted to the lever.

The upper or connecting end of this lever is provided with the Jaw Tongs Spring Box Ball Extension. Although this extension is named as part of the spring box, it must be considered for functional reasons a part of the cam shaft lever. A study of the design of this extension will show that this part must be assembled with the spring box and it is understanable that for assembly purposes the extension acquired its name

The Jaw Tongs Spring Box serves as a connecting link, to couple the Jaw Tongs Bell Cranks to the Jaw Tongs Cam Lever. The term link is applicable because: it serves to join the lever and bell cranks and imparts unmodified motion to the bell cranks in normal operation.

In a preceding paragraph, on the jaw tongs bell cranks, it is stated that:- each bell crank is free to operate as an individual unit and oscillate independent of the other bell crank, in event of interference or obstruction to the travel of the pin or matrix jaws of either air pin block. To accomplish this independent action of the jaw tongs bell cranks, it is necessary for the spring box to be comprised of two separate units.

To impart cushioned travel to the pin and matrix jaws in normal operation and provide for the absorption of shock caused by the aforementioned interference, each unit of the spring box is provided with two strong springs, two spring abutments, a spring brake cone, and a three-piece wooden brake; all these parts are carried directly or indirectly on the spring box rod. The springs are compressed under heavy pressure and the entire assembly is encased in the Jaw Tongs Spring Box Tube.

The complete spring box is mounted on the jaw tongs cam lever by means of the spring box ball extension, the spring box ball plug (right bearing for ball) and the spring box socket (left bearing for ball); all three form a ball and socket joint to permit free movement for the lever and bell cranks. The spring box is in turn connected to the bell cranks by similar ball and socket joints. The design of the spring box incorporates provision for accurate timing of the closing and opening of the pin and matrix jaws of the rear air pin block and, in turn, synchronizing the timing of the pin and matrix jaws of both front and rear air pin blocks.

When the matrix jaws start moving to a closed position, one of the jaws contacts the head of the matrix case sliding frame draw rod. This sudden contact of the matrix jaw and draw rod head causes the springs in the spring box to compress. The ensuing expansion of the springs is checked by the pressure of the wooden brake against the inner wall of the spring box tube. This controlled action of springs and brake prevents the sudden propulsion of the draw rod head against the other matrix jaw.

We have mentioned in detail how the bell cranks are free to operate as independent units, to control movement of the jaw tongs and the pin and matrix jaws of the front and rear air pin blocks. For purpose of demonstration, place a piece of six pica furniture, either wood or type metal, between the matrix jaws and turn the machine over until the jaws close under compression. You will note:- that the matrix jaws, jaw tongs, bell crank and spring box spring rod are arrested in their travel; however, the spring box continues moving to complete its normal travel and the springs absorb this extra movement by compressing. As the spring box travels in the opposite direction, the wooden brake again serves to slow down the expansion of the springs. Obviously, the ability of the spring box to absorb shock will minimize the breakage of parts and loss of time and production sacrificed in replacing broken parts.

Summary:

After the signaled Air Pins have been raised in both the front and rear Air Pin Blocks, the unrestrained pin jaws move to contact on the signaled air pins; the restrained pin jaws then move until both pin jaws meet at the position of the raised air pin. The pin jaws carry the Stop Racks to approximate position, where the pin jaws close. The teeth of the Locking Bars then engage the teeth of the stop racks and accurately locks them in position. The heads of the stop racks determine the point at which the Matrix Jaws close. These jaws move the Matrix Case into position through the Draw Rods, bringing the Matrix desired approximately to casting position over the Mold.

When the Matrix Jaws have positioned the Matrix Case, the Carrying Frame is moved down by the descent of the Centering Pin Lever, which is connected to the Bridge Lever by the Bridge Lever Connecting Link. Just before the Matrix comes in contact with the Mold, and after the matrix jaws have started to open, the centering pin descends and seats in the cone hole of the matrix, accurately positioning it and holding it firmly upon the mold until the character is cast. The centering pin then withdraws and the carrying frame rises, lifting the matrix clear of the type, so that it may be pushed out of the mold into the carrier as described.

It will be noted that when the matrix jaws open, after positioning the matrix case, the pin jaws close and set the stop racks for the next character required. Thus, while one type is being cast, the racks are being set in the position at which the matrix jaws must close for the character that will be cast by the next revolution of the machine. This arrangement reduces the movement of the matrix case, and, consequently, the work of the caster, to the minimum, for it enables the case to move directly to its next position without returning to a fixed point or base. If the same character had to be cast twice, the second time the pin jaws would move the stop racks from their first position, consequently the matrix jaws would again close at the same point and the matrix case would not be moved at all. In other words, the matrix case never makes an unnecessary movement. It never moves unless it has to, and when it does move it travels the shortest distance possible; that is, it moves along the straight line connecting its starting point with its required stopping point for the next character.