

IDENTIFICATION: HIGH SPEED PUNCH (HSP-1) ROUTINE I

AUTHOR: A. W. England, PBCC

ACCEPTED: April 6, 1961

PURPOSE: To allow simple control of the HSP-1 fast paper tape punch for output in a flexible format. This routine can be used as an extension of the punching operation of the Octal Utility Package. In addition, it contains several subroutines which provide various operations to a program which might output on paper tape.

RESTRICTIONS: No less than three non-zero characters can be punched by this routine. Each word is punched in a binary format of 6-8-8 bits. By proper positioning in the word, six-bit Flexowriter codes can be punched by this routine.

SPACE: The main program occupies one long line with the exception of sectors 040, 117, 157-177, 201, 202, 226-232, 241, 243, 260, 261, 274, 276, 277, 302, 304, 314, 316, 327, 335, 346, 353, 355, 372, 374, 376, and 377.

In addition, it uses F13-F17 for temporary storage. Since the main program does not use the last two sectors of the long line, 376 and 377, the routine will operate in lines 05 or 06 without interference from the Octal Utility Package.

TIMING: The timing of the routine is determined by the speed of the punch, which is 110 characters per second. At this speed it requires approximately 7.5 seconds to punch one long line in Octal Utility Package binary format.

USE:

The routine will operate in any long command line. It is first necessary to set the Index register with the number of the line containing the routine.

1. Octal Utility Package Extension

When executing a transfer operation (period) in the Octal Utility Package, the Index register is automatically set with the number of the line to which the transfer is effected. Therefore, to enter the routine from the Octal Utility Package, it is only necessary to transfer to sector 000 of the correct line (000LL).

The punch motor will start and the light on the Flexowriter will come on, indicating keyboard control. It will now be possible to perform various operations by depressing keys on the keyboard.

a) To punch single characters on the tape, depress the BREAKPOINT switch and anything typed will be punched. When all identifying characters have been typed and punched, the BREAKPOINT switch should be raised.

All the following operations require the BREAKPOINT switch to be in the raised position.

b) To punch one long line in binary format, type the line number followed by a B (LLB). Any line from 00-77)₈ may be punched. After punching the line, the routine will return control to the keyboard but will not turn off the punch.

c) In order to turn off the punch and return to the Octal Utility Package, type an I. (Do not depress the ENABLE switch before typing the I or the punch will not be turned off).

d) To punch leader, the tape feed button on the punch front panel may be held down until the desired leader is produced. However, the routine will automatically punch 13 inches of leader and return to keyboard control when the L key is depressed. The BREAKPOINT switch must be in the raised position.

e) The program will also punch 13 inches of trailer automatically when an X is typed. In this case, after punching, the routine turns the punch off and returns to the Octal Utility Package.

2. Subroutines

There are several subroutines contained in this punch routine; the calling sequence of each is similar:

- 1) Set the Index register with number of line containing routine.
- 2) Load B with return command.
- 3) Load A with argument, if needed.
- 4) Transfer to appropriate entrance.

The various subroutines are as follows:

a) Entrance 100: punch one line in Octal Utility binary format, ending with check sum. The line number should be in the A register at a scaling of 21. It is not necessary to rearrange the most significant bit of the line number.

If the sign of the A register is negative, a "W" code will be punched at the end of the binary block.

b) Entrance 140: leader will be punched to any desired length. The number of frames of leader should be in the A register at a scale of 21. The A register should be positive. After entering this subroutine, the number of frames specified plus one will be punched and control returned to the calling program. There are nominally 10 frames per inch of tape.

c) Entrance 200: the contents of the A register will be punched as three characters, the first of 6 bits, the second and third of 8 each.

d) Entrance 240: punch 13 inches of leader. No argument necessary in the A register.

e) Entrance 300: this subroutine will punch all or part of a line starting at sector 000 and proceeding up through the sector indicated. It will also accumulate a logical sum of the information being punched and store it in F14. If desired, the calling program can pick this word up and have it punched as three characters by using the 200 entrance. The argument for this subroutine is a LOAD A (LDA) command with the sector number of the last sector to be punched, plus the appropriate line number. The LDA should not have either a sequence tag or index tag.

METHOD:

The words to be punched are picked up and broken into three characters of 6-8-8 bits as in Octal Utility format. After each character has been positioned in the A register, the program goes into a wait-to-punch routine. This routine is a series of commands repeated four times around the line. A TES for punch busy is the first command executed. If the punch is busy, control passes to the next TES. If, however, the punch is ready for a character, a WOC command with the proper sector is added to the character in the A register. This command is stored in the fast line along with a return transfer, and control is transferred to the WOC. The WOC executes for one sector time and control is then transferred back to the main program.

In the time between characters, the new words are added to the check sum, the variable load command is incremented and tested, and the returns from the short line are set.

The one word punch and the punch from sector 000 routines modify appropriate parts of the general routine in order to handle these slightly different modes of operation. The general routine initializes any parts which may be modified by other routines.

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PROBLEM HIGH SPEED PUNCH (HSP-1) ROUTINE

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PROGRAMMER A. W. ENGLAND

DATE 4-6-61

LOCATION	INSTRUCTION	SYMBOLIC OF CODE	REMARKS	
000 02\$	001S0500I	LDA	[O.U.P. ENTRANCE]	
001	003S5000;	DIU	FOR EXIT	
002	266 1100I	STA	IN EXIT	
003	004S7036;	PTU	START PUNCH	
004	006S4501;	CLA	READ ONE CHARACTER	
005	013S5500I	LAI		
006	004S5101;	RTK		
007	010 5101;	RTK		
010	007 7736;	TES		
011	006 7736;	TES		
012	010S5701;	CIB		
013	000 0057I	CONST		
014	253 7735;	TES		B.P. TO PUNCH CHAR.
015	102 5600I	CAM		B CODE
016	031 7500I	TOF		B
017	133 5600I	CAM		I CODE
020	030 7500I	TOF		I
021	216 5600I	CAM	L CODE	
022	130 7500I	TOF	L	
023	074S5600I	CAM	X CODE	
024	030 2210;	RSO	3	
025	000 0101;	IAC		
026	052 2210;	RSO	19	
027	006S4501;	CLA		
030	033S7037;	PTU	[I] STOP PUNCH	
031	032S0301;	ROT	[B]	
032	045S2110;	LSO	10	
033	000S3701;	TRU	TO O. U. P.	
034	035S4000I	EBP		
035	377S7720;	CONST.		

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036	052S4401;	CLC	
037	043S5001;	DIU	
040	000 0000;		
041	272S3700I	TRU	
042	000 0106;	CONST	"W" FOR WOC
043	046S0202;	IBC	
044	056S3700;	TRU	
045	246S0400I	LDC	
046	220S7500I	TOF	TO RET. 1, SET $\overline{O.F.}$.
047	147 7731;	TES	
050	051S1400I	ADD	
051	075S6000;	WOC	
052	053S1100;	STA	WAIT TO PUNCH
053	054S0002;	MAC	
054	055S1000;	STC	
055	056S0202;	\overline{IBC}	
056	073S3700;	TRU	
057	104 2210;	RSO	20
060	061S4700I	EXF	
061	377S7700I	CONST	-7777601
062	063S1600I	DPA	
063	177 0500;	LDA	INITIAL BRING
064	200 0000;	CONST	-0000000
065	066S0500I	LDA	
066	310 7500I	TOF	TO RET. 3
067	246 1100I	STA	IN SW. A
070	071S0500I	LDA	
071	334S3700I	TRU	TO RET 2
072	146 1100I	STA	IN SW. A
073	076S4402;	CLC	

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LOCATION	INSTRUCTION	SYMBOLIC OP CODE	REMARKS
074	000 0055I	CONST	[X CODE] + 0000067
075	127 7500I	TOF	X
076	023S0202;	IBC	
077	112S0500I	LDA	
100	340 1200I	STB	[SUBROUTINE ENTRANCE]
101	102S0103;	IAC	
102	000 0050;	CONST	[B CODE] +0000042
103	104S0500I	LDA	
104	267S5000;	DIU	
105	110 3400I	TCN	IF W IS TO BE PUNCHED
106	107S1400I	ADD	
107	002 0000;	CONST	
110	266 1100I	STA	IN EXIT
111	113S0103;	IAC	
112	265S3700I	TRU	TO RET. B
113	114S1000;	STC	IN CK. SUM
114	115S5003;	DIU	
115	116S1300;	STD	IN BRINGER
116	034S7036;	PTU	START PUNCH
117	000 0000;		
120	121S0500I	LDA	
121	001 0107;	CONST	"G" FOR WOC
122	147S3700I	TRU	
123	206 7731;	TES	
124	126 6000;	WOC	
125	206 3400I	TCN	PUNCH BLANK FRAME
126	205S3700I	TRU	
127	131S0500I	LDA	[X]
130	131S4503;	CLA	[L]
131	001 3276I	CONST	+0046573

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LOCATION	INSTRUCTION	SYMBOLIC OF CODE	REMARKS
132	133S4303;	CLB	
133	000 00161	CONST	[I CODE] +0000071
134	135S16001	DPA	
135	200 0140;	CONST	-0000202 [-N]
136	027S37001	TRU	
137	152S0203;	IBC	
140	340 12001	STB	[PUNCH LEADER]
141	142S14001	ADD	
142	200 0000;	CONST	-0000000
143	144S04001	LDC	
144	340S7037;	PTU	STOP PUNCH
145	152S0104;	IAC	
146	334S37001	TRU	TO RET. 2
147	247 7731;	TES	
150	151S14001	ADD	
151	175S6000;	WOC	
152	153S1100;	STA	
153	155S7036;	PTU	WAIT TO PUNCH
154	155S1000;	STC	
155	205S11001	STA	
156	173S3700;	TRU	
157	000 0000;		
160			
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LOCATION	INSTRUCTION	SYMBOLIC OP CODE	REMARKS
170			
171			
172			
173			
174			
175			
176			
177			
200	203S7036;	PTU	START PUNCH [PUNCH ONE WORD]
201	000 0000;		
202	000 0000;		
203	340 1200I	STB	IN RETURN
204	212S0600I	LDB	
205	030S7137;	TEMP.	[LEADER SWITCH]
206	361 7731;	TES	
207	211 6000;	WOC	PUNCH BLANK FRAME
210	361 3400I	TCN	
211	205S3700I	TRU	
212	272S3700I	TRU	TO STOP
213	246 1200I	STB	SW. A
214	232S0305;	ROT	
215	216S0500;	LDA	[RET. 2 ']
216	000 0040I	CONST	+0000003 [L CODE]
217	220S4405;	CLC	
220	221S4505;	CLA	[RET 1]
221	222S0005;	MAC	
222	233S2110;	LSO	8
223	224S1400I	ADD	
224	001 0000;	CONST	
225	235S0105;	IAC	

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LOCATION	INSTRUCTION	SYMBOLIC OF CODE	REMARKS
226	000 0000;		
227	000 0000;		
230	000 0000;		
231	000 0000;		
232	000 0000;		
233	234S0205;	IBC	
234	313S0305;	ROT	
235	236S4305;	CLB	
236	341S5600I	CAM	WITH BRINGER LIMIT
237	242S2110;	LSO	2
240	324S0500I	LDA	[PUNCH 13 INCHES LEADER]
241	000 0000;		
242	243S0206;	IBC	
243	001 0000;		
244	146S0400I	LDC	
245	346S0400I	LDC	
246	310 7500I	TOF	TO RET. 3
247	347 7731;	TES	
250	251S1400I	ADD	
251	275S6000;	WOC	
252	253S1100;	STA	
253	254S0206;	<u>IBC</u>	WAIT TO PUNCH
254	255S1000;	STC	[PUNCH]
255	256S4306;	<u>CLB</u>	
256	273S3700;	TRU	
257	262S2110;	LSO	2
260	000 0000;		
261	000 0000;		
262	263S1400I	ADD	
263	323S6000;	WOC	

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LOCATION	INSTRUCTION	SYMBOLIC OP CODE	REMARKS
264	321S1100I	STA	
265	267 7736;	TES	[RET B]
266	003S5000;	DIU	[EXIT]
267	270S4406;	CLC	
270	041S0700I	LDP	[PUNCH W]
271	272S0006;	MAC	
272	340S7037;	PTU	[STOP]
273	274S1400;	ADD	CK. SUM
274	000 0000;		
275	311S0306;	ROT	
276	000 0000;		
277	000 0000;		
300	340 1300I	STD	[PUNCH FROM 000]
301	302S0107;	IAC	
302	000 0000;		
303	304S0207;	IBC	
304	000 0000;		
305	306S4700I	EXF	
306	377 0000;	CONST	
307	331S0500I	LDA	
310	311S5307;	RFU	[RET. 3]
311	000 0000;		
312	314S0600;	LDB	CK. SUM
313	314S1000;	STC	CK. SUM
314	000 0000;		
315	316S4507;	CLA	
316	000 0000;		
317	326S2110;	LSO	6
320	320 7731;	TES	PUNCH TYPED CHARACTER
321	323S6131;	WOC	

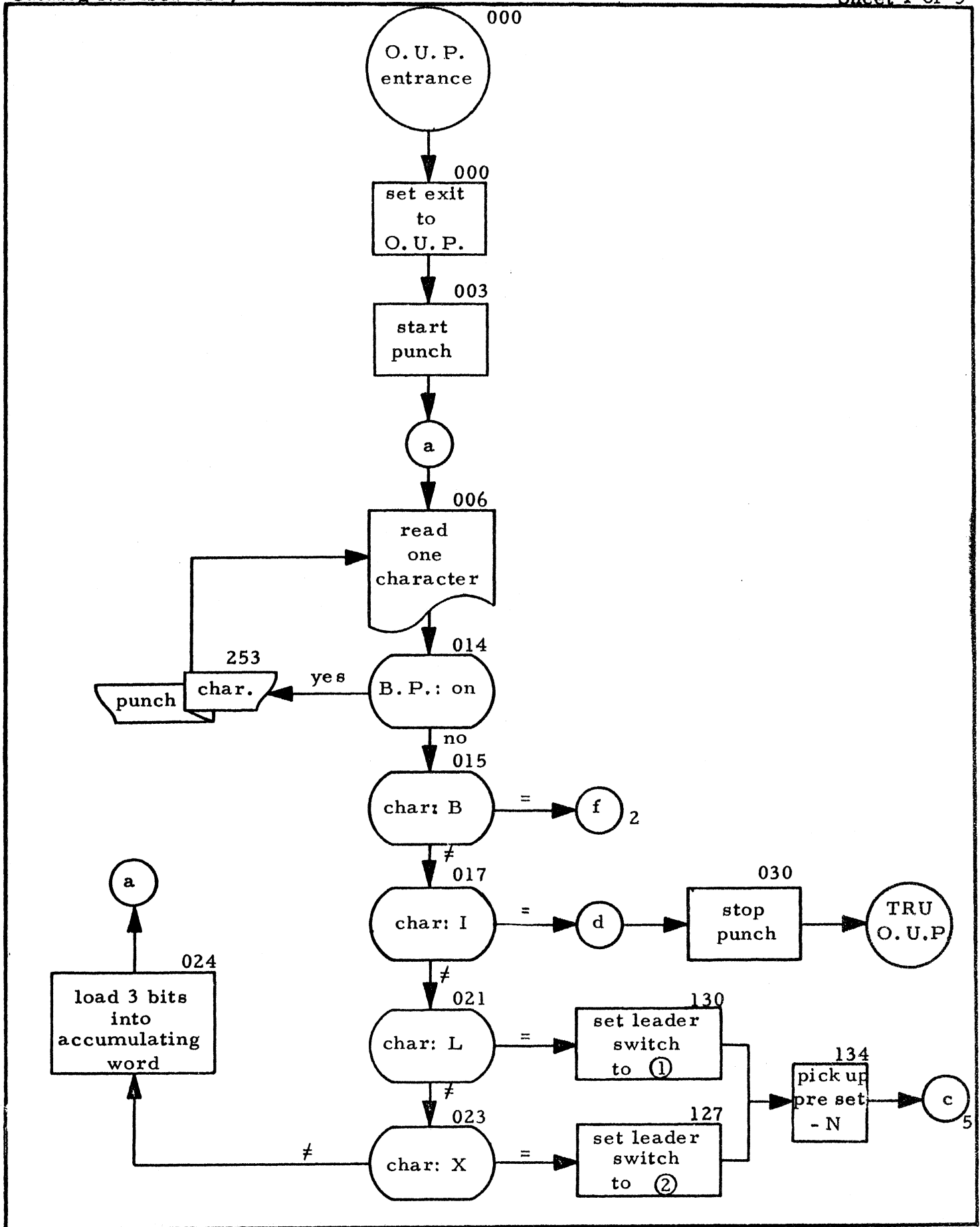
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LOCATION	INSTRUCTION	SYMBOLIC OF CODE	REMARKS
322	316S0307;	ROT	
323	006S4507;	CLA	
324	000 0140;	CONST	+0000202 [N]
325	140S3700I	TRU	TO LEADER PUNCH
326	327S0207;	IBC	
327	000 0000;		
330	332S4307;	CLB	
331	265S3700I	TRU	TO RET. B
332	356S1300;	STD	IN BRINGER
333	336S2110;	LSO	2
334	336S0500;	LDA	WITH BRINGER [RET. 2]
335	000 0000;		
336	344S0207;	IBC	
337	343S1500I	SUB	
340	000S3701;	TRU	[RETURN]
341	001 0506;	LDA	[PUNCH FROM 000 LIMIT]
342	343S0110;	IAC	
343	001 0000;	CONST	
344	356S1100;	STA	IN BRINGER
345	046S0400I	LDC	
346	220S7500I	TOF	RET. 1
347	047 7731;	TES	
350	351S1400I	ADD	
351	375S6000;	WOC	
352	353S1100;	STA	
353	000 0000;		WAIT TO PUNCH
354	355S1000;	STC	
355	000 0000;		
356	373S3700;	TRU	
357	031S4510;	CLA	

Flow Diagram
HIGH-SPEED PUNCH (HSP-1) ROUTINE

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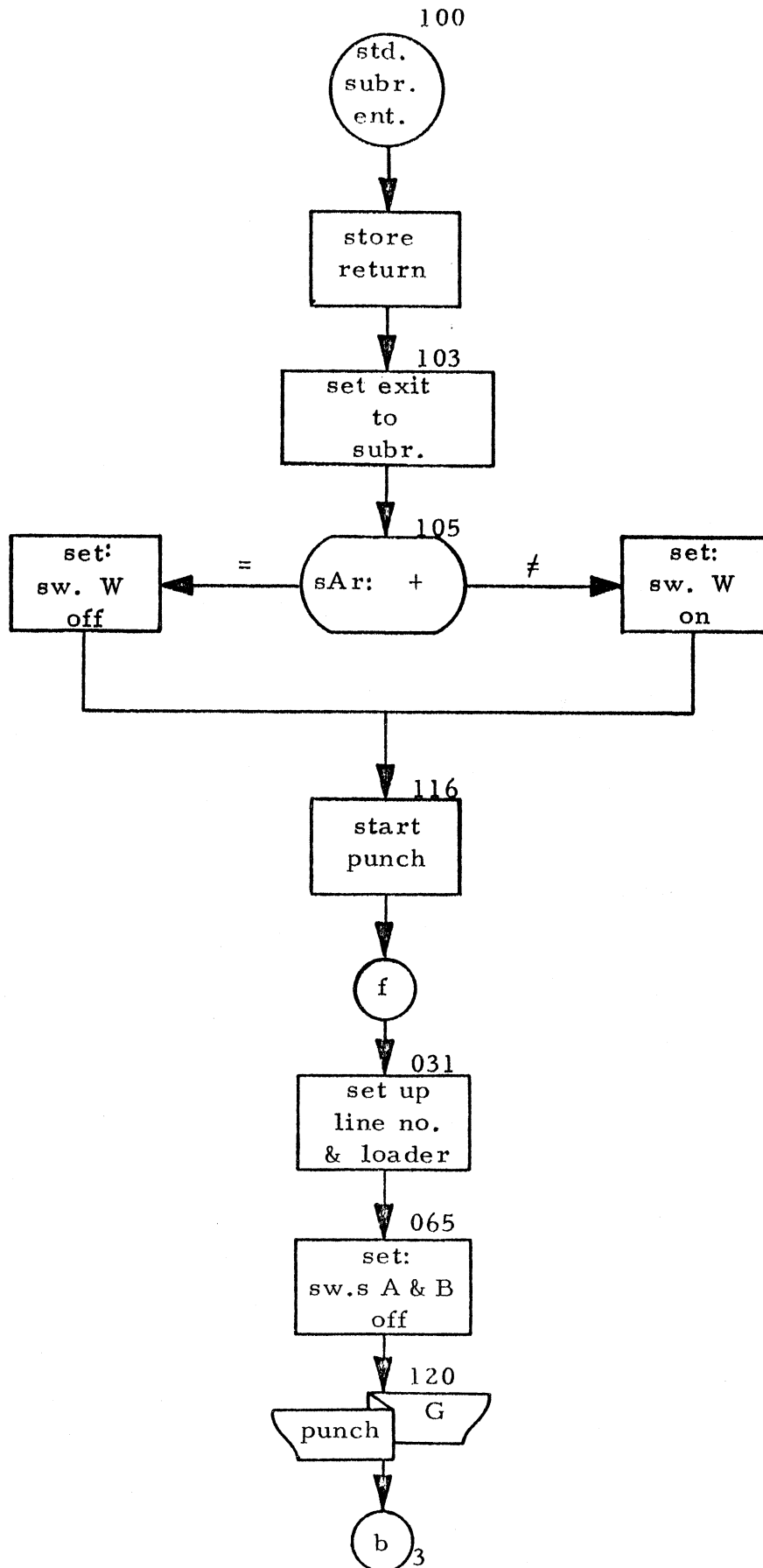
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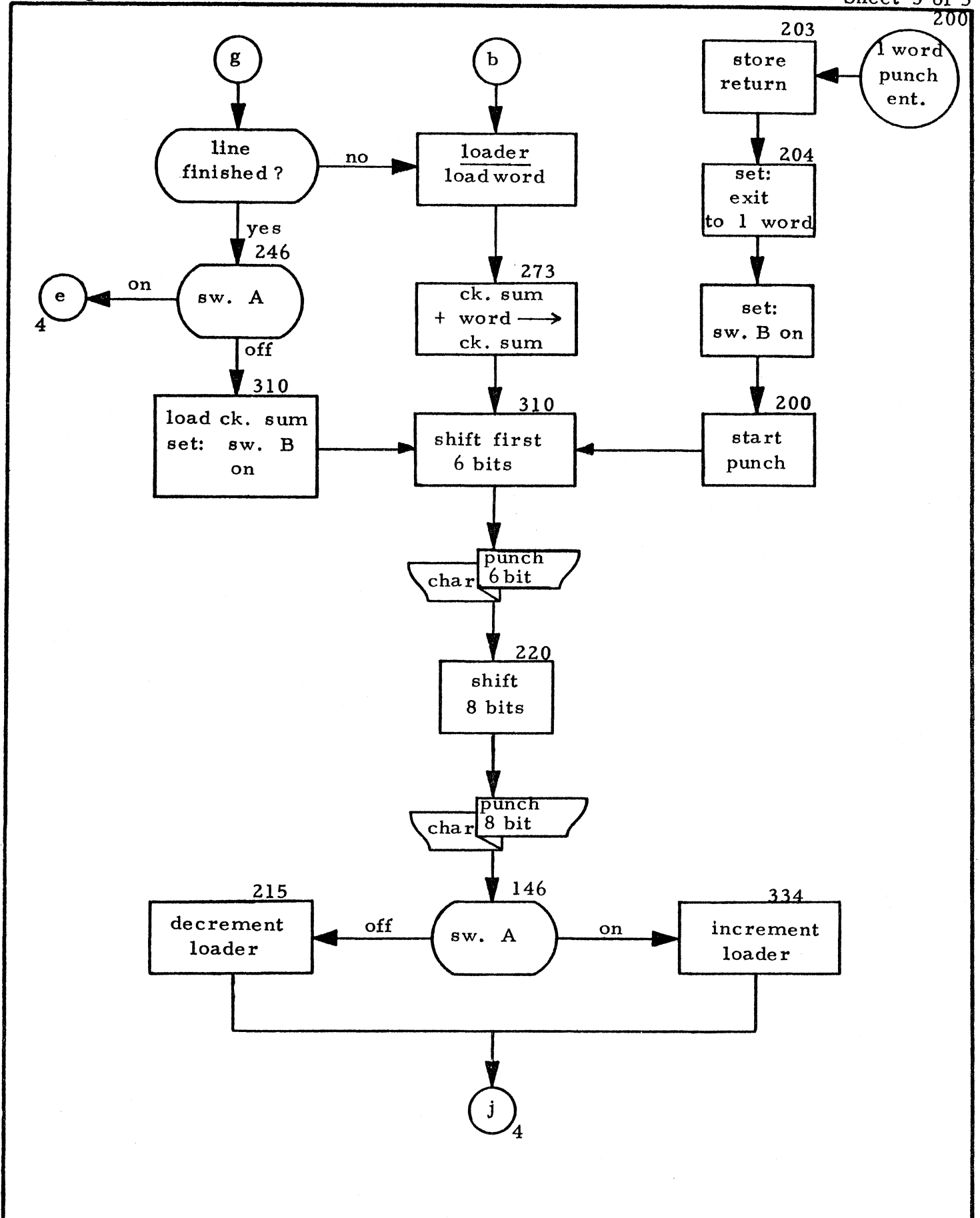


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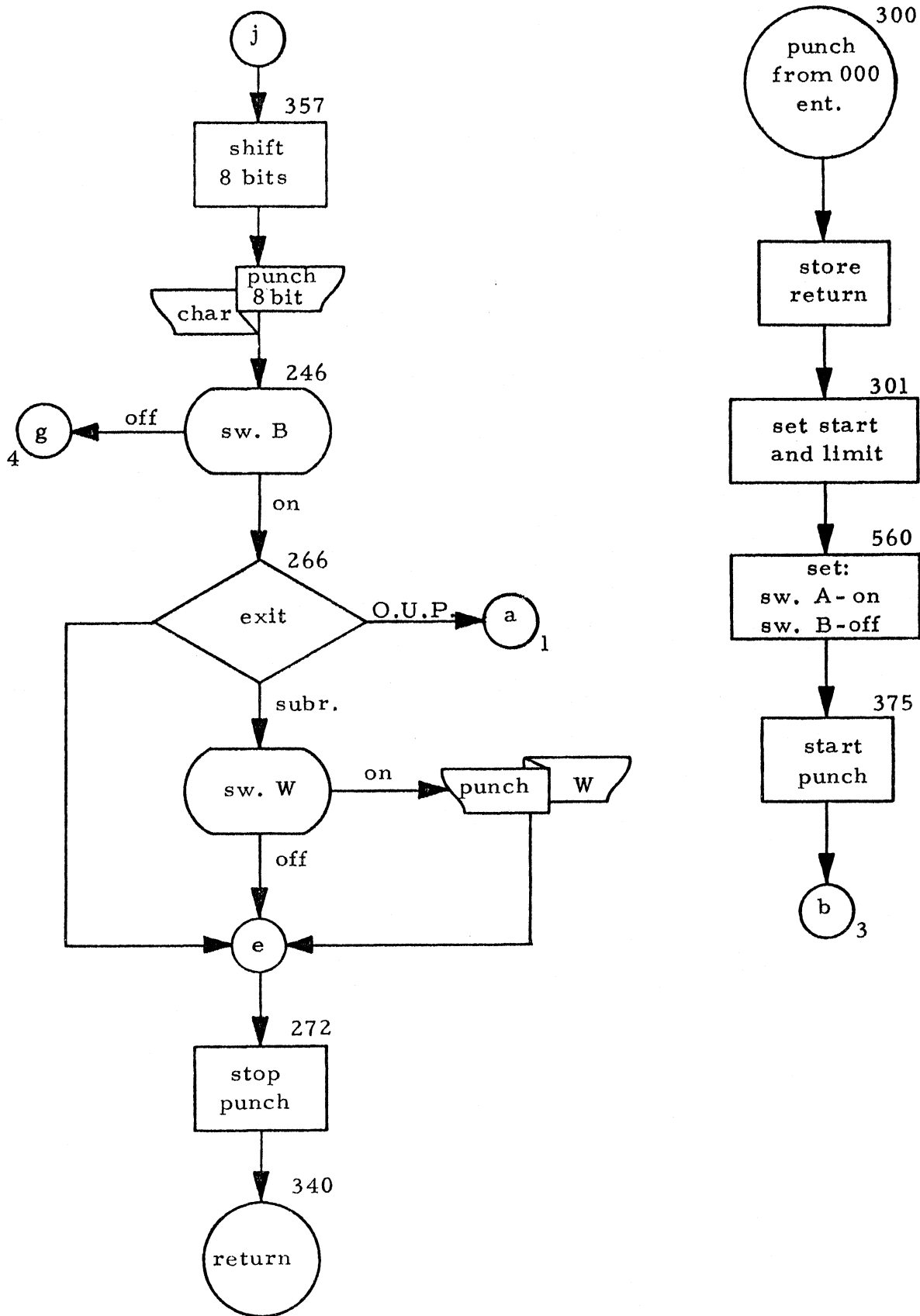


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