INSTR. LOCATION	INSTRUCTION OPER.	INSTRUCTION ADDRESS	ACCUMULATOR A	SIGN	ACCUMULATOR B	SIGN
0004	Sel	0100				
0009	Read	0501				
0014	Sign	0580	&&.	+		
0019	Add Mem	0580				
0024	Set L	0006	a00000&	+		
0029	Load	0510	a30600A	+		
0034	Sel	0200				
0039	Read	0601				
0044	Comp	0606				
0049	Tr Eq	0069				
0054	Sel	0201				
0059	Write	0601				
0064	Tr	0034				
0069	Set L	0004	a600A	+		
0074	Load	0504	aJU25			
0079	Unload	0629				
0084	R Add	0580	a001500	+		
0089	Store	0636				
0094	Add Mem	0642				
0099	Sel	0201				
0104	Write	0601				
0109	Tr	0004				

FIGURE 34. PROGRAM, INVENTORY CONTROL.

0014. Place an & in accumulator A by addressing the units digit of the quantity received field of the card record with the sign instruction.

0019. Sign the quantity received field by adding & to the units digit of the field.

0024. Set left six positions to prepare accumulator A to store part number.

0029. Load part number from the card record.

0034. Select tape unit 0200.

0039. Read the inventory control record into memory.

0044. Compare the receipt part number with the inventory control part number.

0049. When part numbers are equal, transfer to the program for adjusting the inventory record.

0054. When the cards are not equal, select tape unit 0201.

0059. Write out the inventory record on new tape. Receipt balances have not been affected.

0064. Transfer to read in another inventory record from tape unit 0200.

0069. The balance forward program begins with this instruction. Set left four positions to store date received.

0074. Load date received from card.

0079. Unload date into the inventory control record.

0084. Reset and add the quantity received from the card.

0089. Store quantity received in inventory record.

0094. Add quantity to the receipts-to-date field.

0099. Select tape unit 0201.

0104. Write out the adjusted inventory record on new tape.

0109. Transfer to address 0004 and read a new card. Repeat the program.

INTERNAL CHECKING AND END-OF-FILE PROCEDURES

THE INTERNAL checking devices built into the 702 have been designed to insure accuracy of data processing. In order to illustrate the effect of these devices upon machine operation, an explanation of the character coding system is presented in this section together with examples of the use of the check indicators, input-output indicators, and control instructions. Two payroll problems are included, one illustrating end-of-file and error correction and the other illustrating most instructions covered to this point.

Character Code System

Figure 35 illustrates the coding system used for data recording on the IBM punched card. Punching is done in two main areas; the lower numerical section records the digits 0-9 and the upper zone section, used in combination with the numerical section, records alphabetic and special characters. A total of 80 characters may be punched in one card, because each character occupies one of the 80 vertical columns.

The numerical section is further divided into ten horizontal rows, one row for each digit 0-9. The zone section is divided into three horizontal rows, 0, 11, and 12. The zero row is common to both zone and numerical sections.

When punched in their proper rows, the holes can be automatically identified as characters by IBM accounting machines (and the 702); the digits by single punches, the letters and special characters by combinations of zone punching with digits. The 12 zone in combination with the digits 1-9 is recognized as the letters A-I, the 11 zone punch with the digits 1-9 as J-R, and the 0 zone with the digits 2-9 as S-Z.

The same code structure used in punched card accounting is also used by the Type 702. Only the
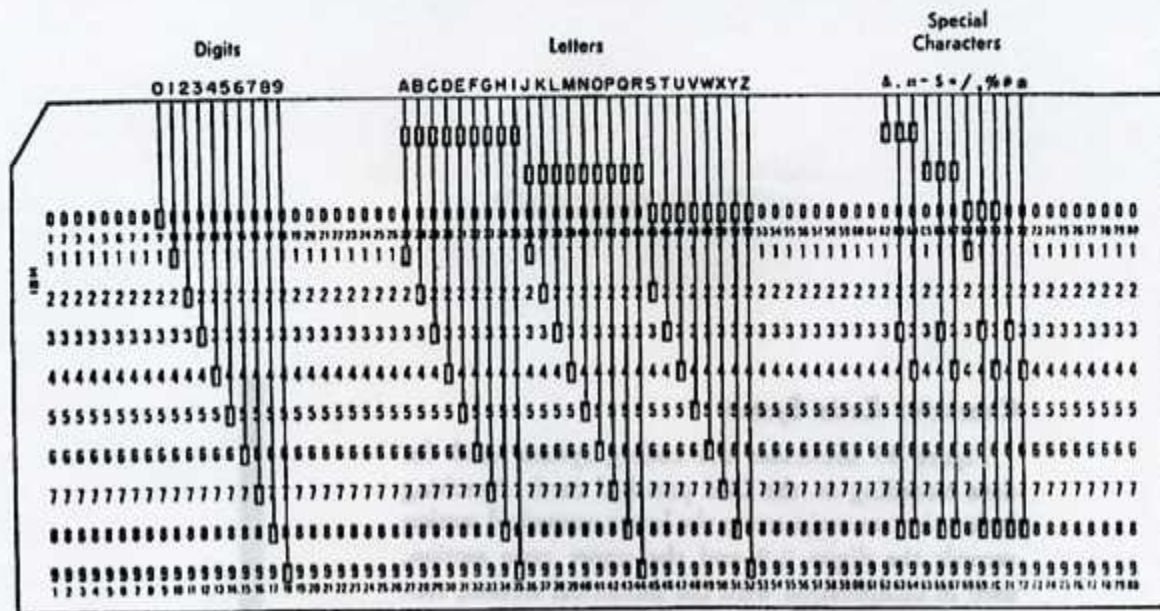
FIGURE 35. CHARACTER CODING, IBM CARD

digit notation and the form of recording are different.

Figure 36 shows an enlarged section of magnetic tape with character coding represented schematically. Actually, recording on the tape is not visible to the eye. The tape is divided into three sections:

1. The zone section, consisting of two horizontal rows or "channels."

2. The numerical section, consisting of four channels. Each numerical channel is assigned a value of 8, 4, 2, or 1, respectively.

3. The check section, consisting of one channel; used for checking purposes only. A character is defined only by the numerical and zoning sections.

Recording is accomplished by magnetizing spots or "bits" in the iron oxide coating of the tape. The presence of a charge indicates a one, the absence of a charge indicates a zero. The arrangement of these magnetized bits in combinations in the seven channels forms digits, letters and special characters. For example, the zoning bit combination of 11 (one, one) represents the 12 zone of IBM cards, the combination of 10 (one, zero) represents the 11 zone, and 01 (zero, one) represents the 0 zone. A 00 (zero, zero) combination corresponds to no zoning or pure numerical punching.

Because there are only four numerical channels on the tape instead of ten possible numerical positions on the card, bits in the numerical section are also used in combination to represent numerical values. By adding the values of one or more bits any number from 1 to 9 can be represented. In punched card coding the number 7 is represented by a punch in the 7 position of the card (Figure 35). By reference to Figure 36 it may be seen that 7 is represented in bit form by 1's in the 4, 2 and 1 numerical positions. The sum of the bits in the numerical and zone sections of the character is odd. Therefore a 1 is stored in the check position to record an even total number of 1's in the number 7.

The character P (Figure 36) is represented by 1's in the 4, 2 and 1 numerical positions and a 10 zoning. The sum of the zone and numerical 1's is even. Therefore a zero is stored in the check position. The check position is used to store a 1 whenever the sum of the 1's in the numerical and zoning portions of the character is odd, and to store a zero if the sum of the 1's is even. A character code check on the transmission, reading, and recording of all data is made by the machine to insure that each character has an even total number of 1's including zone, numerical and check positions.

The code system shown on tape in Figure 36 is used in all components of the 702, including memory, accumulator storage, and drum storage. The conversion of the 702 code system to or from IBM card code is automatic whenever a card reader, printer, punch, or typewriter is used.
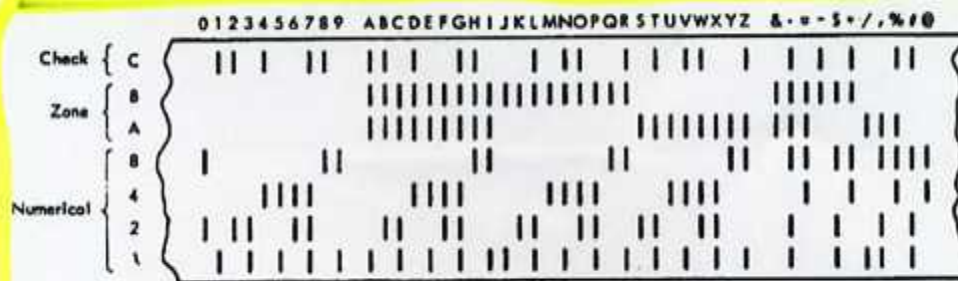
FIGURE 36. CHARACTER CODING, MAGNETIC TAPE