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Developing a data base structure for a die / tool coding system

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ABSTRACT

For the use of computer to store, modify and retrieve technical data, GT coding system has been considered as one of the effective methods. Effective data management is important for Computer Intergrated Manufacturing. Based on actual data obtained from a hand-tool maker, a die/tool coding system is developed as an example and its data base is designed using a linked list structure. It is suggested that industries use this method to make their own data base.

Key words: GT code, die/tool, data base, linked list structure

1. Introduction

Supplying die/tool for production line at proper time is directly related to productivity, and in many cases affects the production cost. However, due to poor communication between purchasing department and production line it is very difficult to know the state of die/tool. That is, it is difficult to plan its purchasing date and loading schedule, so that the machine utilization descreases. The poor communication is caused by a great amount of data volume to transfer and no standard data format. Group Technology(GT) coding system has been considered as one of the effective methods to manage the technical data.

GT coding system is a tool to classify parts with similar geometrical features or machining processes

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for the purpose of rationalization in design, manufacturing, and management(1). Since Mitrafanov coding system in 1959, there have been many public coding systems worldwide on machining parts such as Optiz system(2), KK-3 system(3), etc. Currently the coding systems are also developed for the classification of robot's grippers(4) and electronic components(5). In addition to the development of such coding systems, it is of importance to design its data base to realize GT concept. The data base design is understood as an essential factor for Computer Aided Process Planning(CAPP). In this case, the program is required to retrieve data fast from data base, modify them easily, and store them in a small memory size.

In this study, a coding system on die/tool is developed based on real data obtained from a medium size hand-tool maker. Using this system and the linked list structure, a data base structure is designed. The program is written in PASCAL and run on personal computer.

2. Coding system

The model company to supply real data produces hand tools, mainly long nose pliers, lineman's pliers, diagonal pliers, and slip joint pliers using several kinds of die/tools such as press dies, formed cutters and end mills. Thus two Coding systems are developed for the hand tools and the die/tools.

Hand tools are manufactured from the begining step of sawing raw materials to the final step of coating hand gripper. They have differences in terms of function, size, shape, machining processes, and accessaries. Thus, a hand tool coding system should be developed to include all these factors, resulting in 9 digits as shown in Fig. 1: the first digit is for function, the second and the third for size,

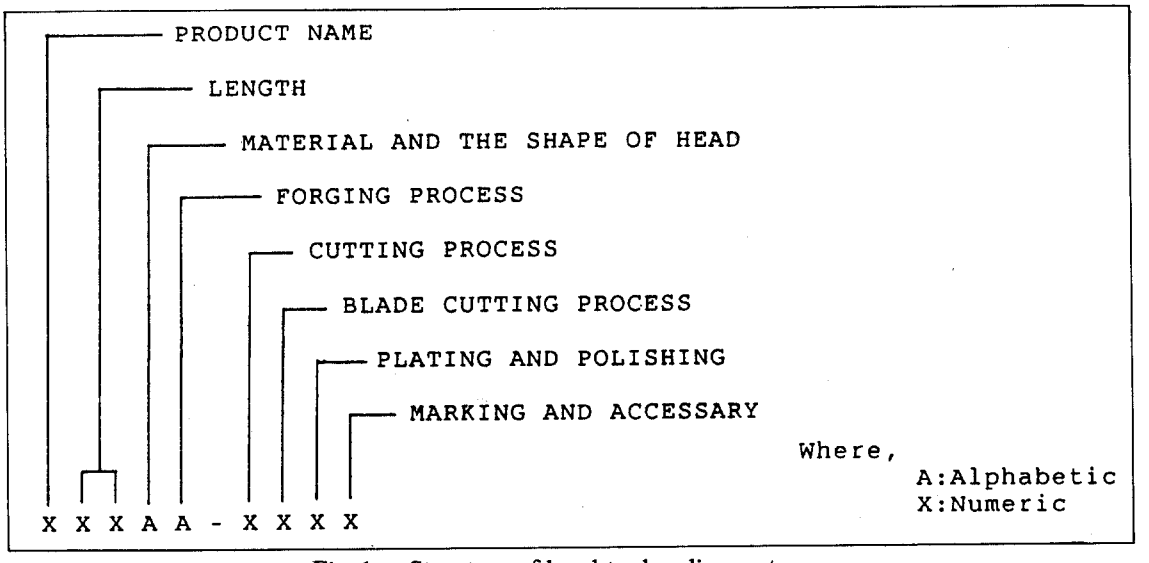

Fig. 1. Structure of hand tool coding system

the fourth for shape, the fifth to the seventh for processes, the eifghth for surface treatment, and the ninth for accessary.

Based on three kinds of die/tools a die/tool coding system is developed. As press dies and formed cutters can be classified with function, size, shape, and forging process, their coding systems can use the first five digits of the developed hand tool coding system as it is. In addition to these five digits, the press dies need one more digit to classify process where they are loaded and the formed cutters also need one more digit to classify surface type which they cut. The coding systems of press dies and formed cutters have a prefix of M and C correspondigly, so they have total 7 digits. In a similar way, the coding system of end mills has a prefix of N, three digits for its diameter, and two digits for shape and rotational direction, so has total 6 digits. The structures of the die/tool coding systems are shown in Fig. 2.

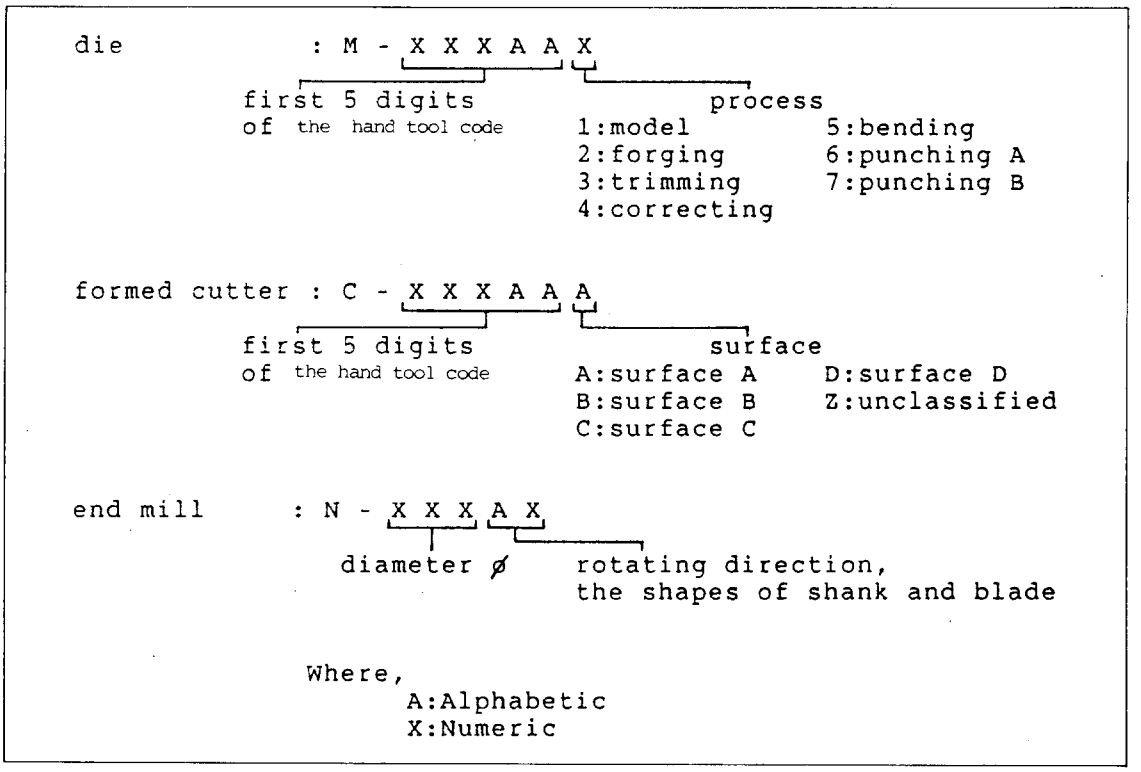

Fig. 2. Structure of die/tool coding system

3. Data base structure

Data are stored and managed in a certain format, called a file. Binary file requires less memory size in case of treating numeric symbols than ASCII fiele, so is selected to manage data. On the other

hand random access mode is selected to search data at random position(6). Thus, data base structure is designed to be in the form of the binary file and to be randomly accessed through addresses in a registration file.

3.1. Registration file(fa)

The registration file is simply designed as Fig. 3, where there are only 'code' and 'ptr' fields. The 'code' field contains the developed code and its corresponding data are stored in a record whose address is in the 'ptr' field. So this file has as many records as the number of die/tool's codes. When data of a code are asked to retrieve, the code is sequentially compared to codes in the 'code' fields and then its data are accessed randomly through an address of the 'ptr' field paired of the matched 'code' field.

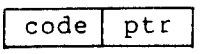

Fig. 3. Structure of a record of the registration file

3.2. Information file

The information file is classified as those for dies and tools. Tool file is again classified as those for formed cutters and end mills, but both files have same kind of fields.

3.2.1. Die information file(fm)

The model company requires several fields of die data such as original size, every restored size, maintenance date, take-out date, volume to manufacture, machine name to be loaded, etc. Whenever a die is taken out for manufacturing and/or maintenance, its corresponding data are input into its record as shown in Fig. 4. The record length increases along the time until the die is destroyed. When the length is over the available memory size, the position of extended memory is indicated by an address of 'cont' field. And an address of 'link' field indicates the position of a record of a newly made die with the same code but different serial number. On the other hand, all the data of destoyed dies are erased in order to be used later for those of newly registered dies by manipulating 'ptr' and 'cont' files.

3.2.2. Tool information file(ft)

More than one tool are usually stored for spare use. The tools with a same code can be distinguished by a serial number as shown in Fig. 5. Tools have several kinds of states: a new tool without restore(I), a restored tool(G), a fractured tool(F), and a destroyed tool(D). 'Current state' field of Fig. 5 depends on the 'state' field. For example, when the state is I, there is no field in 'current state' and when G, there are fields for restore date and its loss amount. As the linkage of the die information file, a record is connected to another record of a tool by 'link' field.

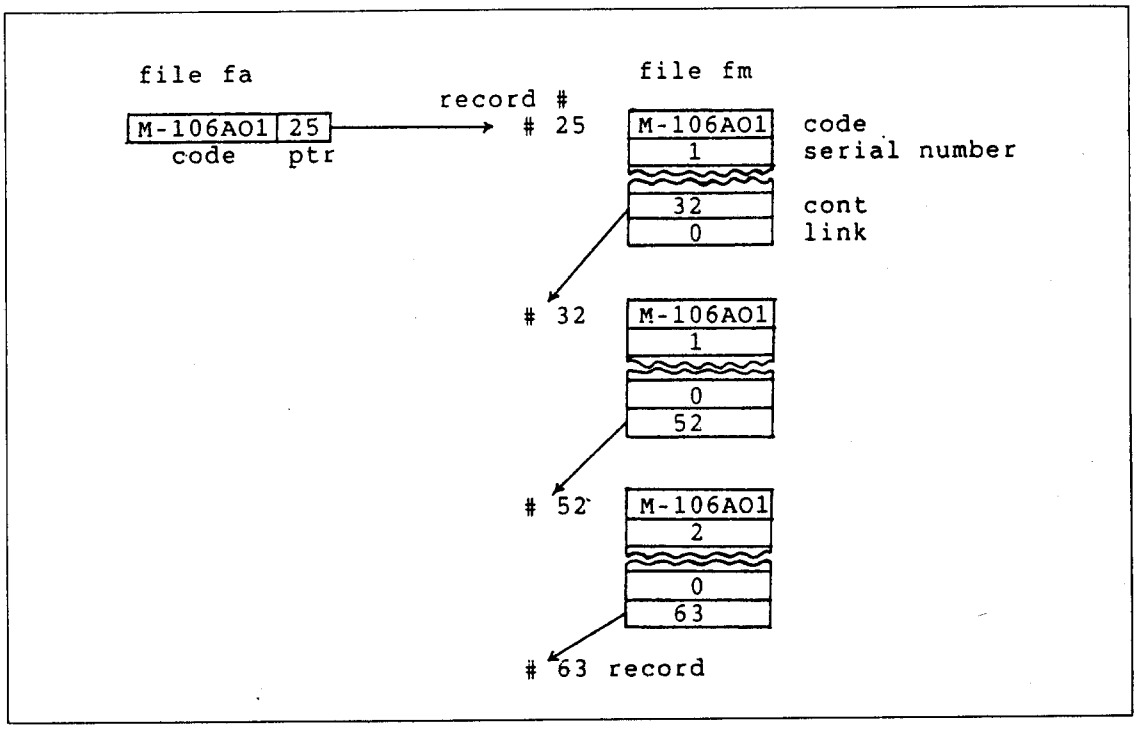

Fig. 4. An example of the relation between file fa and file fm

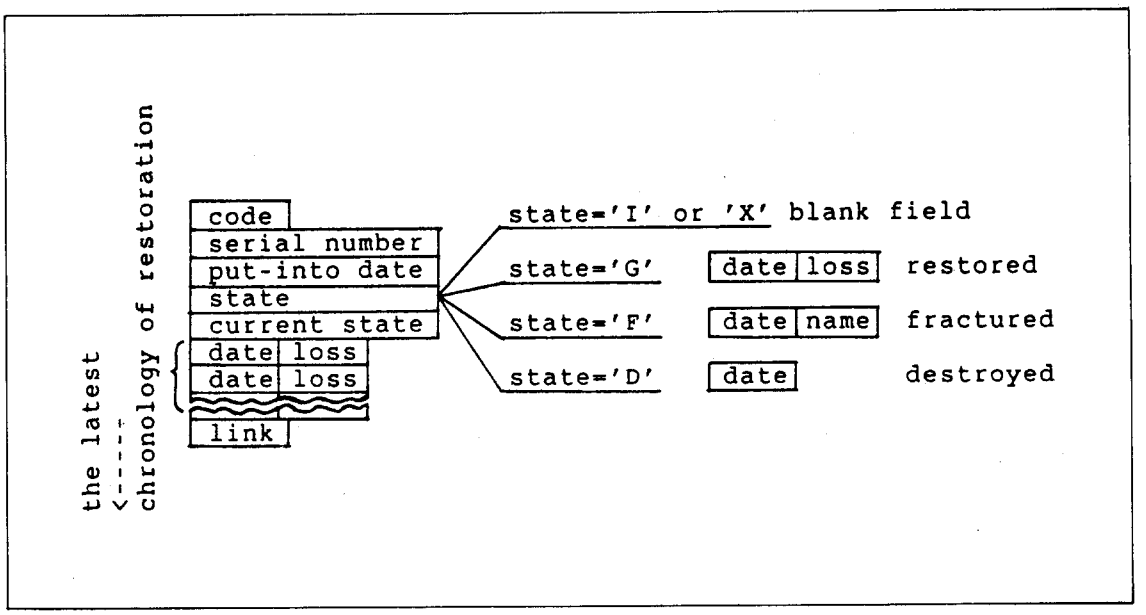

Fig. 5. Structure of a record of the tool information file ft

4. Conclusion

Based on actual data obtained from a hand tool maker, coding systems for hand tools and die/tools are developed. Then a data base structure is designed to store, retrieve, and modify data effectively. Its program is written in PASCAL by using binary file and random access mode and can be run on a personal computer. The data base structure of this program has following features:

- Data can be retrieved fast through GT code and its pointer of a registration file.
- It is easy to insert and delete data because records of an information file have the linked list structure.

Interested statistics on die/tool management can be drawn further by only adding program, because the GT code is developed to represent management factors for inventory and purchasing. It is expected that this program will be extended to manage die/tool data.

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