New methods of programming gas cutting machines

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There is a marked trend towards the use of NC-controlled gas cutting, especially in the case of small and medium-sized machines. The main reason for this trend is that NC-control provides the benefit of increased machine operating time, the more effective use of the sheets and higher quality in the cut parts.

The programming procedure for gas cutting can be divided into three sections; programming the parts, nesting the arts, and the stipulation of a cutting sequence for optimum cutting operation with the minimum distortion.

Parts programming

Back in 1985 ESAB-Hancock decided to implement a CAD package for parts programming. Previously, programming languages had to be used when the parts were programmed. This had the disadvantage for the user of requiring a knowledge of computers and mathematics. Programming is much easier when a CAD system is used since there are certain analogies with the conventional drawing board. Practically no knowledge of computers is required.

The CAD package also offers a wide range of other functions. For example, numerous drawings are dimensioned in such a way that corners are rounded. A rounding routine which rounds the corners with a high level of mathematical precision can be called up in the CAD system for this purpose. Tangents to circles can also be produced easily. Symmetrical parts can be cut without difficulty using instructions for turning, copying and moving (Fig. 1).

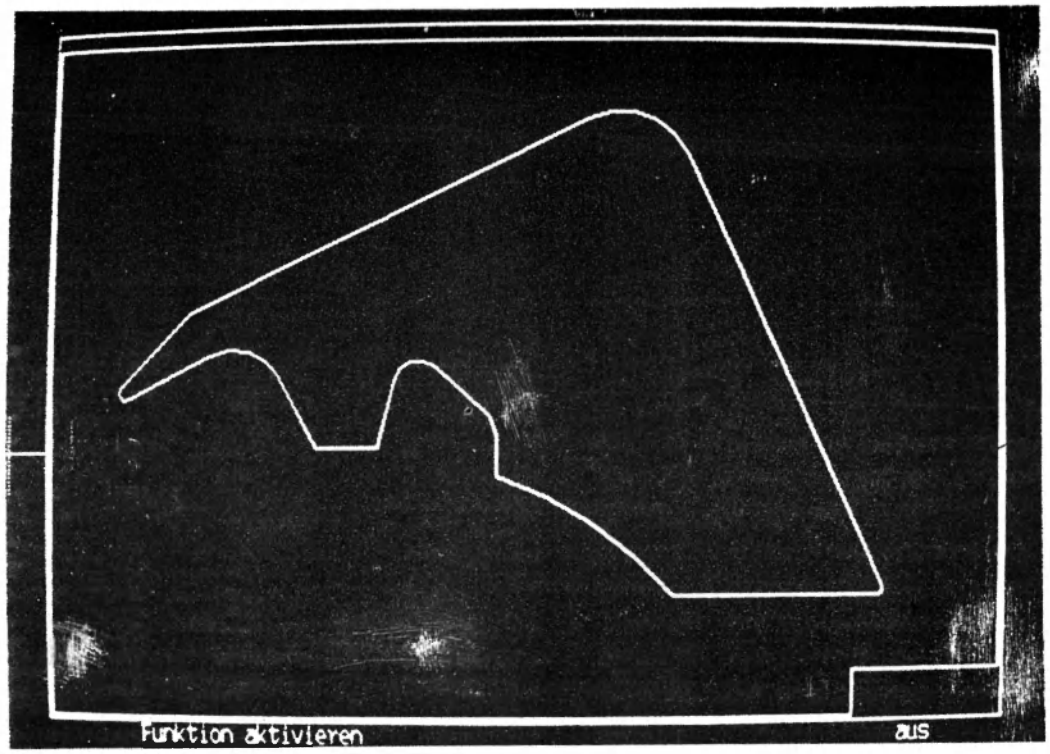

Fig. 1 : Parts creation using CAD

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Another important feature is that the program, working at the display, sees the result of his work immediately. ☞

In particular, users are surprised at the ease with which system operation can be learned thanks to the self-explanatory method of operation of this system.

Nesting

The nesting procedure is carried out after the parts have been produced using the CAD program package. Parameters such as quality, material gauge, drawing number, date and order number are stored together with the program itself. Nesting can be effected either interactively on the display or fully automatically on the computer.

To do the nesting job, the parts are compiled according to particular criteria using a sorting program which is an integrated part of the library program. Sorting can be carried out according to quality, material thickness, date, order number or a combination of these criteria.

Once the nesting job has been compiled. the sheet format is entered and the blank sheet appears on the display. The spaces between the individual parts and the edge of the sheet can then be stipulated for the various material thicknesses and cutting processes using parameter lists. The individual parts can then be called using the nesting program and placed at the upper edge of the sheet.

The parts are presented after being sorted according to size, in other words starting with the largest parts. The parts can be positioned on the sheet by using the move instruction which is executed using the mouse key. The program automatically ensures that the parts are kept at the correct distance from one another. Instructions such as copy, turn and move parts parallel to one another facilitate the work considerably. If parts are inadvertently placed on top of one another, a collision routine issues a warning signal

When automatic nesting is used, the nesting operation runs without any operator action whatsoever. The fundamental concept here is container nesting, where the smallest possible rectangle is placed around the part. Before nesting commences, a check is carried out to determine whether two parts which fit together can form a pair which can in turn be positioned in a more space-saving manner. The parts are then positioned according to size. The nesting operation is displayed on the screen to allow the operator to keep track of progress.

Five nesting levels are available. In the case of the first level, the computing time is very short; internal spaces are not occupied. With the higher levels, each free space is checked to determine whether it can accommodate another part.

In this case, the parts are also turned automatically; so-called banana nesting.

Cutting sequence

The last step of programmed production is to determine the cutting sequence. The nested sheets are offered to the user. He is able to define cutting bridges in order to link the parts to one another and thus produce a connection between them. This prevents the parts from "wandering" and accuracy is increased.

In order to stipulate the cutting sequence, the parts are touched successively using the mouse key. A visible dotted line is produced on the display. If the cutouts are on a contour, a routine ensures that the corresponding cutting sequence is observed. Consequently, only the outer contour of the parts needs to be addressed and not each individual feature. The cutting procedure can then be simulated on the display with the aid of a test run.

Initial cut flags can be produced in a linear or circular manner and are preset using parameter lists.

Modern, low-cost hardware

Personal computers, such as the IBM-PC or compatible systems, have proved to be a low-cost and efficient hardware solution for programming systems of this type. Data transfer is carried out using punched tape or directly by means of data communication (DNC). The latter method is gaining in popularity because expensive peripheral devices are no longer required.

The program memories of the NC-controls are large enough to allow several nesting programs to be stored. In addition, they are designed as static SRAM memories, the contents of which are not lost in the event of a power failure.

The programs are preceded by texts which can be read at the display on the machine in order to provide the machine operator with details of the sheet format, the material thickness, the number of torches to be used, and so on. The actual cutting plan, the nesting plan, is also shown on the monitor.

The programs are sent to the machine using what are known as "saved checksum checks", thus guaranteeing absolutely error-free transmission. ■

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