DESIGN AND FABRICATION OF COMBINATION BORING BAR

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***Abstract*—The concept of combination boring bar was first developed and patented by George G Probert in 1936. Conventional boring bars are usually used to bore a hole of single diameter and the user has to change the boring bar when various diameter holes. So in order to cut out this time involved in the tool changing combinational are involved. This increase the production time in large and medium scale industries since tool changing time become dominant boring bars is used. Here a special structure holder is used in which multiple carbide inserts are inserted. This special structure helps us to bore holes of different sizes without changing the tool.**

***Keywords*—Boring bar, boring,cmc,vmc,20MnCr5,inserts,Heat treatment**

I.INTRODUCTION

The main aim of this project is to eliminate the tool changing time and to increase productivity in large scale industries which produces automobile parts like steering and linkages and also engine and pump cylinders. These components are usually diecasted and primary step is to fabricate the die. In order to cast high precision components the die has to bored with different dimensions. In order to bore multiple holes of different dimensions one need to change the tool according to the dimension of the bore. Boring bars with standard diameter is commercially available in the market. One can make use of it. But in case of large scale industries which require high productivity, the tool changing time has become a major problem that affects the productivity drastically. Hence, this combination-boring bar eliminates the use of the conventional boring bars by boring holes of different diameters in a single stroke. This boring bar also providesfacility for performing chamfering which is also considered as one of the major advantages. When compared with conventional boring bars it is more economically efficient and is suitable for the competitive environment. The use of combination boring bar has considerably increased in recent past and the scope of these type of hybrid tools is high. Since industrialization is becoming highly automated, manual intervention has to be reduced. With particular modifications this boring bar can be used even in automated machines.

II. BORING BARS

Boring can be done on mills, lathes or drill press machines, either with a boring head or with just a boring tool. The shorter the distance between the tool holder and the material, the less distortion created from vibration or unbalanced gyroscopic effects. The greater the distance (static or dynamic mounts) the more flex in the tool or an increase in the imbalance of a moving tool. Use of a boring head increases the mass of the tool holder and decreases the distance. If a vibration is created it will be at a higher frequency and the deflection of the tool from the desired path will be much smaller and easier to erase through repetitive tool passes.

Boring Operation

In machining, boring is the process of enlarging a hole that has already been drilled (or cast), by means of a single-point cutting tool (or of a boring head containing several such tools), for example as in boring a gun barrel or an engine cylinder. Boring is used to achieve greater accuracy of the diameter of a hole, and can be used to cut a tapered hole. Boring can be viewed as the internal-diameter counterpart to turning, which cuts external diameter. There are various types of boring. The boring bar may be supported on both ends (which only works if the existing hole is a through hole), or it may be supported at one end (which works for both through holes and blind holes).

Line boring implies the former. Back boring is the process of reaching through an existing hole and then boring on the "back" side of the work piece (relative to the machine headstock).Because of the limitations on tooling design imposed by the fact that the work piece mostly surrounds the tool, boring is inherently somewhat more challenging than turning, in terms of decreased toolholding rigidity, increased clearance angle requirements (limiting the amount of support that can be given to the cutting edge), and difficulty of inspection of the resulting surface (size, form, surface roughness). These are the reasons why boring is viewed as an area of machining practice in its own right, separate from turning, with its own tips, tricks, challenges, and body of expertise, despite the fact that they are in some ways identical.

III .COMPONENTS USED

INSERTS USED

Indexable inserts:

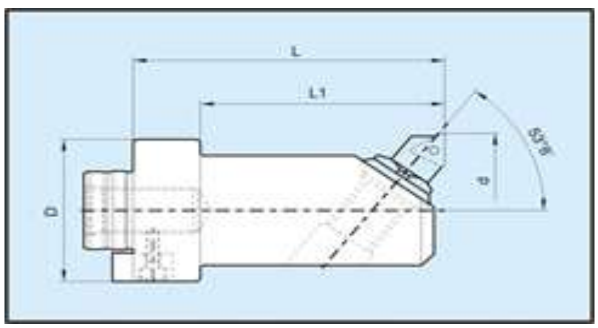
Inserts are a removable cutting tip, which means they are not brazed or welded to the tool body. They are usually indexable, meaning that they can be rotated or flipped without disturbing the overall geometry of the tool (effective diameter, tool length offset, etc.). This saves time in manufacturing by allowing fresh cutting edges to be presented periodically without the need for tool grinding, setup changes, or entering of new values into a CNC program.

Wiper inserts:

A wiper insert is an insert used in a milling machine or a lathe. It is designed for finish cutting, to give a smooth surface on the surface being cut. It uses special geometry to give a good finish on the workpiece at a higher-than-normal feedrate. Wiper inserts generally have a larger area in contact with the workpiece, so they exert higher force on the workpiece. This makes them unsuitable for fragile workpieces.

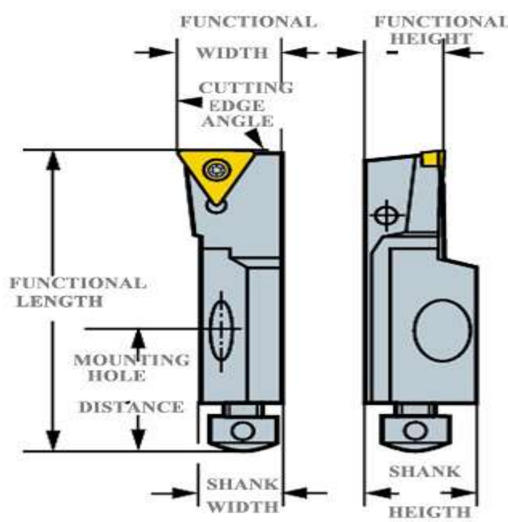
CARTRIDGES:

Cartridges are attached in the holder using screws and which in turn holds the inserts which acts as inserts. Various standard cartridges are available in the market



Part No.	Range d	D	L1	L	Microbore Unit (cartridge)	Appr Wt.in Kgs.
MOD 50 BCA 23 110	23-29	50	90	110	M3 B2 CCMT	0.6

MOD 50 BCA 29 130	29-39	50	110	130	M3 A2 CCMT	0.8
MOD 50 BCA 38 130	38-49	50	110	130	M5 B2 TCMT	1.1
MOD 50 BCA 46 130	46-66	50	110	130	M5 A2 TCMT	1.5
MOD 63 BCA 62 115	62-87	63	95	115	M7 A2 TCMT	2.3
MOD 80 BCA 83 110	83-108	80	85	110	M7 A2 TCMT	3.1
MOD 80 BCA 98 115	98-142	8	85	115	M7 A2 TCMT	3.3



MATERIAL USED AND ITS PROPERTIES:

20MnCr5 20MnCr5S Case Hardening Steel Bar-High strength Alloy Steel

Applications

Alloyed case hardening steel for parts with a required core tensile strength of 1000 – 1300 N/mm² and good wearing resistance as boxes, piston bolts, spindles, camshafts, gears, shafts and other mechanical controlling parts**.**

All Grades Comparison:

DIN 17210	**Material No.**	AFNOR	**SAE**	**UNI 7846**
20MnCr5	1.7147 /1.7149	20MC	5120	20MnCr5

C	**Mn**	**Si**	**P**	**`S**	**Cr**
0.17–0.22	1.10–1.40	0.40 max	0.035 max	0.035 max	1.00–1.30

Chemical Composition(%)

Mechanical properties(T=20°C if not differently stated)

Heat treatment state	Diameter (mm)	Rm (Mpa)
QUENCHED AND TEMPERED	16 max	1200 min
QUENCHED AND TEMPERED	16-40	1000 min
QUENCHED AND TEMPERED	40-100	800 min

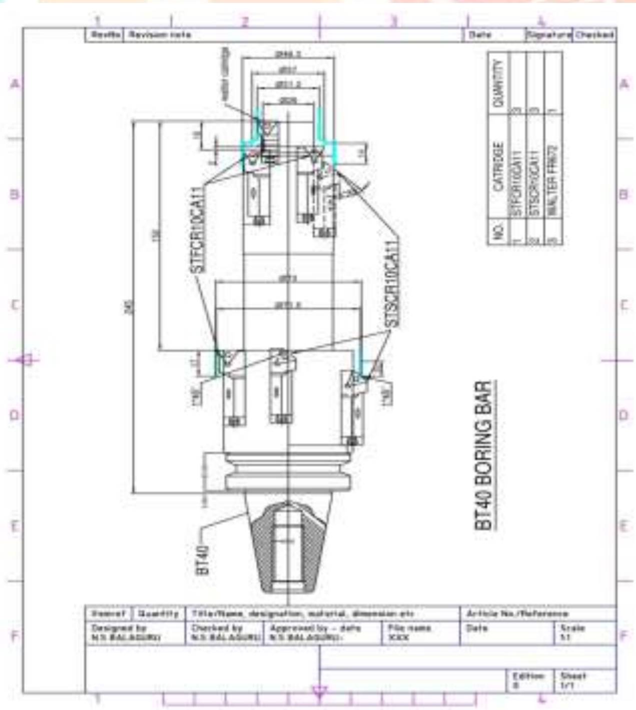
HEAT TREATMENT AND HOT PLASTIC DEFORMATION TEMPERATURES

PROCESSES	TEMPERATURE ° C	COOLING MEDIUM
Forging or hot rolling	850-1100	Air
Normalizing	840-870	Air
Soft Annealing	650-700	furnace 217HB max
Carburising	880-980	/
Core hardening	860-900	Oil
Intermediate annealing	650-700	/
Case hardening	780-820	Oil

PROCESSES	TEMPERATURE ° C	COOLING MEDIUM
Tempering	150-200	-

S.NO	COMPONENTS	SIZE	QUANTITY
1	ALLEN KEY	M6	1
2	ALLEN SCRE	M5	1
3	SPANNER	12/13	1
4	STUD SCREW	M20	1

IV. DESIGN AN DRAWING



AUTO CAD Drawing

EDGE CAM 3D DRAWINGS

EDGE CAM DRAWING (Finished)

V.FABRICATION PROCESS

Step 1:

Cutting of blank-raw material of suitable dimension is selected and is cut using Cutting machine for the required length. The require dimension is 75 x 330.

Step 2:

Facing and turning- rough turning and facing is done in order to remove the outer layer of rust and to prepare for the next operation. The turning operation includes taper turning which is done in order to prepare the shank. A groove is provided at the bottom of the shank in order to provide a holding edge when placed in vmc. The required steps are also done.

Step 3:

Counter boring and internal thread- counter boring is done on the shank inorder to insert the pull stud or to clamp into the vmc tool holder. Internal thread cutting is done into the bore inorder to tight the pull stud.

Step 4:

U slot milling using vmc: next step is to make two u slots at 180 degree each In order to provide key slot for holder. It is done in vertical milling centre.

Step 5:

Heat treatment- next step is to heat treat the job in order to increase the properties of the material both phsically and structurally. A bolt is inserted in the shank before sending the job to heat treatment in order to prevent the internal thread from damaged.

Step6-hardness checking:

The hardness of the heat treated part is measured by using any standard testing methods. Here Rockwell hardness machine is used to measure the hardness. The hardness of the boring bar should be 60hrc to 58hrc. It is important to maintain the hardness in the defined range. If it varies brittleness of the work will increase and lead to breakage and wear of the combination boring bar.

Step7-pocket for cartridge:

The hardened part is fitted in VMC machine and outer surface is machined for reducing the hardness so that it can be reduce to 36-34, it is the machining hardness. Nextthe space or pockets are machined to place the cartridges. Totally seven pockets are made. Holes are drilled in the pockets and it is threaded so that the cartridges are fitted in the pockets.

Step 8- blackening:

Black oxide or **blackening** is a conversion coating for ferrous materials, stainless steel, copper and copper based alloys, zinc, powdered metals, and silver solder. It is used to add mild corrosion resistance, for appearance and to minimize light reflection.

Step 9- final grinding and assembly:

After the blackening process the shank and grooves are finally grinded to gain micron level accuracy and after that the cartridges are assembled and the component is oil cleaned and packed.

VI.WORKING

Boring sequence:

The combination boring bar sequentially bores different diameters and perform chambering operation on the given work piece as defined in the design.

Initially the cartridges are fitted in the combination-boring bar by tightening the screws. The carbide inserts are assembled in the cartridges according to the size allotted in the cartridges. When all the cartridges and inserts are fitted the combination boring bar is loaded in the CNC or VMC

The combination boring bar first bores a diameter of 31.2 mm for a length of 17 mm when it completes the determined length the succeeding insert bores the diameter of 37 mm ,when it goes beyond 2mm the next insert bores 46.3 mm diameter for 12 mm.

The next is the chamfering operation ,for that the carbide inserts are inclined at 1. 45'.The chamfering is made for a length of 128 mm. when it completes chamfering the next insert starts to bore the defined diameter.

The carbide insert bore a diameter of 71.5 mm. simultaneously the chamfering operation is done with same diameter for 17 mm length.

The next operation is also chamfering but it is for finishing purpose. It enlarges the previous chamfering by boring with 73 mm diameter.

All the operations are done in a single stroke. Once the combination boring bar is set it machines all the boring and chamfering operations completely.

APPLICATIONS:

- Large scale production industries.
- Shaft manufacturing industries.
- High precision manufacturing
- Milling machines.
- CNC lathe.
- CNC milling
- VMC(vertical milling center)
- Engine die casting

ADVANTAGES:

- Reduces working time.
- Highly precise and accurate
- It is more economical
- Decreases tool changing time.
- Bores different diameters at a single stroke
- Performs boring and chamfering

VII.CONCLUSION

Thus this combination boring bar reduces the usage of many number of boring bars of required diameters and minimises the time required to change the boring bars to bore different diameters and chamfers. The combination boring bar is mostly used in vertical milling centre. This combination boring bar bores different diameters and also performs chamfers of defined angles. The main thing is that all this operations are performed in a single stroke.

VIII.REFERENCES

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