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Design and Manufacturing of Stapler Body

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Abstract - *A stapler is most commonly used in day-to-day life. A stapler is made up of plastic, stainless steel and zinc plated steel. These are most commonly material used to manufacture stapler. In this project, we are created stapler body die. Because of most stapler are made in china, for Indian manufacturers we going to design and manufacture stapler body die for stapler body. In this project, we are making progressive die for stapler body, which will easily to manufacture, and due to using standard assembly parts, it is easy to replace for maintenance.*

Key Words: Tool Design, Strip Layout, Tonnage Calculation, Stapler Body Design, Final Assembly, Math

1. INTRODUCTION

Tool Design is a specialized phase of tool Engineering Tool - design function may be performed by a tool Engineer in addition to these other duties in manufacturing, or they may be performed by a tool design specialist who devotes his entire working time to tool design the word "tooling refers to the handwork necessary to produce a particular product considerable amount of tooling is the result of work performed by the tool designer Tooling as viewed by the tool designer, consist of a vast array of Cutting device, jigs fixtures, dies, gauge, etc. used in normal production

1] Sheet-metal press working dies you all types of Sheet metal fabrication

2] Die Casting

3] Plastic molds

4] Forging die

Progressive Die:

The progressive die is used to perform two or more operations at different stages at one time. Every time the Ram descend, the stock strip is advanced through a series of stations that perform one or more distinct die operations on the work piece. Thereafter a complete work piece is produced with each stroke of the ram.

2. Literature Review

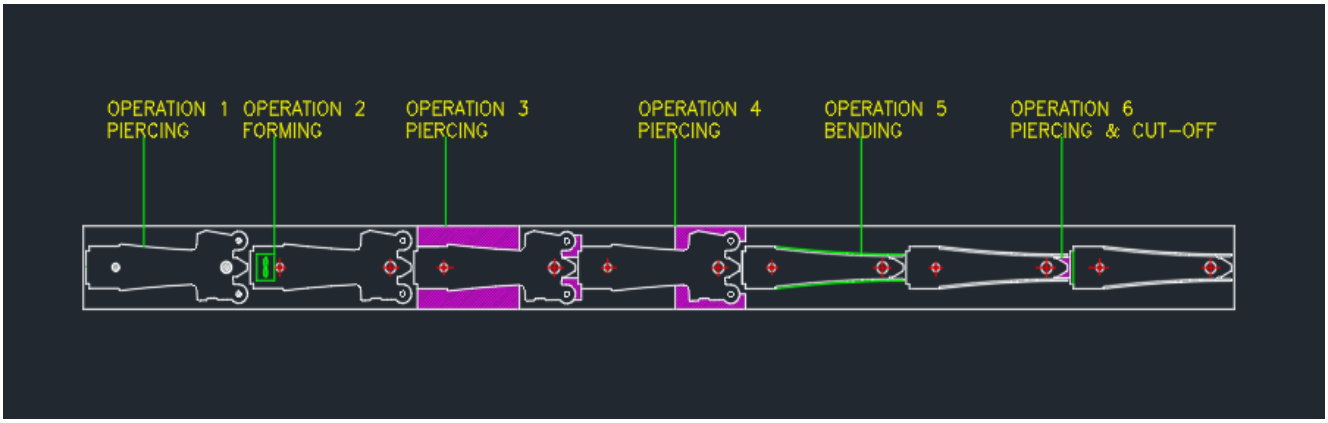

Fig -1: Strip Layout

Strip Layout:

In this strip layout, there are six-station where different types of operations are performed and they are as follows

Station 1: Piercing operation:

This operation consists of simple hole punching.it differs from blanking in that punching is the scrap (cut out blank) and the strip is the work piece. In the first station, there are four piercing operations performed with different sizes of diameter 4 mm and diameter 6 mm, and a hole is made.

Station 2: forming Operation:

This operation consist of stampings requires accuracy; dies employing pressure pads are often designed. The pressure pad helps to hold the stock securely during the forming and eliminates shifting of the blank. The pressure can be applied to the pad by springs or by the use of an air cushion. When springs are used, they can be located directly under the pad and confined in the die shoe. This operation is used to formed the shape of closing stapler pin

Station 3: Piercing Operation:

In the third stage, there is a piercing operation performed cutting the half shape of the component due to less cutting force

Station 4: Piercing Operation:

In the fourth stage, there is a piercing operation performed cutting the shape of the component.

Station 5: Bending Operation:

Bending is the uniform straining of material, usually flat sheet or strip metal around a straight axis, which lies in the neutral plane and is normal to the length-wise distortion of sheet or strip. In four stages there are two bending operations performed on the head of a nail cutter.

Station 6: Cutoff Operation:

A cutoff operation separates the work material along a straight line in a single line cut. In the sixth stage of operation where the components are cutoff and the operation is completed.

3. Calculation

Tonnage:

Cutting forces:

The force required to penetrate the stock material with the punch is the cutting force.

F=SPT

Where, F=Cutting Force

S=shear strength of stock material

P=Perimeter or Length of Cutting Edge

T=Thickness of Material

In this case, the material we used is stainless steel

S=5.1118 ton/squre.cm

P=300mm=30cm

T=2mm=0.2cm

F=SPT

F=5.118 x 300 x 0.2

F=19.045≅24 tons

As per standard, we can used 24 tons capacity. Machine can be used because 24 tons is the standard machine.

2] Scrap: strip layout for blanking, A scrap-strip

Layout having insufficient stock between the blank, will results in a weakened strip, subject to breakage and thereby causing miss feed

T=specified thickness of the material

B=1.25t where c is less than 64mm

B=1.5t where C is more than 64mm

T=1mm

B=1.5 x 1=1.5mm

C=88.5+1.5=90mm

3] Die sets selection:

In this case, the die sets selected four pillar all set standard die set. Due to progressive die and more amount stage of operation. As per company standard.

4] Punch Design:

From the equation

P=SLT

Where, P=pressure

S=shear strength

L=blanked perimeter

T=thickness

P=51.118 kgs

L=300mm

T=2mm

P=51.118 x 300 x 2

P=19.45 ton

The value is well the 24-ton capacity of the select press

5] Spring:

In this case we used solid stripper plate can be used for the job

We are using four-pillar system we are using a yellow spring of 50mm diameter. Pressure can be sustain=250kg

Maximum pressure. We are using four spring.

6] Bending Operation:

First Bending:

B= (A/360) x 2 /π x (IR+Kt)

Where,

B=Bend allowance in mm.

A=Bend angle in degree.

IR=Inside radius of bend in mm.

t=metal thickness

K=0.33 where IR is less than 2t

1] Bending:

B=A/360 x 2π x (IR+KT)

B=45/360 x 2π x (3.0212+0.50)

B=3.065mm

4. Problem Description:

The objective of this project is to make mold 3D to understand the bending of the component. To create a strip layout where there will be no problem during running at high speed. To reduce wastage of components due to increase in the cost of raw material.

5. Introduction to Stapler Body Die Design

Solid work mostly commonly used for sheet metal because it easy to use and widely used in other company solid work used to developed parts or make new part easy and fast

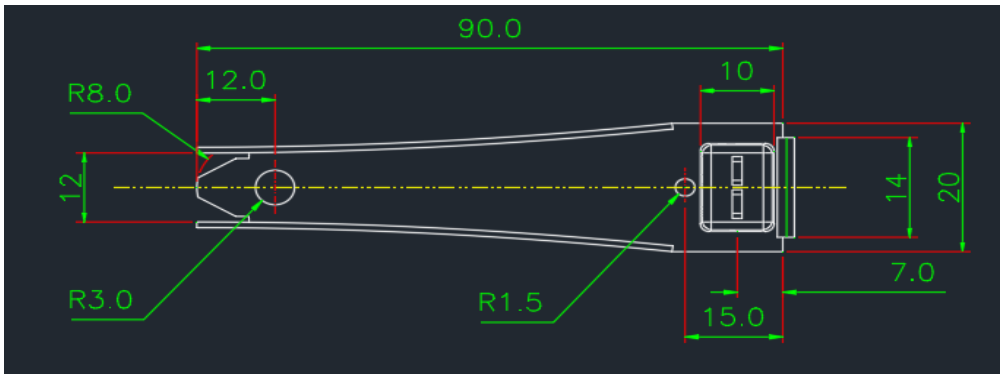

Fig -2: Top view

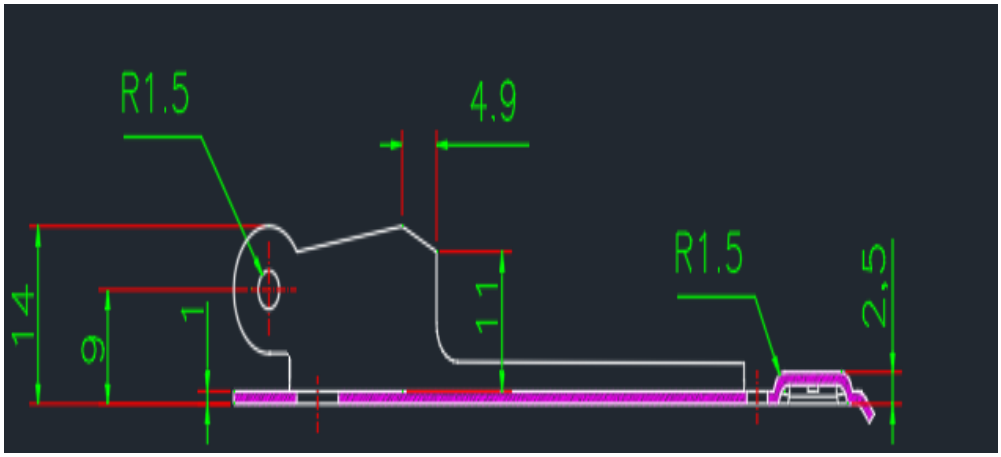

Fig -3: Front view

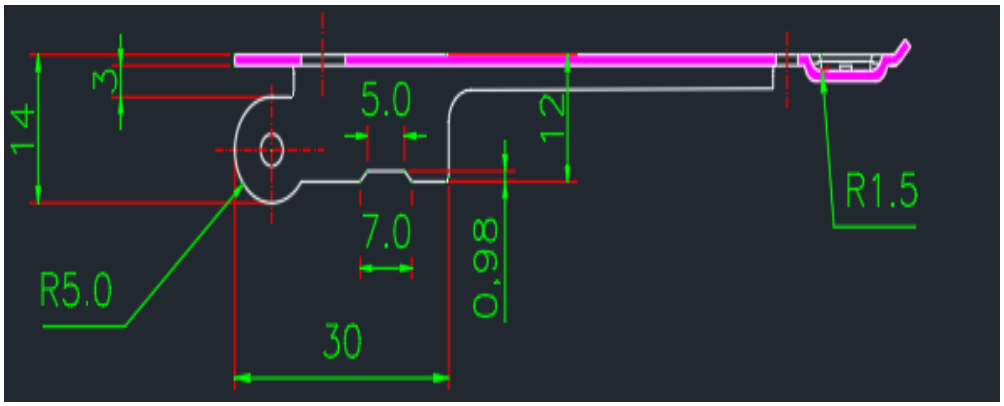

Fig -4: Back view

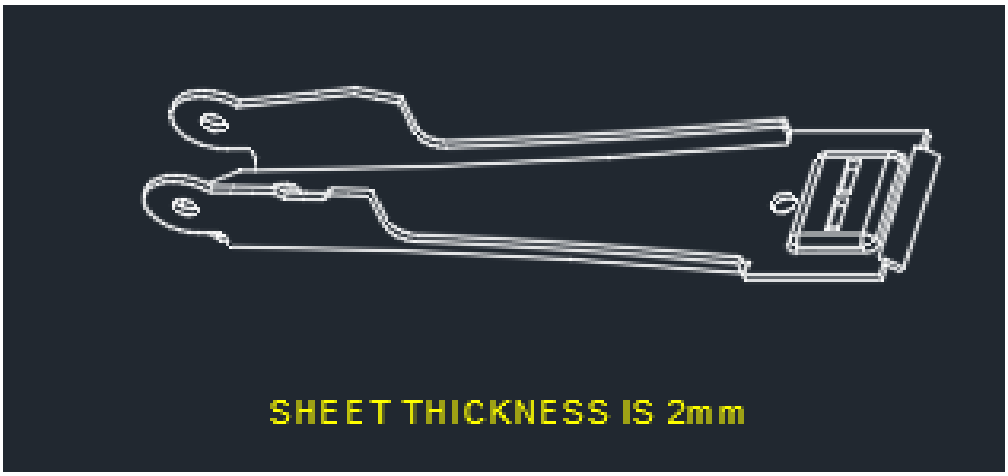

Fig -5: 3D view

6. Result and Discussion

General sheet metal die consists of different parts. Each part is important in its respect and has a different function to perform. The following is the list of parts with their basic functions.

Top Plate:

This is the top most commonly used plate. The top plate is attached to the machine. Where they are used for aliment of plate. This plate is connected to shank where the middle part is connect to press

Size – 685 x 344 x 44

Material – (C-45)

Heat treatment - no heat treatment required

Machine:

Shaping machine

Milling machine

Jig boring machine or drilling machine

Surface grinding

Tolerance: ±0.1

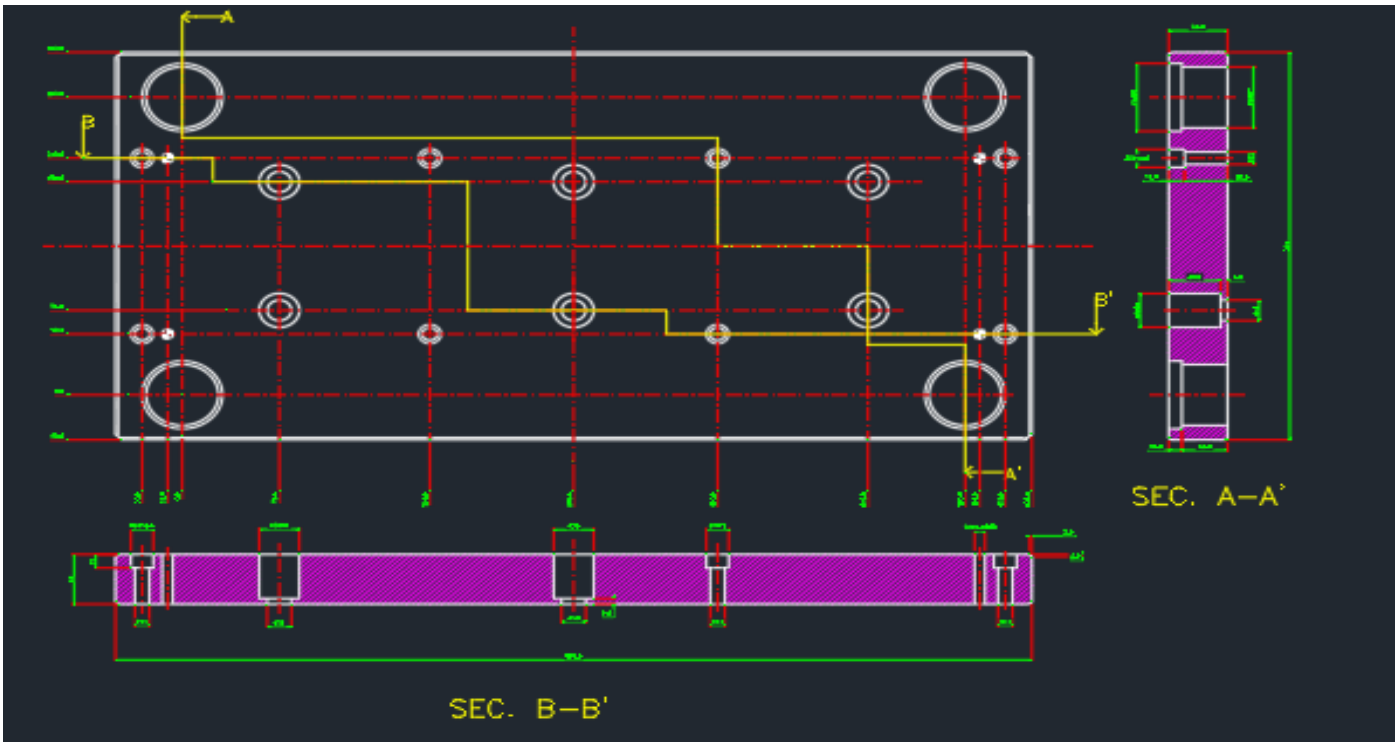

Fig -6: Top plate

Punch holder support housing-

The plate is used for holding the punch in the die with help of riveting or applying the bolting system and dove pin is used for aliment of plate

Size – 495 x 234 x 66

Material – (C-48)

Heat treatment - no heat treatment required

Machines:

Shaping machine

Milling machine

Jig boring machine or drilling machine

Wire cut electric discharge machine

Surface grinding

Tolerance - ± 0.01

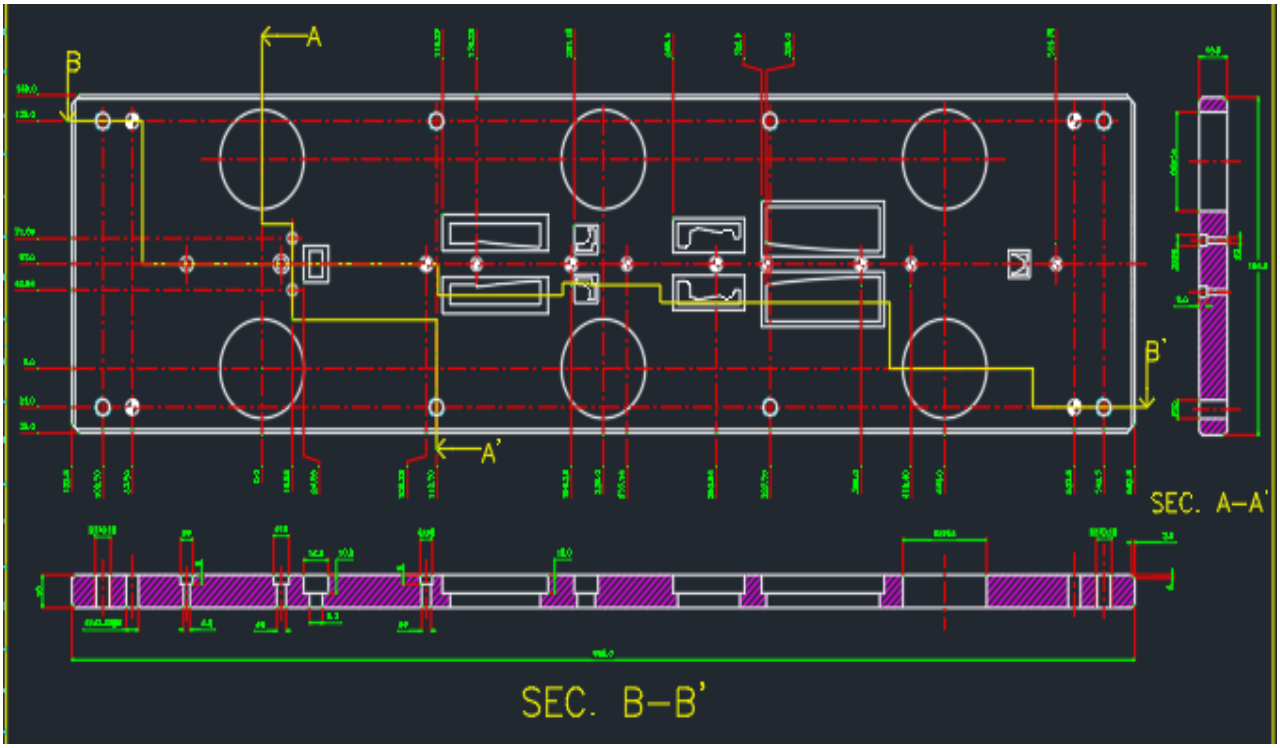

Fig -7: Punch holder support housing

Thrust plate-

This plate is for bolts the plate in their will to misalliment of plate and punch. Due adding this plate there will less chance of bolts, dowel pin and guide pillar

Size – 495 x 234 x 7

Material – (C-45)

Heat treatment – no heat treatment required

Machine- shaping machine

Milling machine

Jig boring machine or drilling machine

Wire electric discharge machine

Surface grinding

Lapping operation

Tolerance-± 0.01

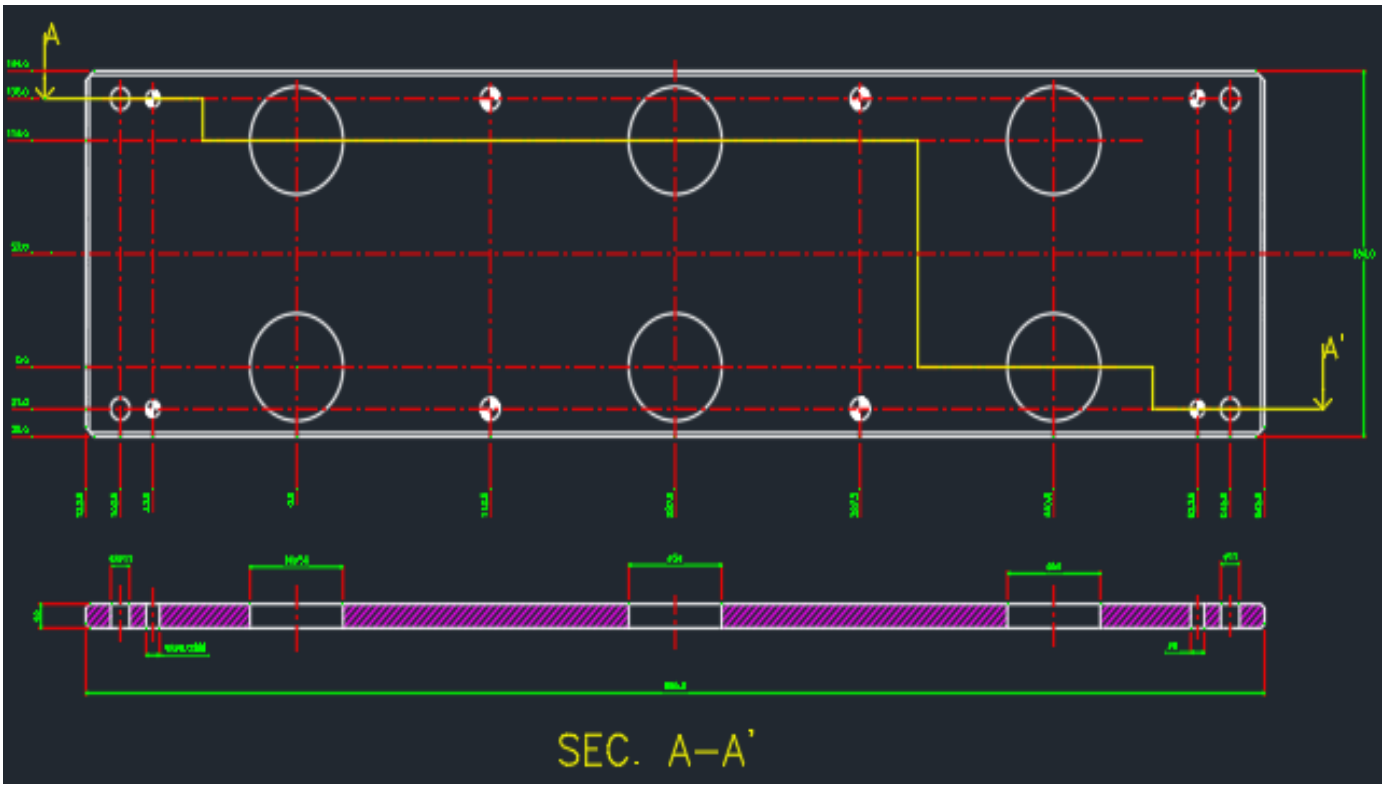

Fig -8: Thrust plate-

Punch plate-

The punch plate where the punch pass through plate the burn does not attached to it and remove from its it always contact with punch

Size – 495 x 234 x 45

Material – (C-45)

Heat treatment – HRC 62 to 65

Machine- shaping machine

Milling machine

Jig boring machine or drilling machine

Wire electric discharge machine

Surface grinding

Lapping operation

Tolerance-± 0.01

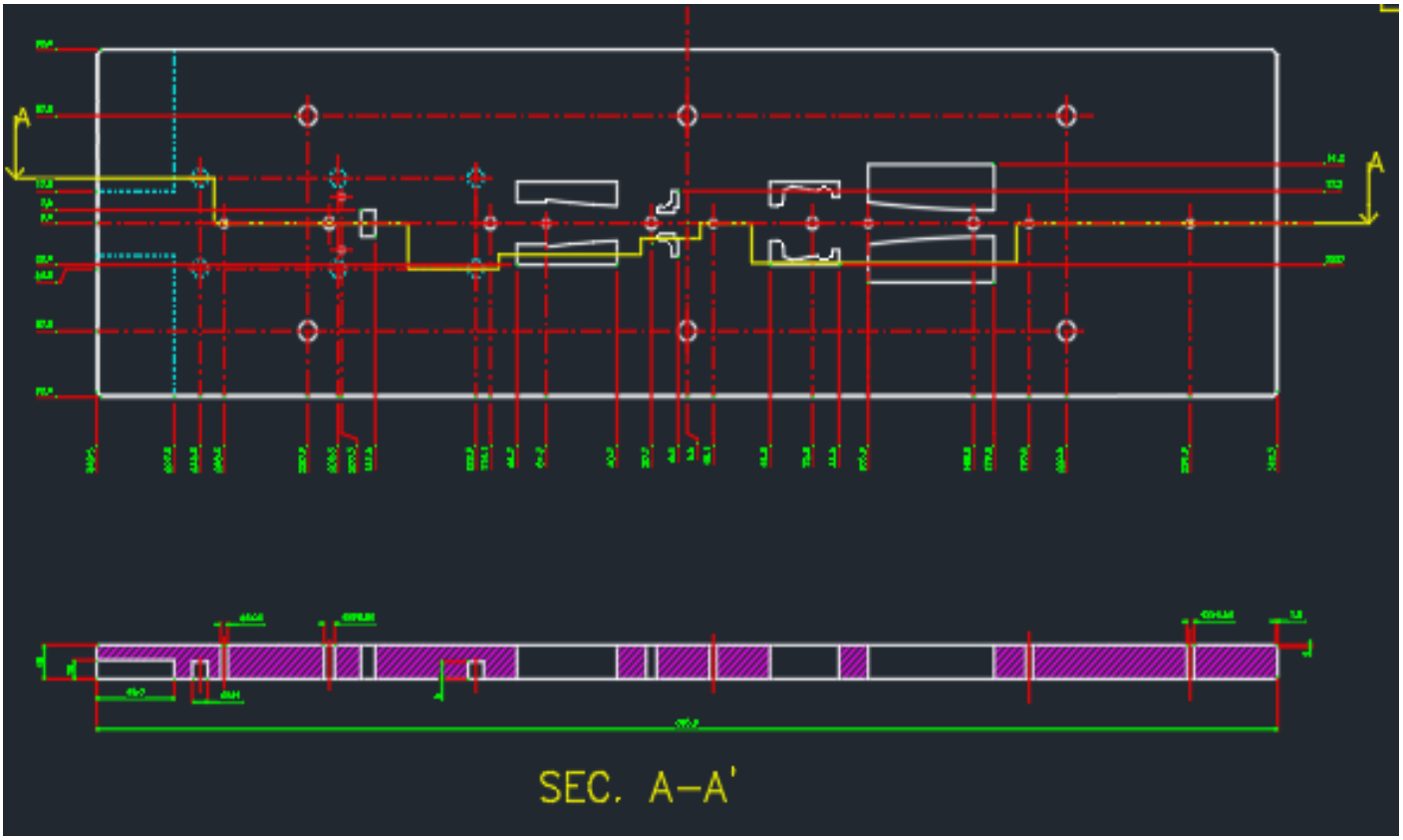

Fig -9: Punch plate

Die housing plate-

In this plate, punch plate attached to die housing plate for allayment of work of press

Size – 495 x 234 x 45

Material-C-45

Heat treatment - no heat treatment required

Machines:

Shaping machine

Milling machine

Jig boring machine or drilling machine

Wire electric discharge machine

Surface grinding machine

Tolerance-± 0.01

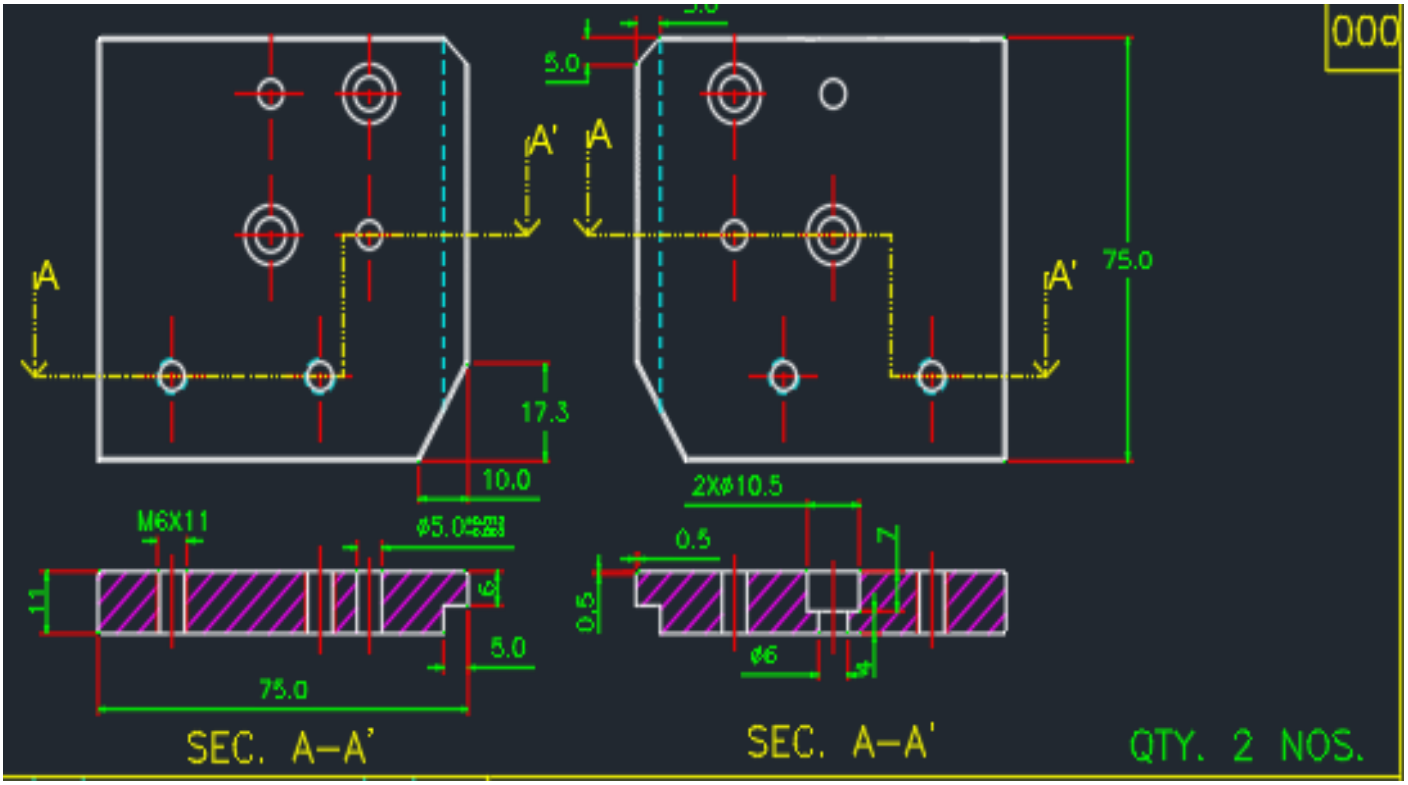

Fig -10: Die housing plate

Bottom plate-

The bottom is attached to base of machine, which is used for clamping from down side and removal of scrap from the bottom

Size – 75 x 75 x 11

Material – (C-45)

Heat treatment – no heat treatment required

Machine- shaping machine

Milling machine

Jig boring machine or drilling machine

Surface grinding

Lapping opertion

Tolerance-$\pm$0.01

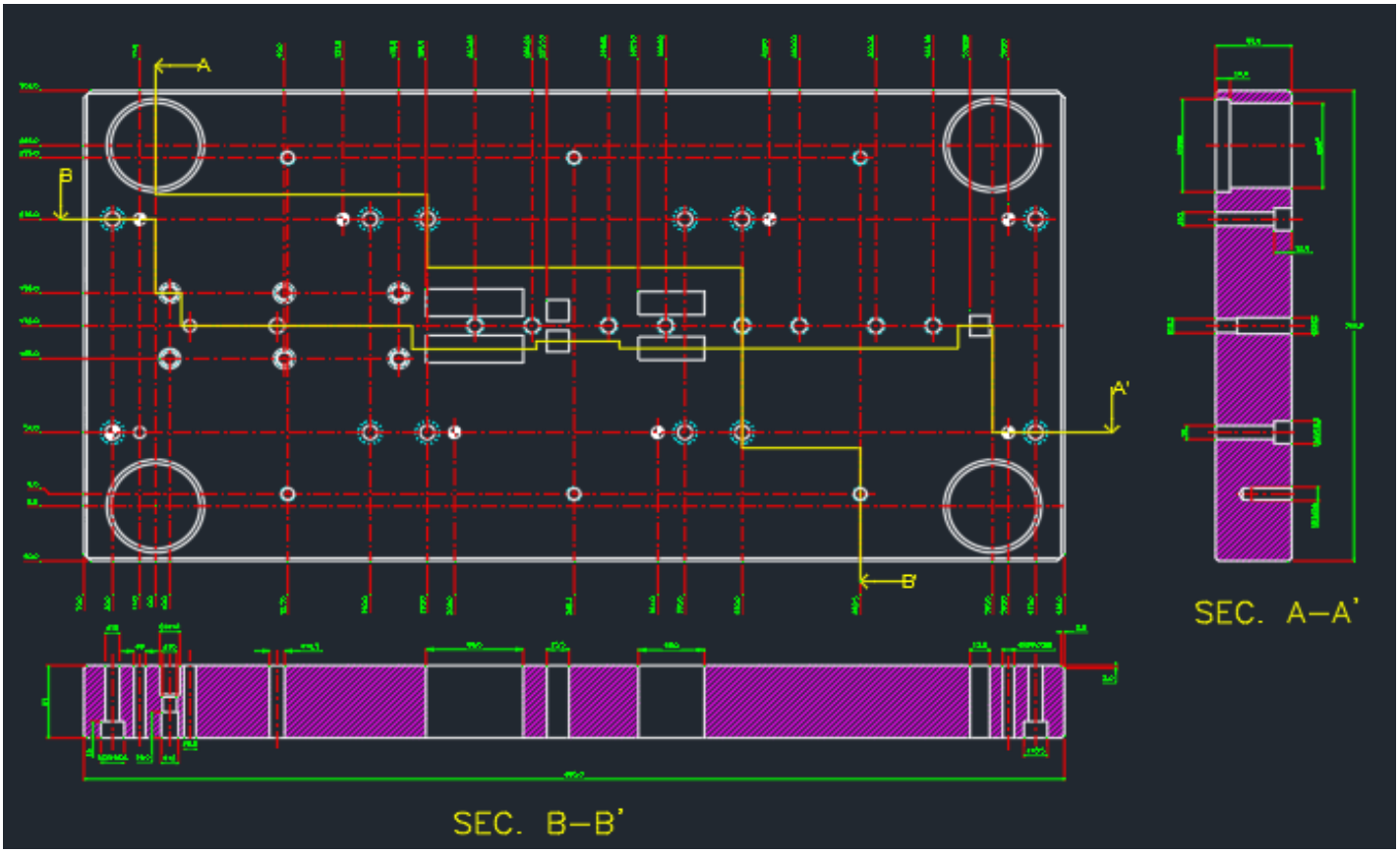

Fig -11: Bottom plate

7. Final Assembly

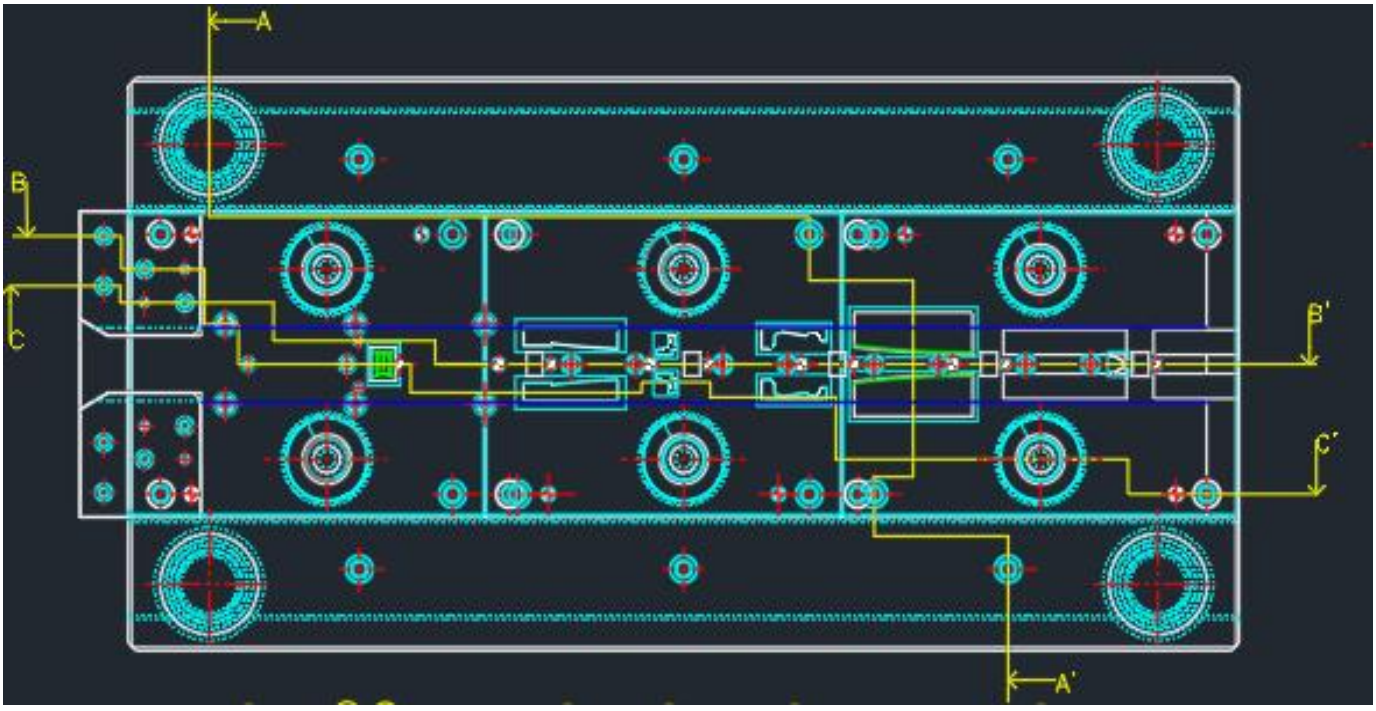

Fig -12: Final assembly of stapler die

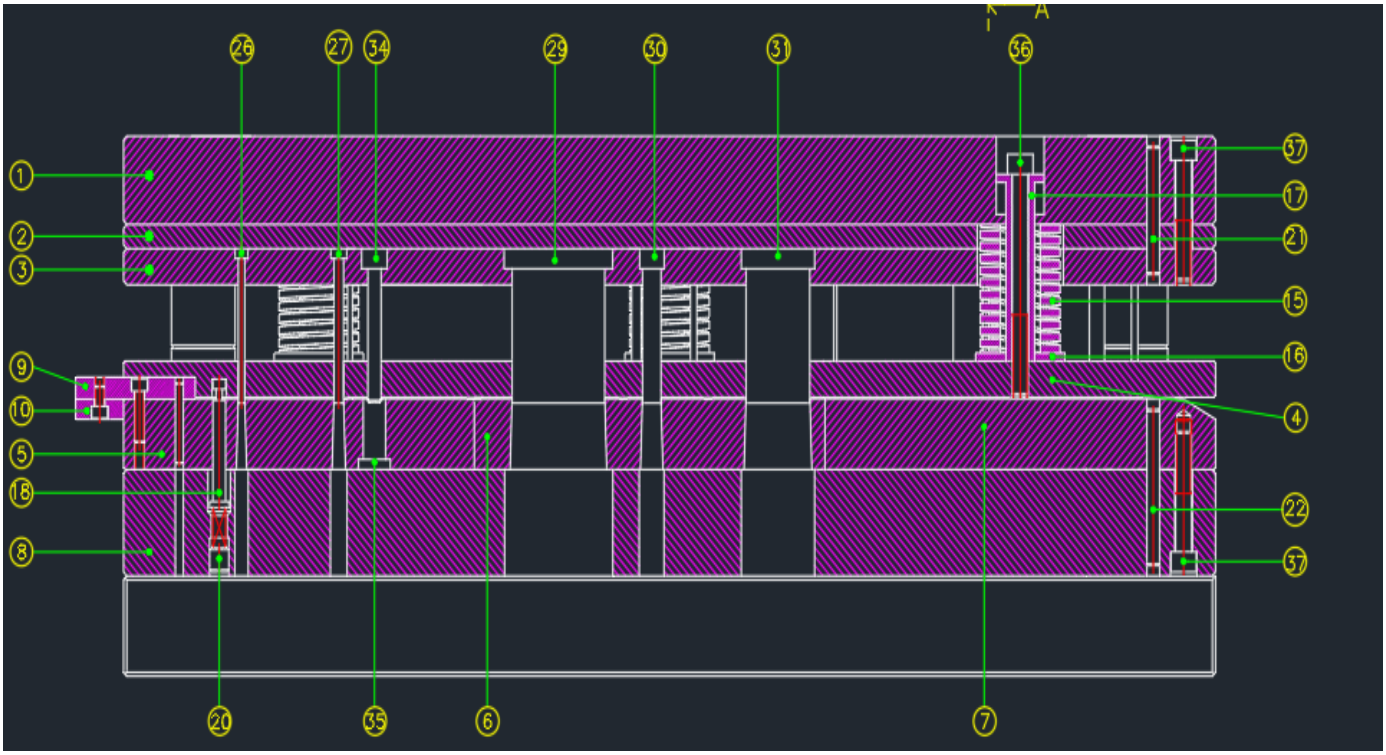

Fig -13: Final assembly of stapler die section B-B

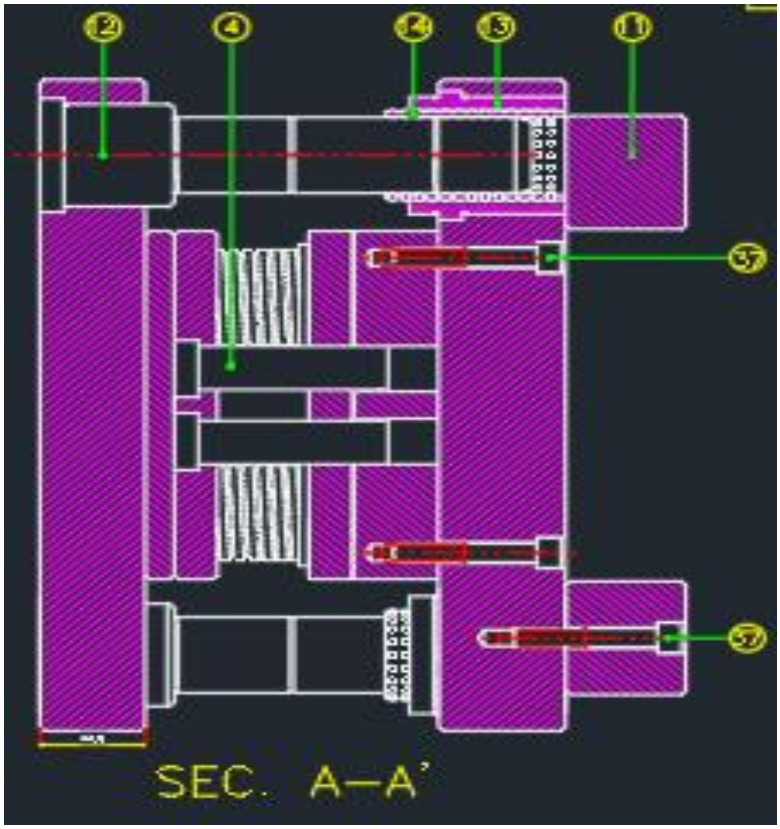

Fig -14: Final assembly of stapler die section A-A

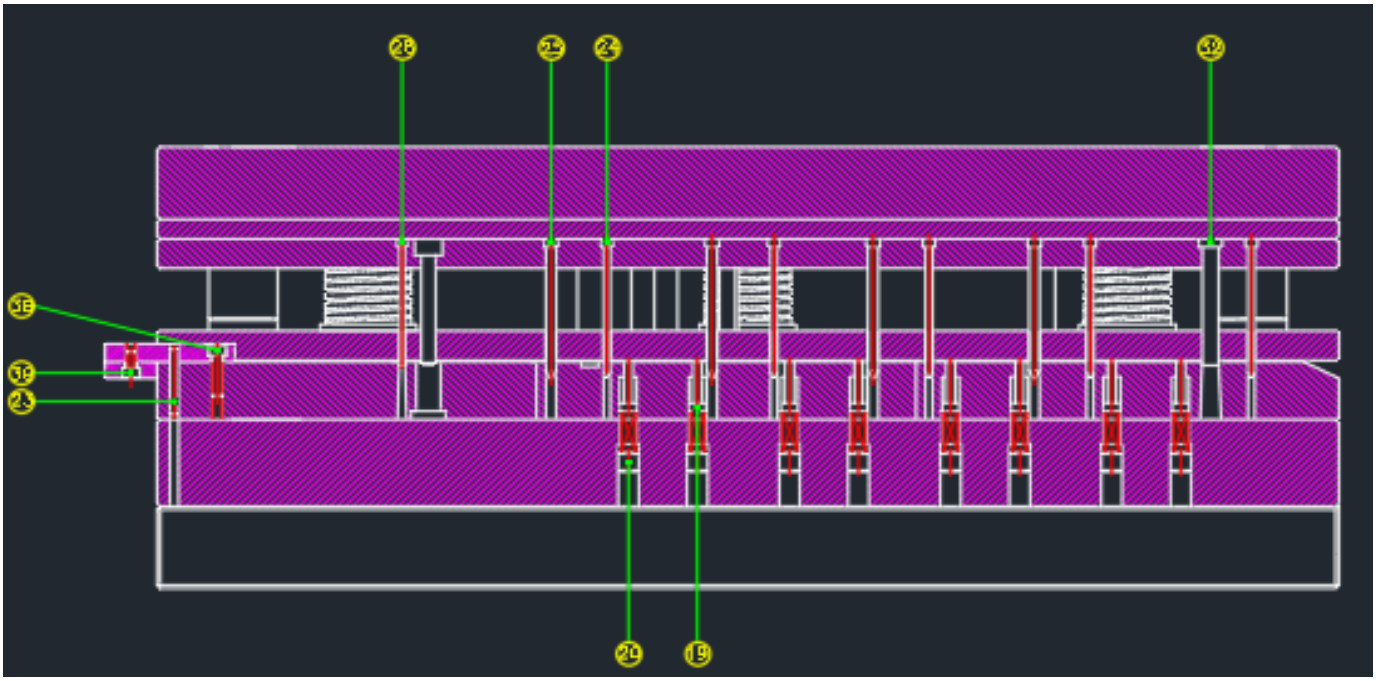

Fig -15: Final assembly of stapler die section C-C

8. CONCLUSION

This study applied to redesigned stapler body die. The new design of stapler body die makes the construction easy and can be manufacture in India. Feeder system enables the no chances of misleading and error of the pitch. Less material wastage, make the proper utilization of material and increases productivity.

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