Design and Manufacturing of Double End Drive (DED) Machine for Automation of Welding Process for Flexible Bellow in exhaust system.

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Abstract: Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the work-pieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld.
In industry, there are different geometrical shapes to which an operator has to weld. Each and every shape carries its own operational constraints. Circular welding is one of the most critical welding process carried out manually, especially when accuracy and uniformity is of high concern. A manual mode of circular welding carries so many disadvantages like lower accuracy and precision, high wire, gas and electricity wastage and frequent micro cracks. This gives rise to need of automation for circular welding. The bulkiness and complexity of circular welding due to the presence of different holding arrangements and fixtures makes it expensive and highly time consuming process. On the other hand, due to the complexity of the process, availability of skilled worker is difficult. Moreover, due to monotonous and high concentration job schedule, worker fatigue becomes high and hence it forces the tendency of worker to have high wages. To avoid these undesirable circumstances, the application demands import of automation for this circular welding process. Welding automation world-wide utilizes different pneumatic and hydro pneumatic instrumentation.

This paper aims to design double end drive (DED) machine for automation of welding process in exhaust system. Exhaust system consist assembly of bend pipe, flexible bellow and straight pipe (catcon). These bend pipe and straight pipe are weld with flexible bellow in middle. it has two circular locations on two faces of both pipe. These two points are located at two different locations in horizontal plane. To weld the pipe and bellow onto their respective locations, we have to design a SPM which must carry an automate drive for uniform and precise welding. This paper also illustrates role of automation, Automation is much helpful in cost saving and to increase the productivity of the system.

Index Terms - Design, SPM, Circular welding, Automation.

I. INTRODUCTION

1.1 Welding

"Welding is the process of joining together two pieces of metal so that bonding takes place at their original boundary surfaces". At the point when two sections to be consolidated are softened, warmth or weight or both are connected and with or without included metal for development of the metallic bond. With the regularly expanding interest for both high generation rates and high exactness, completely motorized or robotized welding forms have assumed a conspicuous position in the welding field. The rate at which computerization is being brought into the welding procedure is astounding and it might be normal that before this current century's over more robotized machines than men in welding manufacture units will be found. Also, computers assume a basic job in running the mechanized welding forms and the directions are given by the computer will be taken from the projects, which thusly, require calculations of the welding factors as scientific conditions. To make successful utilization of the mechanized frameworks it is fundamental that a high level of certainty is accomplished in anticipating the weld parameters to achieve the coveted mechanical quality in welded joints. To create scientific models to precisely anticipate the weld solidarity to be bolstered to the mechanized welding frameworks has turned out to be more fundamental.

1.2 Automation in welding

Automated welding can give substantial gains in efficiency and productivity - in the correct applications.

Welding is ostensibly the most unpredictable assembling process and is much of the time the slightest comprehended. An amazing number of organizations burn through a huge number of dollars to robotize gathering while at the same time overlooking the welding procedure. Manual welding is as yet the best procedure for some gatherings. Be that as it may, numerous constructing agents are actualizing computerized welding frameworks to expand quality, efficiency, and productivity.

Welding computerization can be separated into two fundamental classifications: self-loader and completely programmed. In self-loader welding, an administrator physically stacks the parts into the welding installation. A weld controller at that point keeps the welding procedure, the movement of the light, and stillness of the parts to preset parameters. After the weld is finished, the administrator expels the finished get together and the procedure starts once more.

In completely programmed welding, a custom machine, or arrangement of machines, stacks the work piece, lists the part or light into position, achieves the weld, screens the nature of the joint and empties the completed item. Extra "part set up" and last item quality checks may likewise be structured into the machine if fundamental. Contingent upon the activity, a machine administrator might be essential.

Few out of every odd welding task is a decent contender for computerized welding. Applications will profit most from mechanization if the quality or capacity of the weld is basic; if dull welds must be made on indistinguishable parts; or if the parts have amassed noteworthy incentive before welding. Brilliant contender for computerization incorporate batteries, capacitor jars, solenoids, sensors, transducers, metal howls, hand-off fenced in areas, light components, fuel channels, canteen carafes, restorative parts, atomic gadgets, pipe fittings, transformer centers, valve components and airbag segments. Organizations that gather constrained amounts of items requiring precise or basic welds may profit by a self-loader framework, yet would presumably not require completely computerized frameworks.

1.3. Problem Statement.

we need to weld two circular welding focuses on a vehicle part. The part is a pipe and bellow assembly get together of an exhaust pipe. It has two points on two appearances of the exhaust pipe. These two are situated at two distinct focuses in a horizontal plane. To weld the pipe and bellow onto their separate areas, we need to make a machine which must convey an automated drive for uniform and precise welding.

1.4. Objective

- Reduced errors.
- Cost savings.
- Greater productivity.
- Simple and smooth process.
- Uniform and precise welding.
- Reduction in inventory.
- Reduced labour requirement.
- Increased machine utilization.

II. INTRODUCTION TO FLEXIBLE BELLOW AND PIPE IN EXHAUST SYSTEM.

We need to design the double end drive(DED) machine for the circular welding process utilizing MIG welding for flexible bellow in the exhaust pipe framework, before this, we should have some fundamental data about the flexible bellow and exhaust pipe framework like its parts, of which material it is to be made, and so on. It comprises of 3 sections as, flexible bellow, bend pipe and straight pipe. There is two circular welding position.

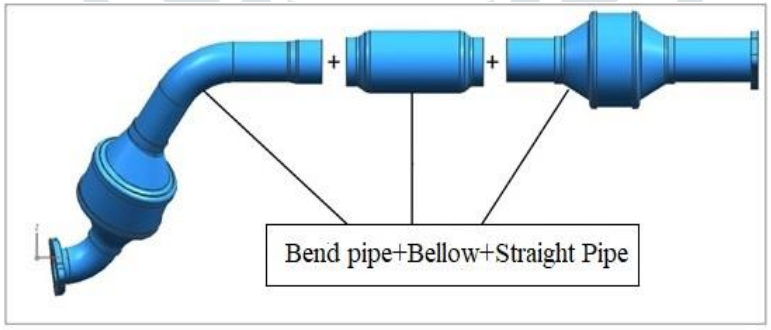

Fig No2.1. Exhaust assembly and its parts

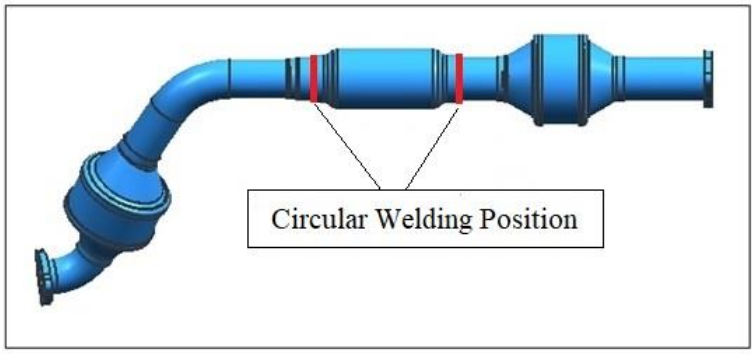

Fig No 2.2 Circular Welding position.

III. DOUBLE END DRIVE(DED) WELDING MACHINE.

As the figure demonstrates the double end drive (DED) welding machine. This machine is extraordinarily structured for this segment to deliver large-scale manufacturing.

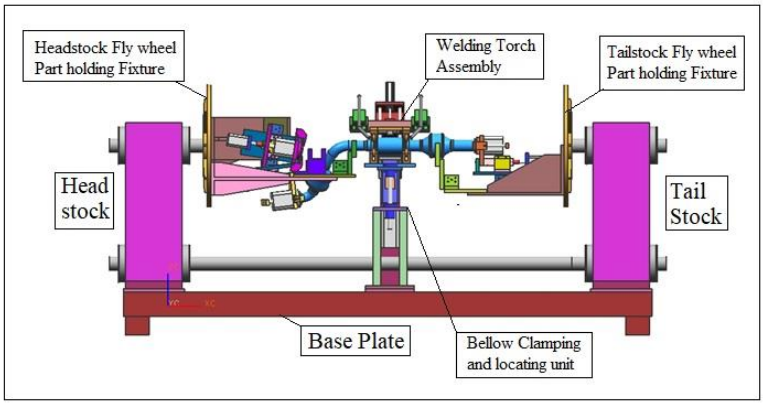

Fig No.3.1 double end drive(DED) welding machine.

Double end drive(DED) welding machine. Welding Machine consists of various manufactured and standard parts. Their construction and working, with its function, are as follows.

3.1 Head Stock

It is basically variable speed drive unit. It consists of a box, which is fabricated out of MS plates & dully stress relieved & machined; houses an in two bearings & geared motor.

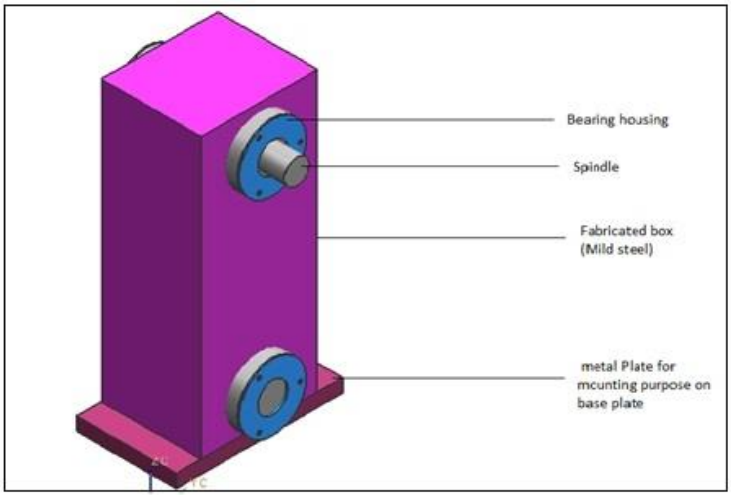

Fig No.3.2 Head Stock.

The motor is coupled to the gearbox by means of a coupling. The power transmission of a motor is done belt drive; Speed variation is achieved by PLC control. For providing welding current return path without the same arrangement passing through the bearings

& avoiding twisting of the cables, a special earthing arrangement is provided. It consists of brush holders in which seats spring loaded carbon brushes which rest on a phosphor bronze ring mounted on the spindle shaft. In this assembly. Slip ring of twelve ways is provided for the supply of current to the read switch. This arrangement allows the current to pass smoothly to rotating electrical equipment. The common shaft is used in headstock to transmit the power supply from headstock to tailstock. Headstock consist Taper Roller Bearing, Bearing Housing, Slip Rings, Timing belt Shaft

3.2 Tail stock

It consists of a box, which is fabricated out of MS Plates & duly stress relived & machined; houses a spindle supported in two bearings & driven by the headstock mounted geared motor by means of a common shaft which is mounted at headstock end.

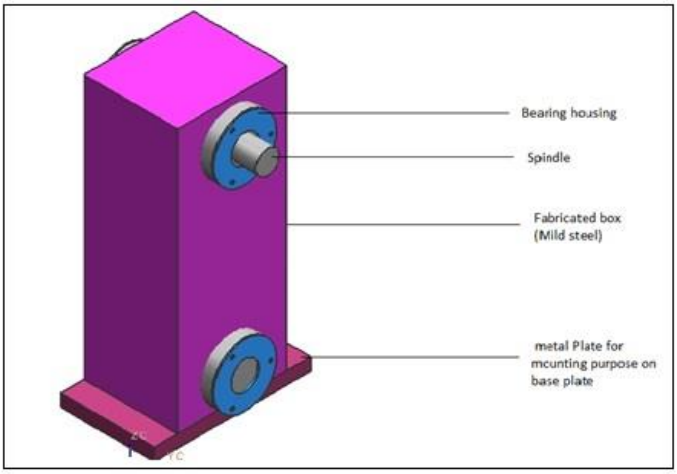

Fig No.3.3 Tail Stock

This center is aligned with the tailstock center; once the setting is achieved this is should be not disturbed, for the accurate position of the tailstock. In this assay. Slip ring of twelve ways is provided for the supply of current to the read switch.

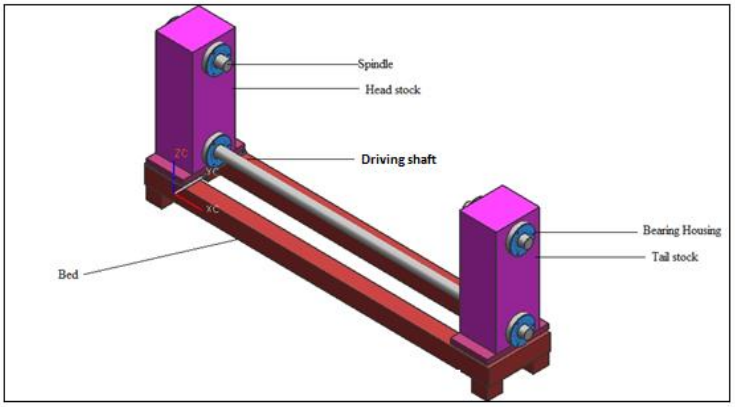

Fig No.3.4 Assembly of Headstock and Tailstock.

3.3 Head Stock Flywheel Part Holding Fixture.

In Double End Drive [DED] welding machine the flywheel is bolted on to the spindle of the headstock, so that it can sustain bearable load. The main advantage of the Bolting the flywheel to the spindle is that the parts can be readily disassembled if one of them is damaged or the parts have reached the end of their service life. The diameter of flywheel (Ø) is 650mm. As the Work piece rotates therefore it is important to locate the welding points for precise circular welding, therefore fixtures are used to ensure proper clamping of work piece. Figure shows the constructional details of the 'Head stock Flywheel Part Holding Fixture'

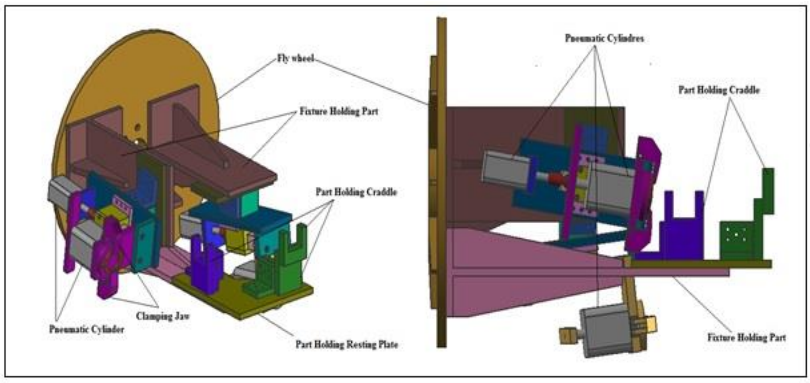

Fig No. 3.5 Head stock Flywheel Part Holding Fixture

Headstock Flywheel Part Holding Fixture consist of Fixture holding the part, Part holding resting plate, Part holding cradle, Pneumatic cylinder, Flywheel.

3.4 Tailstock Fly Wheel Part holding Fixture.

The construction and working of the tailstock flywheel part holding fixture are the same as that of the headstock part holding fixture. In Double End Drive [DED] welding machine the flywheel is bolted on to the spindle of the headstock so that it can sustain the bearable load. The main advantage of the Bolting the flywheel to the spindle is that the parts can be readily disassembled if one of them is damaged or the parts have reached the end of their service life. The diameter of flywheel (Ø) is 650mm. As the Work piece rotates, therefore, it is important to locate the welding points for precise circular welding, therefore fixtures are used to ensure proper clamping of a work piece. The figure shows the constructional details of the 'Tail stock Flywheel Part Holding Fixture'

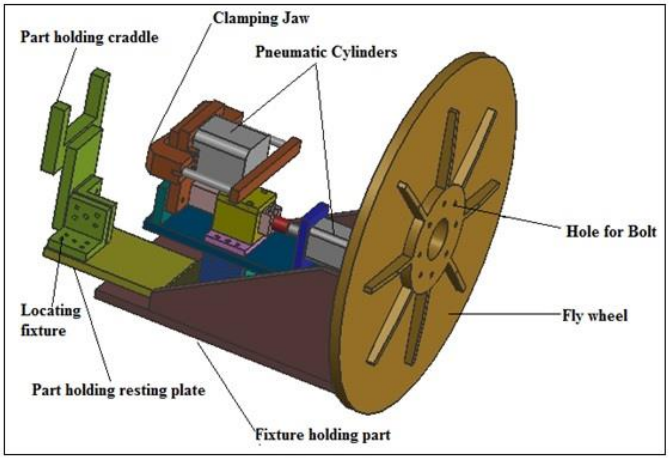

Fig No.3.6 Tailstock Fly Wheel Part holding Fixture.

3.5 Bellow Clamping and locating unit

To keep work-piece stationery, we have to use various jigs and fixtures. As well as, we have to do welding at two faces of a work piece so it's also important to locate the welding points; to facilitate this 'locking and clamping fixture' is provided. So we have to design one unit which will perform all these above functions. Figure shows the constructional details of the 'Bellow clamping and locating unit'.

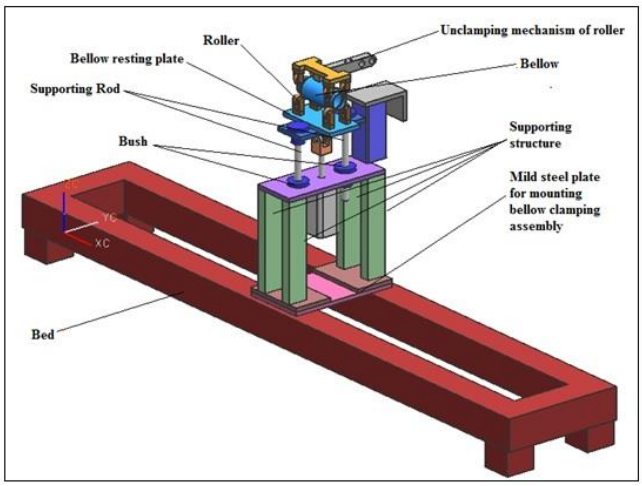

Fig No. 3.7 Bellow Clamping and locating unit.

3.6 Welding Torch Assembly.

This assembly is the core of the machine. It consists of a pneumatic cylinder connected to piston in the slot. Welding torch is mounted on the piston which is controlled by the cylinder when required. These components are then screwed to the base plate through a column also called as 'torch assembly column'

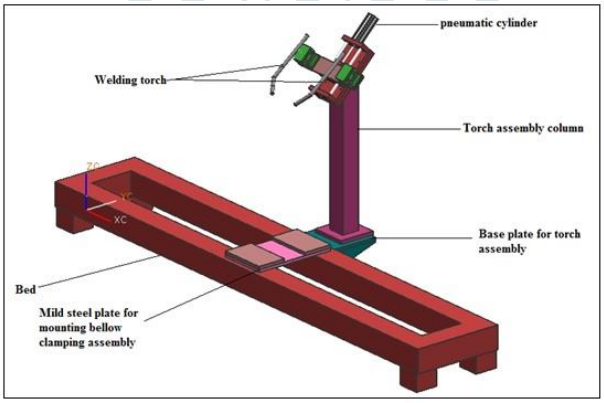

Fig No.3.8 Welding Torch Assembly.

When motor rotates, it gives movement to the geared motor and hence to the spindle mounted on taper roller bearings. This will tend to rotate the 'flywheel of headstock and tailstock' and it rotate the work piece holding fixture around the axis where there will be the bellow (work piece) mounted rigidly.

There are several overlaps and reverse functioning of the torch assembly. For those processes, mechanical support is being given. In this way, this assembly could weld the work piece in pre-defined manner with proper loadings on it.

IV. BILL OF MATERIAL

Table No. 4.1 Bill of Material

Sr.No.	Part Name	Material	Quantity	Remark
1	Base Plate(Whole structure)	M.S.	1	-
2	Center Plate for Bellow	M.S	1	-
3	Flange For Shaft.	M.S.	2	-
4	Geared motor	C50	1	BONFIGLIOLI
5	Flywheel	M.S.	2	-
6	Lock Nut.	M.S	4	-
7	Taper Roller Bearing	STD	6	-
8	Bearing Housing	M.S.	4	-
9	Bearing Flange	M.S.	1	-
10	Slip Rings	-	1	BOP
11	Ball bearing	STD	2	-
12	Boss for Fly Wheel.	M.S.	2	-
13	Bellow Resting Plate	M.S.	1	-
14	Bearing Cover	M.S	4	-
15	Star Washer	STD	4	-
16	Roller clamping assembly	M.S	1	-

17	Supporting structure	M.S	4	-
18	Bush	M.S	4	-
19	Supporting rod	M.S	2	-
20	Plate for bellow clamping	M.S	1	-
21	Part holding cradle	M.S	3	-
22	Locating fixture	M.S	1	-
23	Clamping jaw	M.S	2	-
24	Torch assembly column	M.S	1	-
25	Base plate for torch assembly	M.S	1	-

M.S.- Mild Steel.
BOP- Brought Out Part.
STD-Standard Part.

V. IMPLEMENTATION OF DOUBLE END DRIVE WELDING MACHINE

Manual Mode Operation Sequence

- The operator will select the fixture "Straight Pipe or Bend Pipe" through selector switch & set the pipe locator manually.
- The operator will press the button of JOB CLAMP / JOB LIFT.
- The operator will select machine mode TEST / WELD through selector Operator will press the button of Torch forward.
- The operator will select the machine rotation forward through a selector switch.
- Welding will start (If the machine is in weld mode) After completion of 01 rotations with overlap welding of torch machine & welding will stop on the spot.
- The operator will select the machine rotation reverse through selector switch; the machine will go back at home position.
- The operator will press the button of torch reverse torch assembly will go back at home position.
- in manual mode, the job counter will not count the job switch.

Auto Mode Operation Sequence

- Operator will select the fixture "Straight Pipe or Bend Pipe" through selector switch & set the pipe locator manually.
- Operator will press the button of JOB CLAPM / JOB LIFT.
- Operator will select machine mode TEST / WELD through selector switch.
- Operator will press the button of cycle start.
- Torch assembly will come forward; welding & torch rotation will start immediately. After completion of 1 rotation torch will rotate for 10 mm overlap welding, after completion of overlap welding torch will rotate to reverse for home position.
- If machine is in TEST mode welding will not done.
- After completion of Auto Cycle in WELD mode job counter will count the job automatically.

VI. CONCLUSION

The project aims at automation of circular welding which is successfully achieved in the form of 'Double End Drive [DED] welding Machine' with all desirable features a Double End Drive Welding carries.

Designs and dimensions obtained in the design cycle came to their supposed results, which leads to error-free welding cycle without susceptible failures. Quality improvement and a decrease in time consumption followed the objectives. Productivity increases to a great extent through this work.

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