

## Methodology of Special Purpose Spot Facing Machine

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### Abstract:

Special purpose machine are widely used for special kind of operations, which are not economical on conventional machines. It is design for getting higher accuracy at desired condition. Spot facing in industrial valve is followed by a mechanical drilling or milling process. After the initial hole is drilled recess is develop on the valve with the help of required tool material. This aim of this paper is to presents the concept of spot facing in industrial valve, identified problems in flanges during spot facing and propose concept for avoiding the same.

**Keywords:** Back spot facing operation, Special purpose machine, Spot facing, Industrial valve.

### 1. Introduction

Special Purpose Machines (SPM) is not available off the Shelf. It is also not covered in standard manufacturing programs. They are designed and Tailor Made as Per the customer's specific requirements. They are also Called as Bespoke Machines. The use of SPM minimizes the human errors, human fatigue in repetitive operation etc. and increases the productivity at desired level. It also assures the quality and interchange ability of parts.

It is either cam operated machine or they use Hydraulics and Pneumatics as Actuating Elements or combination of all the three of them Many times a dedicated Programmable Logic Controller is used in Conjunction with Positional Sensors and Transducers, to give Commands to the Actuating Elements. Sometimes different special motors like Stepper Motor and Servo Motors are used as Actuating Element. Special mechanisms, drives, gears etc may also be used. The productivity achieved after all these efforts is very high. However to Fetch the Fruits of these highly specialized machines the pre condition is that the input to the automatic machine must have strict quality control.

#### 1.1 Necessity Of The Back Spot Facing In The Valves:-

The back spot facing is needed in all flanges of the valves. It is provide the fittings for tightening the stud nuts or fasteners Back spot facing is so equally important like any other operation otherwise the stud nut can be fail during tightening or application of torque during the tightening of the stud nut. Here introduce the paper, and put a nomenclature if necessary, in a box with the same font size as the rest of the paper. The paragraphs continue from here and are only separated by headings, subheadings, images and formulae. The section headings are arranged by numbers, bold and 10 pt. Here follows further instructions for authors.

#### 1.2 Current Available Facility For Back Spot Facing

The shape and geometry of the valve body is very different than any other component. The shape of the side and top flanges are intricate and difficult to machining.. Presently back spot facing operation is the last process after all the other process is completed.

The radial drilling machine is the only option on which the back spot facing operation can perform. There are so many aspects involved in the actual operation, but currently there is no other option other than radial drilling machine. This is an unnatural type of operation on the Radial drilling machine, since the spindle moving towards upward direction means opposite to gravity. This results the vibration on spindle and increasing the chances of run out of spindle. Sometimes at the time of drilling operation the accuracy of the machine is totally out of control. Clamping of component encountered a problem in radial drilling machine because it required more time and if clamping is not done properly the chances of accident may occurred.

#### 1.3 Advantages And Disadvantages Of Current Facilities

Following are the advantages & disadvantages of the existing operation i.e. the back spot facing on the Radial drilling machine.

##### Advantages:-

- 1) No need of body indexing during spot facing of each drilled hole

- 2) Auto feed mechanism is available.
- 3) Any size can be spot face up to the capacity of the machine.

#### 1.4 Disadvantages:-

- a) Rigid clamping required for the work piece.
- b) Special type of tooling attachment is required like socket as per the machines Morse taper.
- c) Tool clamping is difficult, since it is operating in opposite direction of the spindle.
- d) Tool changing time is much higher.
- e) No judgment of dimensions to be maintained, since it is very difficult to see the actual operation going on by operator.
- f) Special types of clamping devices are required to clamp the work piece.
- g) Skilled operator requires performing the desired operation.
- h) Cost per piece is very high.
- i) Other operation can delay due to this operation.
- j) Machine accuracy is affected very much due to this unconventional operation on this machine.
- k) Breakdown time is more.
- l) Tool breakage is very high since operator cannot see the condition of tool visually every time during operation.

## 2. Literature review:-

Many works have been done to carry out the various machining operations, for that special machine, tools, fixtures are invented. Some inventor had tried to carry out the spot facing operation by inventing special tool but very little inventor had tried to make special purpose machine for it. Burr et al. have worked on the back spot facing tool, A backspot facing tool includes a shaft and a cutting element. The shaft has a first and second end and a recess located near the first end. The shaft also includes an outer circumference and is centered on a first axis. The cutting element has an inner portion and an outer portion and is pivotally coupled to the shaft about a second axis.

The cutting element is movable between a closed position and an open position. Louis Belanger<sup>2</sup>, This invention relates to rotary cutting tools for use in a drill press milling machine or other spindle type machine tools. An object of the invention is to provide a tool for performing an internal, substantially blind machining operation accurately and with a minimum of time and effort. Further object of the invention is to provide a tool especially useful to readily perform a spotting or facing operation upon an inaccessible inner face of a wall or other element adjacent to an aperture through the wall. Stuart A. Cogsdill<sup>3</sup>, This invention relates to cutting tools and particularly to a cutting tool that will spotface or counterbore the back side of a workpiece around a bore extending there through Kenneth P. Chamberlain<sup>4</sup>, His invention relates to rubber lined pipe and to the preparation of joints therefore, and has for its object the provision of an improved cutting tool and a machine for counterboring the rubber lining at the end of the pipe, for example to receive a joint sealing member, his machine effects a rapid, clean cut of various kinds of rubber, especially the soft resilient rubber, and is notable for its effective counter boring of soft rubber which could not be counterbored heretofore.

Henry F. Swenson<sup>4</sup>, His invention pertains to a back spot facing tool whose cutting blade is pivotally mounted on a spindle body and is axially actuated by a plunger rod so as to be moved to either a cutting or a concealed condition in response to either a manual manipulation or to a hydraulic actuation of this rod. Arlan W. way, Terrence M. McCarver<sup>6</sup>, A spot facing mechanism employs a self centering chuck, a stationary mandrel and housing. Axial feed controls are also stationary when the apparatus is operational. Incremental radial feeding of the tool head is provided, with the degree of feed being adjustable between zero feed and maximum feed. radial feed rate adjustment controls remain stationary while the apparatus is operating, enabling adjustment of feed rate without having to stop the machine. Walter C. Bergstorm<sup>7</sup> His invention relates to new and useful improvements in countersinking and counterboring tools, An important object of the invention is the provision of construction for such tools which prevent chattering of the tool in use, provide precision smooth surfaces of the work, provide for more rapid ejection of the chips or shaving, and deburr the work.

## 3. Checklist of Information Useful in Investigation of Solution for Back Spot Facing

1. The spot facing on RD machine is a non conventional job, since the operation is reverse of the machine behaviour, so we need to develop the solution which is having parallel or same cutting action in the feed direction of the machine.

2. The mechanism which is suitable for the type of operation of spot facing.
3. Focus on some current available facility which is helpful to make some new economical and useful solution.
4. Selection of suitable drives for the mechanism like Belt drive, Chain drive and Gear drive. Also find the advantages and disadvantages of this drives.
5. Dimensional requirement, finishing requirement of spot facing and economy of the operation.
6. User friendly and low maintenance solution.
7. Properties of the materials which we have to cut or machine and cutting tools available for cutting these materials.

#### 4. Proposed Mechanism of the Spot Facing Machine

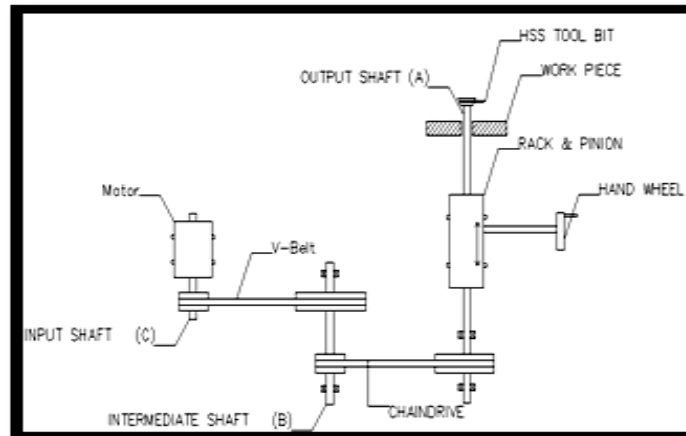


Fig. 1 Belt & Chain drive mechanism

- a) Belt drive mechanism
- b) Chain drive mechanism
- c) Gear drive mechanism

#### 4.1 Construction And Working Of Mechanism (1):-

##### Belt Drive:-

This system is used for back spot facing operation. It consists of smaller pulley, V belt, larger pulley, Worm and worm wheel gear box, Guide way for worm gear box, Rack and pinion arrangement, Hand wheel. A Belt is a looped strip of flexible material, used to mechanically link two or more rotating shafts they may be used as a source of motion, to efficiently transmit POWER, or to track relative movement. Belts are looped over pulleys. Power transmission is achieved by specially designed belts and pulleys. Belts run smoothly and with little noise, and cushion motor and bearings against load changes, but have less strength than gears or chains.

##### Advantages

- Cheap
- Allows misalignment (parallel shafts)
- Protects from overload
- Absorbs noise and vibrations
- Cushion load fluctuations
- Needs little maintenance
- High efficiency (90-98%, usually 95%).

##### Disadvantages

- Speed ratio is not constant (slip & stretch)
- Heat accumulation
- Speed limited – 2000 m/min,
- Power limited - 700 kW
- Endless belts needs special attention to install

**Chain Drive-**

Like any method of power transmission, chain drives have advantages and disadvantages. Advantages of chain will be discussed initially, and the note will conclude with a discussion of chain disadvantages.

**Advantages**

- Virtually any length chain can be obtained (splicing).
- Positive drive provides synchronization of two shafts (Synchronous belts such as Poly Chain® also possess this characteristic).
- Bearing loads are generally lower than for belts (no slack side tension).
- Chain drives are 95-99% efficient (Poly Chain is 98-99% efficient).
- Due to chain's symmetric design characteristics, serpentine drives are possible (serpentine drives are also possible using twin tooth synchronous belts).
- Chain drives seem to give the appearance that they will do the job - i.e., steel is tough.
- Chain offers higher HP capacities on smaller diameters.

**Disadvantages**

- Lubrication is critical - unlubricated drives can wear 300 times faster than lubricated drives (difficult to properly re-lube chain).
- The lubrication attracts dirt which leads to wear problems.
- Life is usually low since an estimated 90-95% of chain drives are improperly lubricated.
- Frequent maintenance is required due to wear and stretch.
- Chain drives are noisy (proportional to speed) due to metal-to-metal contact.
- Linear speed is limited to 3000 ft. /min. for roller chain.
- Vertical drives may present problems since less slack can be permitted than in a horizontal drive in order to insure proper chain/sprocket engagement.
- Equipment damage can result upon chain failure due to steel construction.
- Available only in full box length increments except in rare cases.

**Gear Drive Mechanism**

A gear is a rotating machine part having cut teeth, or cogs, which mesh with another toothed part in order to transmit torque. Two or more gears working in tandem are called a transmission and can produce a mechanical advantage through a gear ratio and thus may be considered a simple machine. Geared devices can change the speed, torque, and direction of a power source. The most common situation is for a gear to mesh with another gear; however a gear can also mesh a non-rotating toothed part, called a rack, thereby producing translation instead of rotation. In transmissions which offer multiple gear ratios, such as bicycles and cars, the term gear, as in first gear, refers to a gear ratio rather than an actual physical gear. The term is used to describe similar devices even when gear ratio is continuous rather than discrete, or when the device does not actually contain any gears, as in a continuously variable transmission.

**Advantages**

- Provide Positive Drive without slip.
- Suitable for high speed, high torque & high power transmission.
- Properly designed & properly maintained gear system can run over decades.
- Very high transmission ratio is practicable.
- Compact machine train in limited space.
- Due to rigid construction gives rigidity to mechanism.
- Drastic speed variation is possible without any major problem.
- Low maintenance cost.

**Disadvantages**

- Needs Proper Lubrication System.
- Which involve high cost.
- Require skilled technician to maintain.

#### 4.2 Construction And Working Of Mechanism (2)-

This system is also used for back spot facing. it consist of sun and planet gear mechanism, gear drive, variable frequency drive, lead screw, indexing table. By using this system we can spot face four hole of side flange of the valve by using four cutting tool at a time. Gear drive is used for power transmission.

**Working:** We can externally supply the power and speed from the motor to the gear drive mechanism. In gear drive mechanism there is sun and planet gear mechanism which is used for power transmission sun gear distributes power and speed to the planet gears which is used as a output power and output speed in this way we can done back spot facing operation on one side of flange of valve. After completion of back spot facing operation on one side we are apply same process for another side by providing rotary table indexing mechanism we can rotate table by 180 degree and done operation on another side of flange of valve.

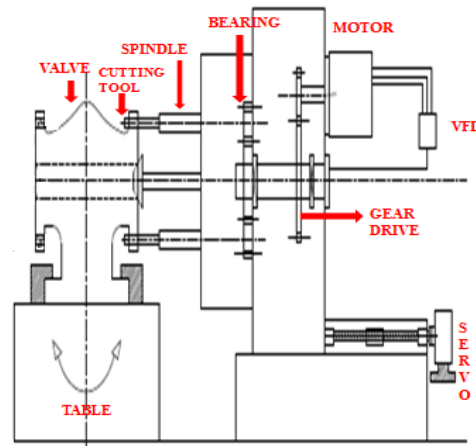


Fig.2. Sun and Planet Gear Mechanism

#### 5. Conclusion:-

In this paper discussed about the spot facing operation and methodology. In this suggesting two special purpose machines for back spot facing operation perform on the industrial valves. In existing process required more time for completion of operation of back spot facing as well as difficult to achieving to each back spot facing . This problems eliminating by providing dedicated back spot facing machine i.e providing special purpose machine.

Above suggesting mechanisms in facilitated to loading the valve in short time as well as unloading, easily performing operation on back side of flange of valve. This system also increase rate of production with accurated dimensions.

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