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Survey On Design of Hydraulic Press Machine

Design Of 30 Ton Capacity Press Machine *(paper subtitle)*

Janjal Rahul[1], Shikhare Sayali[2], Bobade Sudhir[3], Shinde Priyanka[4], Ghode Manoj[5]

[1]*Mechanical Department, GES R.H. Sapat College of Engineering*
[2]*Mechanical Department, GES R.H. Sapat College of Engineering*
[3]*Mechanical Department, GES R.H. Sapat College of Engineering*
[4]*Mechanical Department, GES R.H. Sapat College of Engineering*
[5]*Mechanical Department, GES R.H. Sapat College of Engineering*

Abstract — *The project is related to cycle time optimization for press operation of tip on massecuite pump rotor. Rotor is moving part of this pump, the tips that are inserted at the extreme ends gets wear out. Replacing a rotor is not economical thus tips that are inserted on the extremities of rotor which can be replaced. This inserting operation is carried out on 'Dowel Hydraulic Press'. The process is time consuming and need human efforts. As present the machine is manual operated and require human efforts so an automated is to be implemented.*

Keywords*- [Massecuite pump, Rotor Tip, Dowel Hydraulic Press, Automated setup, Jig]***

I. INTRODUCTION

Massecuite pumps are designed principally to handle high viscosity abrasive sugar products that contain sugar crystals such as Massecuite, Magma and Molasses. Rotary pump employs elliptical rotor rotating at a very slow speed in a circular casing. It is excellent for handling Magma/ Massecuite in the sugar and other highly viscous liquids like black liquor in the paper industries. The design ensures that the sugar crystals contained within the liquids are not damaged by the pumping action, and that the pump is subjected to minimum wear. A flap follows the surface of the rotor, scraped off the pumped medium and directs it up into discharge.

'Tips' are inserted on extreme ends of rotor, which gets wear out periodically. Thus the tips are replaced. This operation is carried out on "Dowel Hydraulic Press." It is manually operated. The hand levers are operated, which supply the fluid to cylinder of ram. This develops the force on ram thus the moves forward and key gets inserted. By operating the knob of cylinder pressure get released.

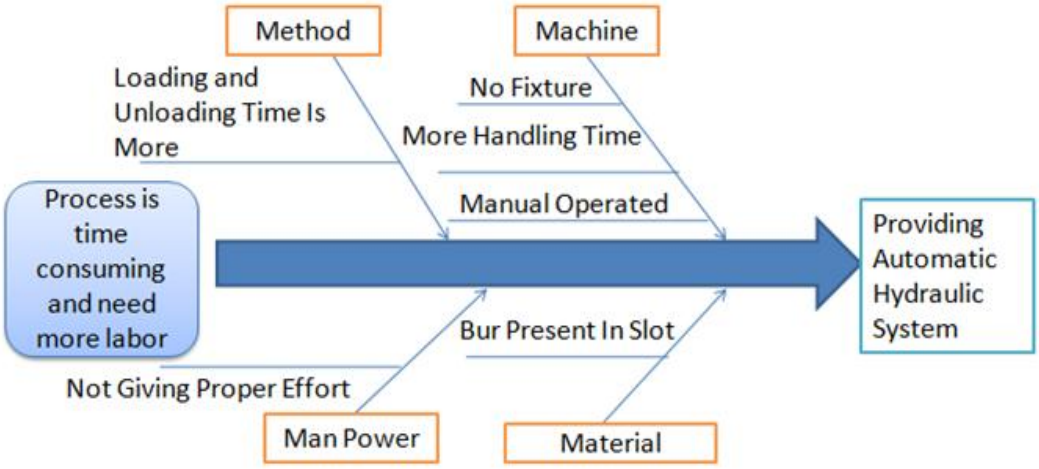
"***Figure 1. Dowel hydraullic press machine"***

A. Problem statement

The inserting operation is carried out on Dowel Hydraulic Press which is manually operated. Presently with manual setup more time and human effort is required for alignment purpose and to perform operation. So there

is need to develop a system which can help in improving the accuracy of operation, productivity and reduce the cycle time and human efforts.

B. Fish bone diagram



"***Figure 2. Fish bone analysis"***

C. Time study

The following table shows the sequence of operation to be performed on 'Dowel Hydraulic Press' and average time required for each operation.

Sr. No	Particulars	Time
1	Loading of Rotor on Bed	10 min
2	Adjusting of Rotor Below Ram	2 min
3	Operate Lever of Cylinder	12 min
4	Return Stroke of Ram	25 sec
5	Unloading of Rotor	7min
Total Time		31.25

"Table 1. Time Study"

By providing the automated hydraulic setup, reduce the time recquire for the operation and simultaneously reduces the human efforts.

D. Hydraulic system design calculation

Maximum Pressure Built Up:
For 30 Ton,
M=30 Ton=30000 kg

a) Force=M*g=30000*9.81

F=294300 N

b) Area of cylinder
Outer Diameter of Cylinder = D = 161 mm
Area of Cylinder=$\Pi/4*D^2$
$=\Pi/4*(0.161)^2$

$A=0.02035\ m^2$

c) Pressure=Force/Area
=294300/0.02035
=144.44*10^5N/m^2

Pressure =144 bar

1. Maximum Flow Rate or Discharge:
Total stroke length =190 mm
Distance travel in one stroke = 5 mm
Time required for fluid flow in one stroke=2 sec
Velocity=displacement/time
=0.005 /2
V =2.5*10^{-3}m/sec

Discharge=Area of Cylinder * Velocity
=0.02035*2.5*10^{-3}
= 5.0875 *$10^{-5}$$m^3$/sec

Discharge=3.05 lpm

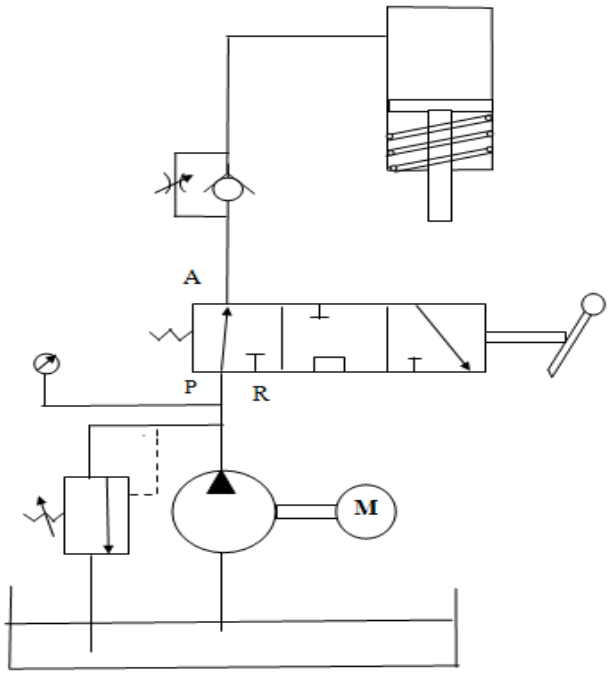
1. Displacement of Cylinder = Area * Stroke Length
= 0.02035 * 0.190
=3.866 * 10^{-3} m^3
=3.866 lit

2. Volume of cylinder = Area* Length of cylinder
= 0.2035 * 0.370
=7.52*10^{-3} m^3
=7.52 lit

3. Reservoir capacity = 3 * Volume of cylinder
= 3 * 7.52

Reservoir capacity = 22.56

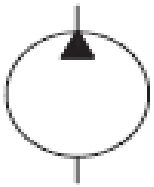
E. Hydraulic circuit



"***Figure 3. Hydraulic circuit***"

II COMPONENT SELECTION

A) Selection of Pump



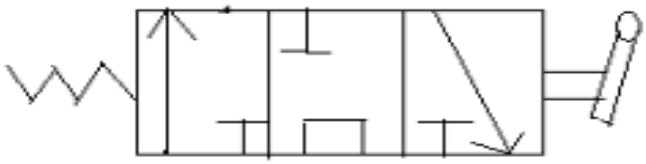
"Fig.4. Symbol of pump"

Model	Pressure (Bar)	Delivery (m^3/s)
P1	65	$12*10^{-3}$
P2	100	$2*10^{-3}$
P3	150	$6*10^{-3}$

"Table 2. Selection of the pump"

Pump P3 is selected
Pressure= 150 bar
Delivery= $6*10^{-3}$ m^3/s

B) Selection of DCV



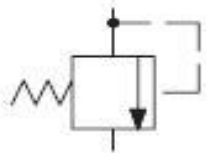
"Fig 4.3: 3/3 Direction Control Valve"

Model	Pressure (Bar)	Delivery (m^3/s)
D1	150	$12*10^{-3}$
D2	90	$2*10^{-3}$
D3	70	$6*10^{-3}$

"Table 3. Selection of the DCV"

DCV D1 is selected
Pressure=150 bar
Delivery= $12*10^{-3}$ m^3/s

C) Selection of Relief valve



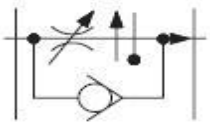
"Fig 5 Pressure relief valve"

Model	Pressure (Bar)	Delivery (lpm)
R1	100	12
R2	150	3
R3	105	6

"*Table 4. Selection of relief valve"*

Relief valve R2 is selected
Pressure =150bar
Delivery = 3 lpm

D) Selection of flow control valve



"Fig 6 Flow control valve"

Model	Pressure (Bar)	Flow Range (lpm)
F1	70	0-4.1
F2	105	0-4.9
F3	105	0-16.3
F4	70	0-24.6

"*Table 5.Selection of flow control valve"*

Flow control valve F1 is selected
Pressure = 70 bar
Flow Range = 0-4.1 lpm

E) Selection of reservoir

"Fig 7. Symbol for reservior"

Model	Capacity (lit)
T1	40
T2	100
T3	250
T4	400
T5	600

"***Table 6. Selection of reservior"***

Oil Reservoir T1 is selected
Capacity = 40 lit

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