IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)
e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 12, Issue 2 Ver. VI (Mar - Apr. 2015), PP 73-78
www.iosrjournals.org

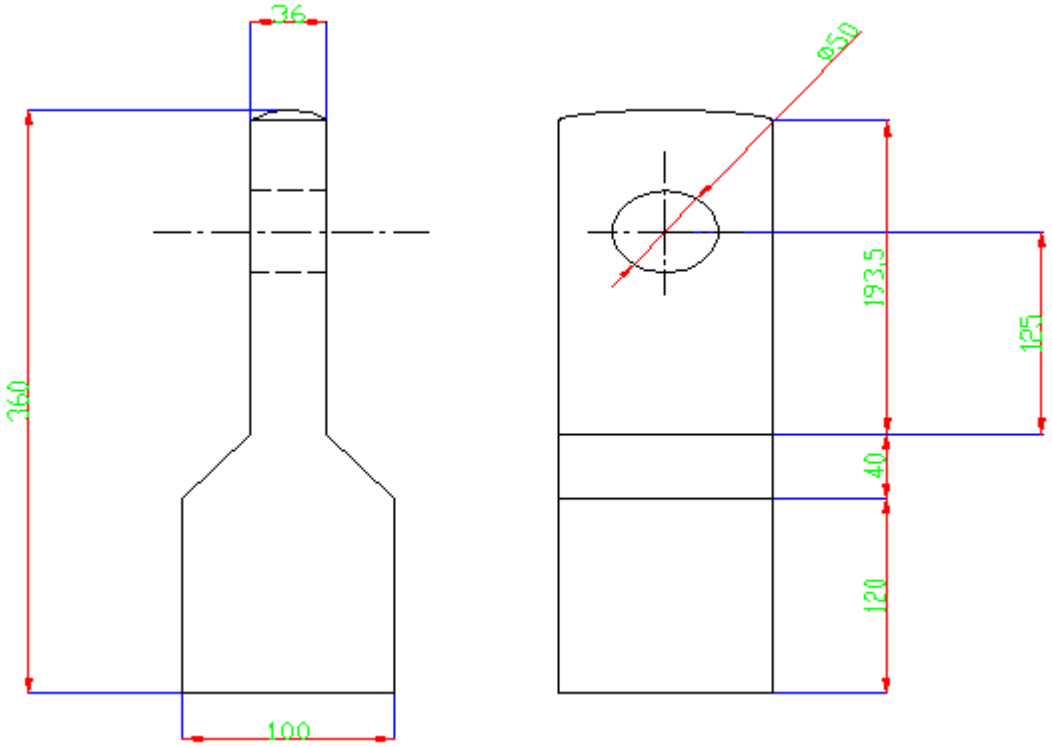
Life Improvement of Dolomite Crushing Hammers

[*]K.Prabhakar[1], P.Anand Kumar[2,] U.J.Surendra[3], C.Mohan Naidu [4]
[1]*Associate Professor in Mechanical engineering, MeRITS/ JNTUA, INDIA*
[2]*M.Tech II Year Mechanical engineering, Stanley Stephen College of Engineering & Technology / JNTUA, INDIA*
[3,4]*Associate Professor in Mechanical engineering, GATES/ JNTUA, INDIA*

Abstract: *In Sinter Plant, crushing of dolomite is carried out by crushing machine in which hammers are the main components. But these hammers are not giving expected life as they are breaking up at their neck portion and are wearing out fast. Though there are various factors affecting the failure we concentrate on two parameters which improve the life of the hammer considerably, they are forging and heat treatment processes. The main aim of our project is to improve the life of the bull head hammer by forging the head as well as shank portion. After forging heat treatment process is carried out. In this process the hammers are quenched in circulating water system.*

Keywords: *Foundry, blooms, strength, bull head hammer.*

I. Introduction



1. As per technical specification given in drawing, hammers may be tried by stamping
Heat treatment as per proposed cycle is difficult to achieve due to poor functioning valves, actuators Heat transfer rate is difficult to achieve in furnaces since there is no facility of considering time factor during heat treatment.
To control the heat treatment, pyrometer may be used for checking temp of different bullhead hammer at different areas of furnace. According to this measured temp, different burners of heat treatment furnace may be kept on or off so that uniform temp of each bull head hammer may be achieved as per proposed heat treatment cycle
2. Tempering furnace also has no facility to control the heat transfer rate and air cooling is not being done
3. Temperature control of hammers inside furnace is difficult to achieve uniformly.

4. Procurement of a heat treatment furnace which can be controlled automatically will reduce the problems related to heat treatment of bull head hammers
5. Magnetic test is not done. Quench cracks also during quenching of bull head hammers, magnetic testing may be done in order to avoid any quench cracks
6. Toughness testing is also not being done. Toughness is very important property in consideration of bull head hammer failure. If it is less it is more prone to failure. Right now there is no provision for checking of toughness for bull head hammers. Izod impact test/charpy test may be done on sample basis
7. Improper quench due to formation of water bubble. While doing quenching, it is proposed that quenching should be in up to max 100 mm in head area, but due to boiled water bubble formation length may goes up to high. So proper checking of stand dimension, proper height should also be maintained carefully
8. Range of hardness as per drawing is more. Presently it is 380-500BHN.Due to this high range some hammers may be of vary 380BHN and some of 500BHN this will lead to improper wear out.

Sinter plant has facing the problems with respect to bull head hammer.

1. Fracture ,Increase in down time of crushers ,Low production , High raw material cost
2. High production cost High maintenance cost Industrial relation problems Inter departmental relations
3. Customer satisfaction

I.1 Reasons

1. As per technical specification given in drawing, hammers may be tried by stamping

Heat treatment as per proposed cycle is difficult to achieve due to poor functioning valves, actuators Heat transfer rate is difficult to achieve in furnaces since there is no facility of considering time factor during heat treatment.

To control the heat treatment, pyrometer may be used for checking temp of different bullhead hammer at different areas of furnace. According to this measured temp, different burners of heat treatment furnace may be kept on or off so that uniform temp of each bull head hammer may be achieved as per proposed heat treatment cycle

2. Tempering furnace also has no facility to control the heat transfer rate and air cooling is not being done
3. Temperature control of hammers inside furnace is difficult to achieve uniformly. Procurement of a heat treatment furnace which can be controlled automatically will reduce the problems related to heat treatment of bull head hammers
4. Magnetic test is not done. Quench cracks also during quenching of bull head hammers, magnetic testing may be done in order to avoid any quench cracks
5. Toughness testing is also not being done. Toughness is very important property in consideration of bull head hammer failure. If it is less it is more prone to failure. Right now there is no provision for checking of toughness for bull head hammers. Izod impact test/charpy test may be done on sample basis

Suggestions

1. Due to not proper recirculation of water, in quench area steam layer forms, which resists further cooling and contact of water. So it is desired that proper recirculation of water may take place to perform proper quenching
2. Range of hardness as per drawing is 380 to 500 BHN. This large may lead to variation of properties of each and every bull head hammer. This range should be minimized in order to get uniform properties if each and every bull head hammer

II. Existing System

The raw material used for bull head hammer is 50crmo4, initially this raw material melts in steel melting shop and further this entire molten metal or steel will be continuously cast at the radically type continuous machine in continuous casting shop. The shape produced by that molten metal in continuous casting shop is a bloom. The cast blooms produced in structural machine shop and continuous casting shop do not find much application as much and are required to be shaped into products such as billets, rounds, squares, flats, angles, T-bars, channels, wire rod and reinforcement bars by rolling.

The billets produced in rolling mills will further cut into no. of pieces as per the dimension which is used o manufacturing the bull head hammer, further these cutting pieces will transported to forged shop at which these are forged.

Actually the bull head hammer consists of two portions one is head portion and other one is shank portion. We know that the entire metal piece before coming to the forge shop is rolled one. In forge shop they forged only shank portion and the head portion remaining same, i.e. it's a rolled one. After that this work piece will send to

central machine shop. In C.M.S the shank portion of the work piece will drilled as per the dimension and further it send to heat treatment process.

The processes involved in the heat treatment are annealing, hardening, tempering. Quenching is the process which will do after hardening; in this they are using static water system. After heat treatment this hammer will send to testing and after this will deliver to customer.

The entire processes required for bull head hammer to manufacturing, i.e. rolling, forging and heat treatment are explained clearly as following.

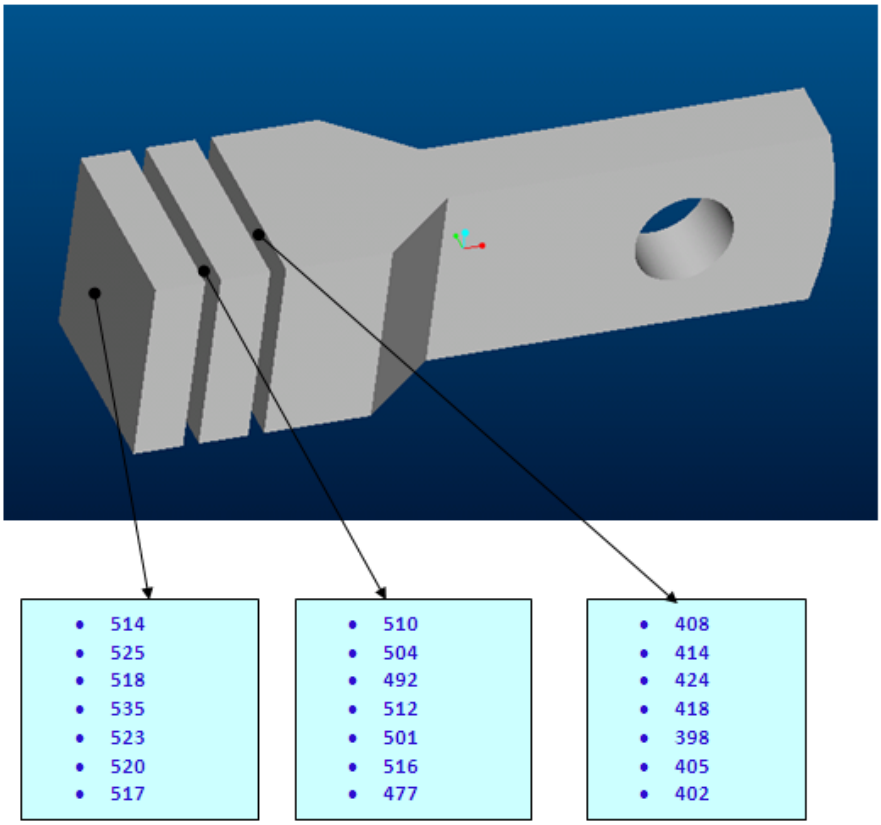
1 Rolling mill

1. As per technical specification given in drawing, hammers may be tried by stamping
2. Heat treatment as per proposed cycle is difficult to achieve due to poor functioning valves, actuators

Heat transfer rate is difficult to achieve in furnaces since there is no facility of considering time factor during heat treatment To control the heat treatment, pyrometer may be used for checking temp of different bullhead hammer at different areas of furnace According to this measured temp, different burners of heat treatment furnace may be kept on or off so that uniform temp of each bull head hammer may be achieved as per proposed heat treatment cycle Tempering furnace also has no facility to control the heat transfer rate and air cooling is not being done Temperature control of hammers inside furnace is difficult to achieve uniformly

3. Procurement of a heat treatment furnace which can be controlled automatically will reduce the problems related to heat treatment of bull head hammers
4. Magnetic test is not done. Quench cracks also during quenching of bull head hammers, magnetic testing may be done in order to avoid any quench cracks
5. Toughness is very important property in consideration of bull head hammer failure. If it is less it is more prone to failure. Right now there is no provision for checking of toughness of bull head hammers. Izod impact test/Charpy test may be done on sample basis
6. Improper quench due to formation of water bubble. While doing quenching, it is proposed that quenching should be in up to max 100 mm in head area, but due to boiled water bubble formation length may go up to high. So proper checking of stand dimension, proper height should also be maintained carefully
7. Range of hardness as per drawing is more. Presently it is 380-500BHN. Due to this high range some hammers may be of vary 380BHN and some of 500BHN this will lead to improper wear out

The following figure shows clearly hardness values at different sections of bull head hammer. These values are not in a uniform manner and they vary with respect to area. These values are gradually decreases from left to right portion of hammer as shown. So this may cause failure in between shank and head portion of the hammer. Due to this type of hardness may reduce the life of the hammer



All the values are in BHN

Fig2 Hardness values for the hammer at various points

III. Suggested System

Implemented system is almost same as existing system but in implemented system some slight changes had done for manufacturing the bull head hammer they are

1. In forge shop clearly mentioned above that in forge shop they are doing forging only on shank portion but in implemented system forging is done on both shank portion and head portion.
2. In existing system while doing quenching for bull head hammer in heat treatment they are using static water system but in implemented system the water system used for quenching are circulating instead of static system.

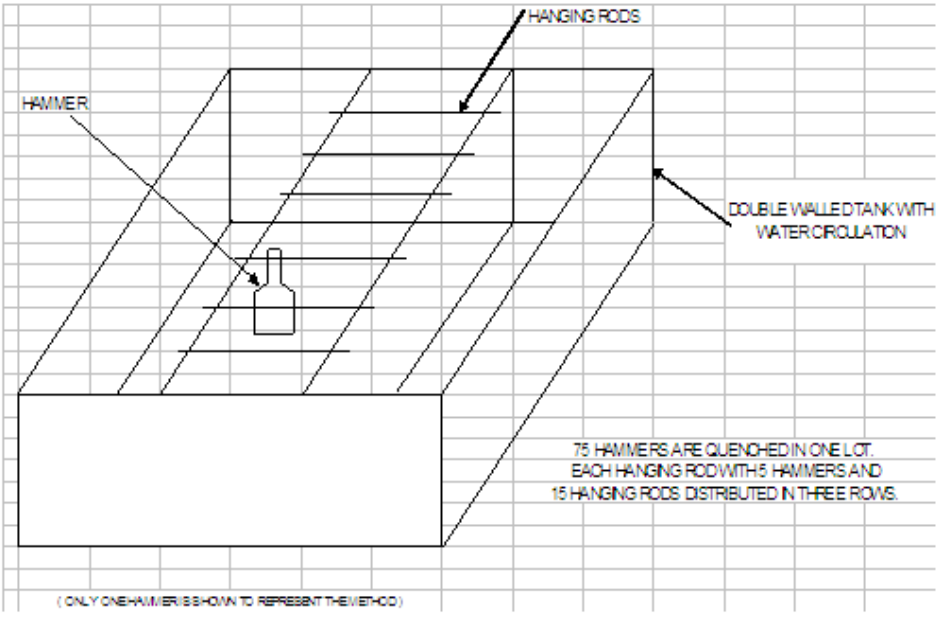


Fig3. circulating water system in quenching

3.2. Advantages

At present rolled billets are used to manufacture Bull head hammers whose performance is not satisfactory. As forged billets have following distinct advantages over rolled ones it is suggested to procure minimum heat quantity for trail.

Especially forging enhances the mechanical properties of metals and improves its structure when forged, the structure of metal changes in two diametrically opposite direction and becomes fibrous.

1. The formation of fibrous structure is characterized by the fact that, when a continuous cast bloom ingot of steel for instance, is forged, the liquation of segregation zones, gas bubbles, slag inclusion, etc, and at low temperatures the grains of steel (dendrites),are drawn out in the direction in which the metal flows

The structure of continuous cast bloom ingot changes from a Coarse grained to a fine-grained, because the crystal are crushed and pressed under the blows of hammer

2. Through the grains are already crushed to a certain extent during the rolling process, since the forging is done with heavy hammer blows it results in much fine grain structure. For this reason, the mechanical properties of forged metal are always higher than those of rolled metal.

When a bloom/ingot is forged its large crystals are destroyed and the metal is made denser or compressed. This results in the elimination of cavities, welding of bubbles etc. In the bloom/ingot whereas the rolled sections the crystal like structure of metal is only destroyed or crushed during the rolling process without getting denser

3. In rolling to transmit deformation energy from the work rolls to the work piece in a hot rolling operation, friction at their interfaces in the roll bite is necessary. "Excessive friction however tends to restrain the deformation and results in undesirably high rolling forces and spindle torques". But in forging there is no problem of friction, because that forging process does not depends upon friction
4. Invariably it is found that shrinkage cavity like pipe in bloom/ingot gets welded in forging during heavy hammer blows. Where in rolling, when 320*250 blooms is rolled to as smaller cross section as 5mm dia wire rod the pipe is still exists at the center. It clearly shows compactness of forged metal over rolled metal
5. Thus the characteristic of forged steel enhances the mechanical properties over rolled steel. It will result in higher impact strength; better wear resistance, longer life of hammers over rolled steel

Head portion of the bull head hammer is not forged at forge shop due to practical difficulties. Therefore forged billet will give advantage of complete forged structure in whole Hammer

From above specified points we can say that FORGING is better than ROLLING. The following figure shows clearly hardness values of hammer at different portions. These values indicate clearly they are marginally same at portions. So with this type hardness, life of hammer increases comparatively more.

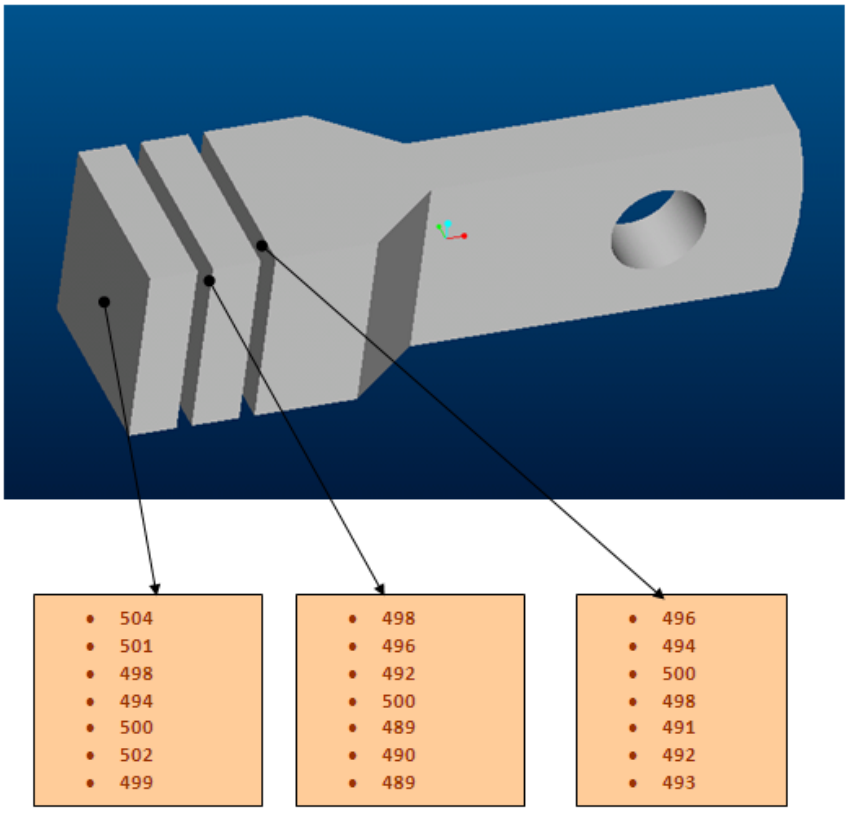


Fig 4. Hardness values for the hammer at various points

IV. Results

In February implemented The manufacturing process for three bull head hammers and their life is shown in the following table.
For the past six months

Table 1 Table showing life and cost analysis

S.No	Month	Year	Avg. life in Hours	No. of hammers	Avg. cost in Rupees
1.	August	2006	28.23	1076	32,28,000
2.	September	2006	27.43	1104	33,12,000
3.	October	2006	26.53	1144	34,35,000
4.	November	2006	25.58	1187	35,62,000
5.	December	2006	27.45	1104	33,12,000
6.	January	2007	30.27	1008	30,24,000

According to this system
1. Average life of each bull head hammer for past one year is in hours is 28.45.
2. Number of hammers used on an average for past one year is 12,569.
3. Average cost for total bull head hammers for past one year is in rupees is 3,77,07,000.

Table 2Table showing life analysis

Hammers	Life in Hours
1	40.27
2	39.57
3	40.18

Average life for three hammers is 40.01 hrs.
According to this system
1. Number of hammers used per month is 763
2. Cost investment on hammers per month is 22,89,000
3. Number of hammers used per year is 9156
4. Cost investment on hammers per year is 2,74,68,000

V. Conclusion

The life of Bull Head Hammer is increased
1. By doing forging instead of rolling on the head portion of hammer.
2. By using circulated water system instead of static water system in quenching.

Life of the Bull Head Hammer had successfully improved up to an average of 11 hours as compared to existing system. So that we saved nearly 27% of the actual amount spending on bull head hammers yearly. The life of Bull Head Hammer has improved up to 11hrs, this life will indirectly related to following parameters. Ideal time .If the life increases, automatically the ideal time of crushing machine becomes less.

Economy also related to life, per every month in VSP they are using around 1047 hammers, each hammer costs 3000Rs, so per every month they are spending nearly 31 Lakhs, yearly they are spending 3.77 Crores, in earlier days the life is nearly 29 hrs now it becomes as 40 hrs, so we saved 27% of actual amount yearly.

References

Journal Papers:
[1]. Journal of roman studies/volume104/November2014,pp28-50
Books:
[2]. .Production Technology- A. K. Jain. K. C. JAIN, A. K. CHITALE PHI Learning Pvt. Ltd., 29-Mar-2010 - Technology & Engineering
[3]. Material Science and Metallurgy- Kodgire. Everest publishing House
[4]. Strength of materials - Ramamrutham. Dhanpat Rai Publishing Company (p) Ltd (2011)
[5]. Production Technology - O. P. Khanna. Dhanpat Rai Publications