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STEM Kafr El-Sheikh

Ferro Pro

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جمهورية مصر العربية
وزارة التربية والتعليم

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Abstract

In the years since the 2011 revolution, the industrial sector has been put at the forefront of the government plans for economic growth. New industrial zones, substantive training programs and development plans along the Suez Canal corridor have all been committed to paper as part of a strategy to boost the manufacturing sector's contribution to economic output over the next decade. The proposals and initiatives are of considerable value, particularly given that Egypt's industries have had to face headwinds over the past few years, both globally and domestically. In the shorter term, industrial growth is likely to be constrained by electricity and dollar shortages, but we are working to address these issues and conditions should ease over the medium term. And with a market of 92m consumers and growing, Egypt is a natural fit for manufacturing processes, especially in steel manufacturing which is a prime base in Egypt industrialization which avails Egypt both economically and domestically and with the provision of the natural resources and raw materials, any enhancement like speeding up the rate of the procedure or providing a source of energy to the furnaces or diminishing the number of inoperative rolling machines will increase the efficiency of the process, thus will make Egypt from the leading countries in steel making in the world. This would clear the way for more robust industrial expansion, in turn, result in significant opportunities for growth of the industrial base over the next decade.

Introduction

As we know that Egypt has been suffering a lot of challenges that have caused Egypt to fall in the trap of poverty. One of these vital problems that we are going to find a solution for is to improve the industrial base in Egypt. Subsequently, we are going to work mainly in Steel Industry as it is an extremely profitable industry, has a high rate of exports in Egypt and from the industries that develop our beloved country.

Chart (1) Steel production

Industry is very crucial in improving our bad economical state. If we increased our production rate we will provide the basic needs for The Egyptian populations and we will export our products. Hence we will get the needed money to construct countrywide projects. We know that the first step of solving any challenge is to know the causes of these problems. As a result we identified the most imperative problems in steel industry and found that they are the poor technology used, besides the poor technical experiences. Therefore by researching, we found some errors in the mechanism and we are going to improve them.

First and foremost, the used velocity for the process was 10m/sec. But as we went to the factory we found that the motor has the capability to increase the velocity to 13m/sec. So as we increase the velocity we would increase the profit and the production which means it would provide us with millions of pounds. Secondly, the engineers make a 10 seconds time gap between each billet while in modern factories in Japan the time gap is only two seconds so by decreasing this 10 seconds gap to only 2 seconds we will increase the production thus we will increase the efficiency. Thirdly, we would improve the rolling machine to make the factory work for 1439 hours per two months as it is working only 1260 hours per two months therefore by increasing the production time the production rate would increase. As a final point, we are also going to save the money of the rolling machine as it is not going to be changed as the outer surface will be the only thing to be changed. All the numbers and equations needed to support our idea will be present in the analysis.

Materials

Fig.(1) UHU Glue | Fig.(2) Motor-Wheel | Fig.(3) Clay | Fig.(4) Power supply | Fig.(5) Servo | Fig.(6) Arduino | Fig.(7) Plastic zip tie | Fig.(8) Cork

Methods

- First, we made an Aluminum cylinder to act as a furnace and we made a path made of Cork joins between it and the rolls.
- We chose some wheels with motors to act as the rolling machines. Then, the stands that hold the rolls is made of cork.
- The wheels will be held by plastic zips so that it doesn't fall down.
- We made a path made of cork to join between the rolling machines and the cutting section which consists of an Arduino and some jumpers in addition to a blade to cut the bars made of clay.
- Finally, we used a power supply to supply the current needed and all prototype parts are fixed into a wooden plate so that it can have a stationary base.

Test Plan:

- We made a number of test. The first test was the measuring of the number of clay bars made before increasing the velocity from 2 bars To 3 bars after increasing the velocity.
- The second test was trying to decrease the time gap between each clay bar. So we decreased it from 10 seconds between each bar to 2 seconds.

We tried to decrease it approximately to the ratio we need.

- The last test was connecting the Arduino (computing system) to the blade and measure the ratio of the wastes due to the inaccurate cutting. By measuring the time needed to cut the bars which equals 3 seconds and subtracting the time taken by the blade to move down to cut the bar which equals 0.36 seconds approximately.

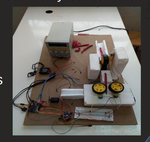


Fig.(9) Prototype Test plan

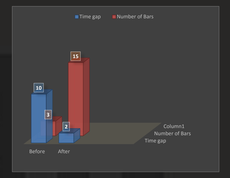
Results

All our tests will be on efficiency trying to improve it to increase the production rate and we will the tests on three things:

First: Time – Gab

After making the test plan, we got the results as follow: We chose to make duration of the process 30 seconds.

In the time gap test we measured the number of bars that result from the process when the time gap is 10 seconds. It took 30 seconds to produce 3 bars.

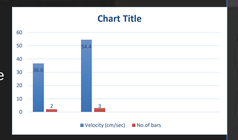


Chart(2) Time – Gab Graph

After decreasing the time gap between each bar to 2 seconds we found that during 30 seconds we can produce 15 bars as presented in the graph. Thus we decreased the production time, so we increased the efficiency.

Second: Velocity

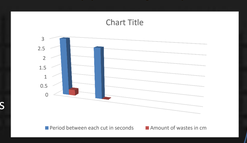
After making the test plan ,we found that the speed has a big effect on the production as when it was 36.6 cm/sec we produced 2 bars of clay each takes one second,
after increasing the speed by 30% as real life so the speed became 54.5 cm/sec we produced 3 bars of clay each one second. Therefore we increased the speed of the process so we increased the production rate .



Chart(3) Velocity Graph

Third: Auto cutting

We tested the accuracy of the cutter so we put a task for the cutter to cut a 12 cm bar of clay to 3 parts each one is 4 cm, we found that it takes 3 seconds between seconds to each cut to finish the task, there was an extra part of length 0.3 cm that makes the last part equal 3.4 cm that mean we wouldn't use it and get rid of it. so we changed the code and decreased the rate of time by rate of time by 0.3 second for each cut so we found that the task was finished in 8.1 seconds, and the length of each part was exactly 4 cm. Consequently, decreasing the number of the remains or wastes will increase the efficiency.



Chart(4) Cutting Graph

Analysis

Velocity:

Increasing the speed is one of our major advances in the mechanism of steel industry in Egypt. In most of the Egyptian factories the speed of the process was 10m/sec. By using this speed the factory was able to produce 47.5 ton per hour. But as we increased the speed we had the ability to produce 61.75 tons per hour which means that we produce 14 more tons per hour. Since the factory is working for 21 hours per day, this means that by increasing the speed we will produce more products than before. As a result, this will increase the efficiency in about 294 ton per day and 97020 ton per year as the factory works only for 330 days per year and the factory doesn't work for the other 35 days for maintenance. Since the cost of each ton is about 500 L.E then by multiplying 97020*500 we get 48,510,000 million pounds. This is the money that comes only from the enhancement without adding the money coming from the normal process.

Time – Gab:

The second improvement that we are going to do is by decreasing the time gap between each billet. In modern factories in Japan the time gap between each billet is only 2 seconds. In Egypt the time gap is 10 seconds. So we are going to decrease the time gap to only two seconds. When the speed of the process is 13m/sec after improvement we will produce 59 ton/ hour or in other words we will produce 78574 ton/year or we are going to produce 545160 billets per year. Moreover, as the cost of the ton is 500L.E so we will earn 39,287,000 L.E per year only from decreasing the time gap. The old way that was used produced only 438900 billets per year which means we added new 106260 billets to the annual production.

Rolling machine:

Rolling is a metal forming process in which metal stock is passed through one or more pairs of rolls to reduce the thickness and to make the thickness uniform.
As we are working with a billet of a temperature 1050 ^{0}c and a high friction force which cause the deformation of the rolls· shape. We searched for new material with high melting point and hardness to avoid the deformation of rolls that forces the factory to stop for 3 hours each day.

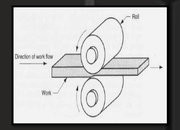


Fig.(10) Rolling mechanism

The third enhancement is using molybdenum as insulation layer; that will reduce the effect of friction and the temperature on the rolls, as it has a high melting point that equals 2,623 °C (4,753 °F) and Mohs hardness of 5.5, by this way we will extend the lifetime of the rolls as we will change it each one month. By this way we will save 3 hours each day, so we will extend the hours of work from 6930 hours to 708 hours annually that will allow us to produce 466572 tons per year in addition to our ability to save12000000 L.E the cost of the changing the rolls as we will change it each year, this layer will cost 4200000 L.E per year so the net profit will be 36800000 L.E

Fig.(11) Molybdenum

Fig.(12) Prototype

AUTC addition:

One of the most important improvements that we are going to do is to improve the cutting machines. We said before that the 6 meter billet is reshaped to make a 500 meter bar. This bar is cut down to small bars so that it can pass through the next process which is cooling in the cooling bed. The 500 meter bar is cut in 13 bars, each bar is 36.3 meters. These 0.3 meters are caused due to the bad time measurement of the cutting machine. When we did our measurements, we found that if we cut the bar accurately we would have a 12 meter bar per each billet. Furthermore, as we produce 545,160 billets per year thus we would have more 545,160 bars. As we measure the profit that we get with tons. The mass of each bar is 0.019 ton. Moreover, as we multiply the 545,160 (which is the number of bars that we would get from the improvement) by 0.019 which is the mass of each bar we would realize that we get 10358 ton per year. We would multiply 10,358 by 8000(COST OF EACH TON) we will get 82,864,000 L.E per year.

Laws we used in our calculations:

Mass of unit meter = Diameter^2/162

Linear velocity = pi(3.14)*Diameter*number of rotations

Measuring units.

Conclusion

The development of the country comes from its industrial progress, our solution improves steel industry in Egypt, so our exports will increase that leads to elevation of our national income. The increase of speed of the factory from 10m/s to 13m/s will increase our production as we will be able to produce about 97020 tons per year, so we will make about 48,510,000 million pounds each year. The second improvement is decreasing the time gap between each billet, as we will decrease the time gap from 10 seconds to 2 seconds which will allow us to work with 545160 billet per year instead of 438900 billet per year, this improvement allows us to add more 106260 billets per year, this will give us more 39,287,000 L.E. the third improvement is working with the rolling machines, as we will put an isolating layer made of molybdenum on the rolls to increase its life time from 6930 hours to 7908 hours annually. This layer will cost 4200000 L.E per year but its profit will equal 36800000 L.E after subtracting the cost of the material and adding the cost of the rolling machine as we that won't change it. The fourth improvement is making a computing system that will measure the length of each bar accurately and cut it at distance 36 meter instead of 36.3 meter by this way we will save 12 m bar from each billet, so we will get 10358 ton per year without paying any additional money so as a result we will make 82,864,000 L.E per year. By gathering all the incomes, our solution will allow us to have 182,400,000 L.E annually after spending money in all other requirements as the electricity, water ,natural gas and workers' wages. This is very effective during Egypt's bad economical state.

Recommendation

If anybody is going to work ink steel industry, we highly recommend you to provide a renewable source of energy for furnaces, after a few researches we made, we are suggesting working on geothermal energy because once water or steam is used; it can be pumped back into the ground. It is also clean energy. Geothermal power plants, unlike plants that burn fossil fuels, do not produce greenhouse gases that can be harmful to the atmosphere. Geothermal energy is easy on the local environment because the power plants do not require the clearing of large areas of land, damming of rivers or mining like other energy sources and inexpensive at all.
Another suggestion you can work on, is the enhancement of furnace itself. You can substitute the traditional furnace and make a new one using two electrodes with nickel chrome coiled around them and with heat energy produced by the high resistance of nickel chrome which will reach 1250 C (the needed temperature for melting the iron), that will eliminate the greenhouse effects produced by the natural gas for the traditional furnace and supply it with a 12.4 M geothermal plant in Hammam faroun in Egypt.

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