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Design and Fabrication of Tandem Drive Human Power Flywheel Motor for Application of Seed Oil Extraction

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Abstract: ***The biggest Aim of This Paper Design and Fabrication of Human power flywheel motor (HPFM) is to get maximum energy with minimum amount of your time. Tandem drive means double pedal in machine. The main component of this machine is hopper, chain sprocket, shaft, flywheel, pedal, freewheel, gear, The machine is very simple and comfortable, it can be easily operated either male or female. The machine is economically viable and it often is operated skilled and unskilled people. In India most of people suffering from electricity. So overcome this problem our group select HPFM, which operated manually. In today scenario farmers need electricity in the agricultural areas. Our team works on HPFM for application of seed oil extraction. This energy uses so many applications like water purification, seed oil extraction, Bio-ethanol plant (ethanol made from rise, made ethanol from waste material). The agricultural products are oil-seeds (cotton, castor, sunflower, etc), nuts (coconut, groundnut, shea-nut, etc), oil made from sunflowers and fruits (oil palm).***

Keywords: HPFM, Flywheel, Shaft, Gear, Seed Oil.

I. INTRODUCTION

In today developing world so many challenges ahead of humans like electricity, unemployment, loss in farming etc. in today scenario farmers need electricity in the agricultural areas, Our team work on HPFM for application of seed oil extraction. This energy use so many applications like water purification, seed oil extraction, Bio-ethanol plant (ethanol made from rise, made ethanol from waste material). The agricultural products are oil-seeds (cotton, castor, sunflower, etc), nuts (coconut, groundnut, shea-nut, etc), oil made from sunflowers and fruits (oil palm). It is simple that extraction of oil from the seed, nuts, sunflowers. This machine is simple and comfortable, low cost, easy to operate either male or female, easy to operate unskilled and semiskilled peoples. This machine use farmer and people business point of view.

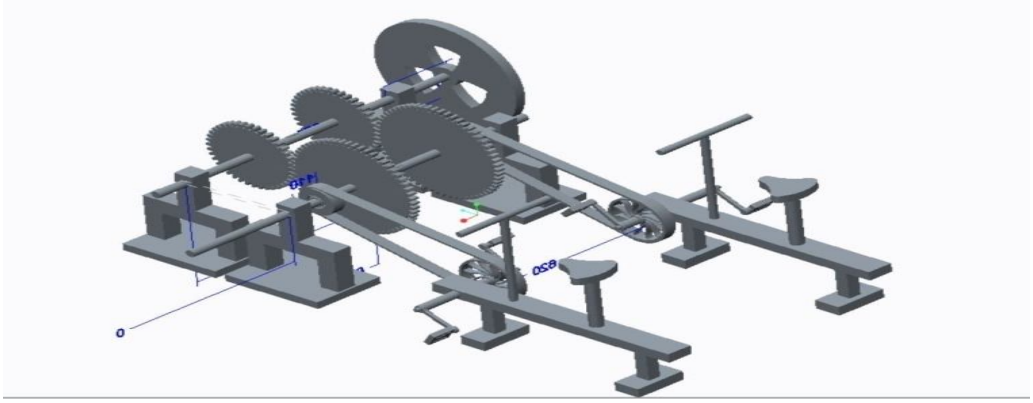

Fig - 1 CAD model of tandem drive human power flywheel motor

The Main Problem In India there is no electricity in Rural, Semi-rural and agricultural areas thats Why poor People, farmers Faces Big Problems And income of farmers and poor people does not grow. Death Of Farmers Is Maximum. People are going to leave the villages and migrate the city. our team work on HPFM machine. This machine work to generate electricity by manually. The maximum output of this machine is 13 HP. When You Pedal Machine Chain Sprocket Is Connected To Shaft. In This shaft Rotating Gear Pinion Arrangement Connected To Another Rotating Shaft And Flywheel Mount On It. This Rotating Flywheel Rotational Energy Stored On It.

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This Rotational Energy Converted Into Electrical Energy. This energy use application of seed oil extraction firstly the inputs i.e. the seed are fed to the machine through the hopper. Then seed come in contact with the two members, one is semicircular net and another is roll shaft. Semicircular net be a stationary member while the roll shaft is rotating member. When the seed comes in contact with these two members then the shearing action takes place here. Due to shearing action (crushing) the seed gets shelled and extract oil.

You can locate this machine in rural, semirural, urban, agricultural areas. If you have use this machine to purify water then locate in pond, river, drain. But our team use this machine in agricultural area because of extraction of seed oil. The seeds that come out of farmers farm, that seed will take in the HPFM machine and oil come out this machine use farmers in our agricultural farm and rectify our all problems.

II. DESIGN AND ANALYSIS

A. Design of Flywheel

Fig - Reference by Google images

Where, E = kinetic energy of flywheel in (Joule)
I = moment of inertia (kg m^2)
ω = angular velocity (rad/s)
k = constant inertial - depend on shape of flywheel
m = mass of flywheel (kg)
r = radius (m)

Thickness of the rim= 0.06, width of the rim= 0.08

Density = 7200 kg/m^3

$E= 1/2\ I\ \omega^2$

$I=mk^2$

$m=0.06*0.08*2\ \pi*0.5*7200$

m=108.58 kg

K=D/2=1/2=0.5m,

I= 27.14 kgm^2

For N=2000 rpm

$\omega =2\pi N/60 =2\pi*2000/60$

ω =209.46 rad/sec

$E=0.5*27.14*(209.46)^2$

E=595363.28 Joule

Power=E/60 =9922.72 J/sec

Power= 9922.72

Power=12.9 HP

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For N=1200 rpm
ω = 2πN/60
ω = 125.68 rad/sec
E= 0.5*27.14*(125.68)^2
E= 214344.42 Joule
Power= 3572.40 J/sec
Power= 4.64 HP

For N=1500 rpm
ω =157.1 rad/sec
E= 0.5*27.14*(157.1)^2
E= 334913.16 Joule
Power= 5581.88 J/sec
Power= 7.25 HP

B. Design of Shaft

Fig : Reference by Google images

For 1200 rpm

Where, N= speed of the shaft in rpm
T= twisting moment in N-mm
J= polar moment of inertia for solid shaft

τ = shear stress
Power= (2*pi*N*T)/60
Power= 3572.40 watt

N= 1200 rpm
T=60×P2π×N

T= 28420 N-mm

T= $\tau \times r/j$
J= pi/32*d^4
r= d/2
τ = Sut/FOS = 91.75

d= 14.6 mm

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For 1500 rpm
Power= 5581.88 watt
T= 35530 N-mm

d= 15.8mm

For 2000 rpm
Power= 9922.72 watt
T= 47.37 N-mm

d= 17.4 mm

C. Design of Gear

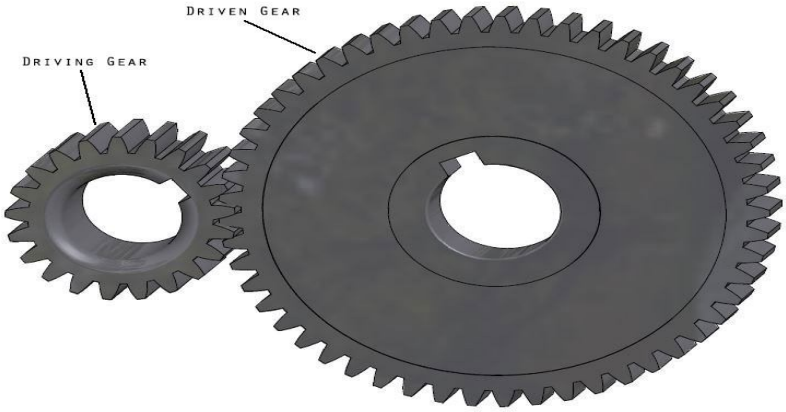


Fig - Reference by Google images (http://thereviewstories.com)

For N= 2000 rpm
Power= 9.92272 KW
N = Pinion =2000 rpm
Velocity Ratio = 8
Static Stress = σ_V =120 Mpa
Static Stress = σ_V =100 Mpa
Pinion Teeth = 20
Face width =14m
y= 0.154 -0.192/20
y = 0.1084

Given,
P= 9.92272 KW = 9922.72 watt
N = 2000 rpm
V.R. = TG/TP =8
σop = 120 Mpa = 120 N/mm^2
σog = 100 Mpa = 100 N/mm^2
T_P = 20
b = 14m

m= module in mm

D_P = diameter of pitch circle pinion in mm

Pitch Line Velocity

$V = \pi * D_P * N/60 = \pi * m * T_P * N/60$

$= \pi * m * 20 * 2000/60$

$V = 2.0946 * m$ m/s

The service factor (Cs) is given in table

Tangential tooth load

$W_T = P/V * Cs$

$W_T = 9922.72/2.09466\ m * 1$

$W_T = 4737.1506/m$ N

Velocity Factor

$C_V = 3/3+V = 3/3+2.09466m$

$C_V = 0.5888m$

Tooth from Factor (Pinion)

$Y_P = 0.154 – 0.912/20$

$Y_P = 0.1084$

Tooth from Factor (Gear)

$Y_G = 0.154 – 0.912/ T_G$

$= 0.154 - 0.912/8*20$

$Y_G = 0.1483$

$\sigma op * Y_P = 120 * 0.1084$

$= 13.008$

$\sigma og * Y_G = 100 * 0.1483$

$= 14.83$

$\sigma op * Y_P < \sigma og * Y_G$

Pinion is weaker

Using Lewis equation to the pinion

$W_T = \sigma wp * b * \pi * m * Y_P$

$= (\sigma op * C_V) * \pi * m * Y_P$

$4737.1506/m = 120\ (3/3+2.09466\ m)*14m * \pi*m*0.1084$

$3+2.09466m = 0.04512\ m^3$

Solving this equation by hit and trial method

m= 7.44 mm

m= 8 mm

Face width

b= 14 m = 14*8 mm

b = 112 mm

Pitch Circle Diameter of pinion

$D_P = m * T_P$

$= 8*20$

D_P = 160 mm

Pitch Circle diameter of gear

$D_G = m * T_G = 8*160$

D_G = 1280 mm

N = 1200 rpm

V = 1.2568*m m/s

W_T = 2842.45/m N

Velocity factor,

C_V = 0.7047m

Y_P = 0.1084

Y_G = 0.1483

Using Levis equation,

m = 2.65 mm

m = 2 mm

Face width (b) = 28 mm

Pitch circle diameter for pinion

D_P = 40 mm

Pitch circle diameter for gear

D_G = 320 mm

N = 1500 rpm

V= 1.571*m m/s

W_T = 3553.07/m N

Velocity Factor,

C_V = 0.6563m

Y_P = 0.1084

Y_G = 0.1483

3+1.571 m = 0.4831 m^3

m = 3.076 mm

m = 4 mm

Face width (b) = 56 mm

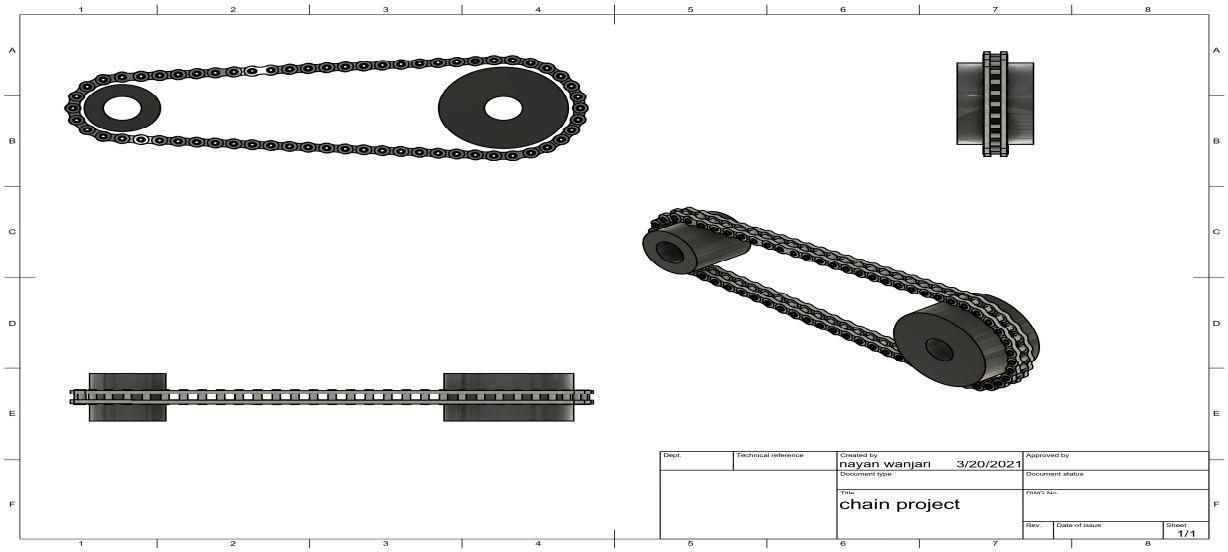
Pitch circle diameter for pinion

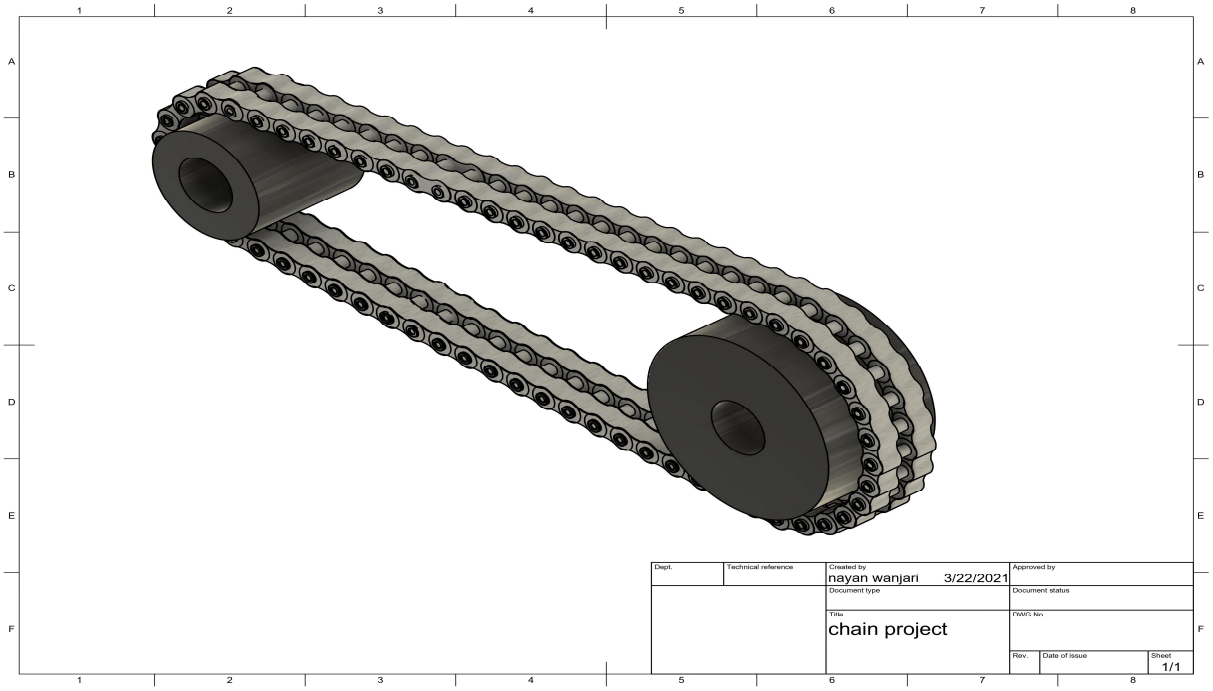
D_P = 80 mm

Pitch circle diameter for gear

D_G = 640 mm

D. Design of Chain





Module = 8 mm
T_P = 20
T_G = 160
D_P = 160 mm

Pitch of the chain,
D_P = P cosec (180/20)
160 = P cosec (180/20)
P = 25.02mm

Therefore, the minima centre distance between the smaller and bigger sprockets should be 30 to 50 times the pitch.
Therefore,
Centre distance between the sprockets = 30 P = 30 × 25.02 = 750.6 =~ 751 mm
In order to accommodate initial slag within the chain .
The value of centre distance is decrease by 215 mm.
X = 751 – 3 = 748 mm

Therefore,
Number of chain links,
K = T1 + T2 / 2 + 2x / P + [T2 – T1 / 2π]2 × T / x
= 20 + 160 / 2 + 2 × 748 / 25.02 + [160 – 20 / 2π]2 × 25.02 / 748

K = 166.30
K = 167 mm
Link of chain,
L = P × K
= 25.02 × 167
= 4178.34 mm

L = 4.178 m

Pitch line velocity of small sprocket,

$V1 = \pi \, dp \, N / 60 = \pi \times 160 \times 2000 / 60$

V1 = 16.755

Find the value of torque

T_{mean} = total area/ 2π

= (1/2 * b*h) + (½ *b*h)

= (1/2 *6*10.4) + (½ *6*1.7)/ 2π

= 5.77*20

T_{mean} = 115 N-m

Sr.no/Ang	d	F	θ	Fcosθ	r	T
1	0°	240N	0	0	0	0
2	30°	240N	60	240cos60°	0.18	21.6N-M
3	60°	240N	30	240cos30°	0.18	37.41N-M
4	90°	240N	90	0	0.18	43.2N-M
5	120°	240N	30	240cos30°	0.18	207.84N-M
6	150°	240N	60	240cos60°	0.18	21.6N-M
7	180°	240N	90	0	0.18	0
8	210°	240N	120	240cos120°	0.18	-21.6N-M
9	240°	240N	150	240cos150°	0.18	-37.41N-M
10	270°	240N	270	0	0.18	-43.2N-M
11	300°	240N	150	240cos300°	0.18	-37.41N-M
12	330°	240N	240	240cos330°	0.18	-21.6N-M

Table-1 - Pedalling force at 30° each (Thesis Design of Human Powered Vehicle by Ashwin Kubde and Guided by G. D. Mehta. as a reference.

III. LITERATURE REVIEW

A. Dr. R. A. Kubde, Shahajad Khan, Swapnil Bodade, Showbuddinmulla, Roshan Ughade, Shubham Lonkar, Vitthal Bangar(2017)

Design and fabrication of manually operative wood working machine.

In this paper we are studied mainly for small wood factory, The machine operated by human peddling so no any other extra energy it's needed. Power required for pedalling is above the capacity of an average healthy human being. But with the Help of pulley we supply the more power this is used to increase the communication with workpiece which is away from the machine us multipurpose machine makes the machining operation like grinding and wooden cutting operation etc. Very easy without electricity. In this machine one alternator is attached to flywheel which transmits to mechanical power into electrical power.

B. M. P. Mohurle , D. S. Deshmukh, P. D. Patil (2016)

Human power Using Bicycle Mechanism as an Alternative Energy sources -A Critical Review

In This paper importance of human power as an alternative energy sources is investigated, to present state and its future scope. In bicycle technology operator uses mostly pedal to operate machine and transmits power through crank, chain and freewheel to the working unit. In the paper, a method of harnessing the power of children play in playground and public places, on devices such as seesaw, marry-go-round and swing is proposed Owing to the linear dependence of energy with IG, the generated, current can be used as a measured of the energy produced by the system.

C. D. Mohammed Rafi, Mr.B.Raja kumar, G.S.R. Nagamalleswar A ram(2016)
Design and development of gear box for multipurpose Milling Machine (5 pm)
The concept of purpose of a gear reduction system is to convert input an speed and torque into a different output speed and torque. This paper is a partial ful fillment to the present market needs to understand the variation in machine design accessories. The progress in non-linear dynamics of gear driven system is received, especially the gear dynamic behaviour by considering the backlash and time-varying mesh stiffness of teeth. The method of introducing the frictional torque between teeth into the dynamic equation is given in his paper.

D. Prof. Vivek padole laxminarayan m. Patorkar
Design and fabrication of pedal operated thresher machine.
In this paper we learn the process of machine less bulky and the ergonomic consideration in the design would allow for its comfortable use for it can easily be operated by either male or female. The thresher can help to sub substantial reduce the human labour involved in threshing at an affordable cost 8e also reduces the time used for threshing operation on small farms.

E. S. G. Bahaley, Dr. A. U. Awate, S. V. Saharkar (2012) :
Performance analysis of pedal power multipurpose machine
In this paper we learn process of the conventional energy sources are being source, so alternative energy sources are found which must be cheap. Easily available and must satisfy the technical requirements. This system of pedalling will act as a health exercise and also during a useful work. A healthy male can only reliable maintain the high power range. This energy needs by method will be great way to improve human health in busy life.

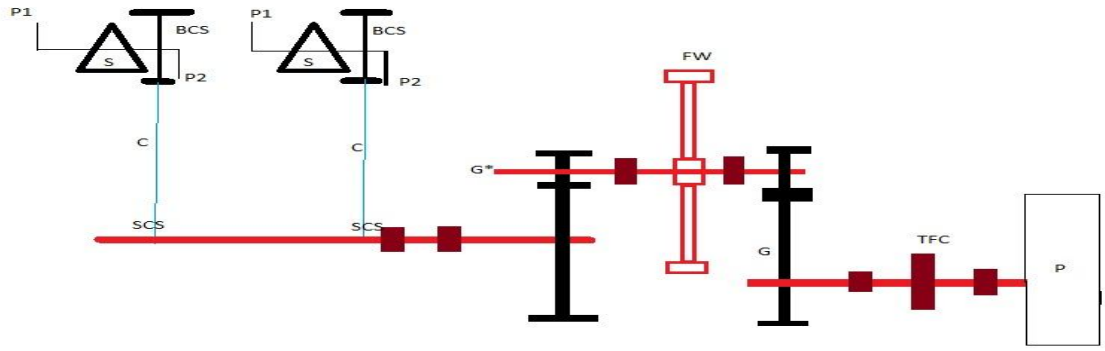
F. Gaurang Bhatawadekar, Budye Salman, Nilesh Chiplunkar, Swapnil Devrukhakar, Singh Akashdup(2015)
Design and fabrication of pedal powered washing machine.
As we know HPFM machine can be used in various applications. In this experiment the human power is utilizing for washing machine. This machine is developed because of the lack of electrical energy in rural as well as urban areas. This machine doesn't require power supply or diesel supply and it is portable as it is low in weight. This experiment works on the principle of rotating impeller by peddling and cause to washing cloth. The outlet grey water from machine can be recycled for filling toilet tanks or for watering plants.

G. P. B. Khope, j. P. Modak(2013)
Design of experimental set up for establishing empirical relationship for chaff cutter energized by human powered flywheel motor
In this research paper we learn the process of system for pumping using muscular energy in the flywheel is feasible and then the energy stored in flywheel can used for different application. The design of experimental set up for carrying out the experimental ion to establish empirical relationship for chaff cutter energized by human power flywheel motor.This human energy out put is in the low range and the process could be operated intermittently can be considered for utilization.

H. A. D. Dhole, J. P. Modak (September 2012
Formulation of experimental data based model for oil press using human power flywheel motor as energy sources.
For extraction of oil from the oil seed we use electric power but from this experimental research we can also use the human power for this extraction. As in rural areas, especially in Maharashtra (India) there are 10 to 12 hours load shedding of electricity hence this experimental research is very useful to farmers small scale entrepreneurs in rural areas to enhancement of technology for low profile farmers in view of human power mechanization of agriculture operation.

I. K. S. Zakiuddin, H. V. Sondawale, J. P. Modak (March 2012)
Human power an earliest source of energy and it's efficient use.
The concept of paper is the importance of human power from the earliest times to the present and it's future scope. For development of industries we use the natural fuels as a source hence now we need to come with alternate source of energy, i. e., non conventional energy. There are many applications of this machine such as domestic use, commercial and industrial use, agricultural use, transportation, electrical generator, physical fitness etc.

IV. WORKING PRINCIPLE



When You Pedal Machine Chain Sprocket Is Connected To Shaft. In this shaft Rotating Gear Pinion Arrangement Connected to Another Rotating Shaft and Flywheel Mount On it, This Rotating Flywheel Rotational Energy Stored On It. This Rotational Energy Converted Into Electrical Energy. This energy use application of seed oil extraction. The agricultural products are oil-seeds (cotton, castor, sunflower, etc), nuts (coconut, groundnut, sheanut, etc), oil made from sunflowers and fruits (oil palm). It is simple that extraction of oil from the seed, nuts, sunflowers Firstly the inputs i.e. the seed are fed to the machine through the hopper. The seed are available contact with the 2 members, one is semicircular net and another is roll shaft. Semicircular net be a stationary member while the roll shaft is rotating member. When the seed comes in contact with these two members then the shearing action takes place here. Due to shearing action (crushing) the seed gets shelled and extract oil. . This machine is simple and comfortable, low cost, easy to operate either male or female, easy to operate unskilled and semiskilled peoples. This machine use farmer and peoples business point of view.

V. CONCLUSIONS

A. The HPFM is study and design model is formed for different variables or values similarly find the value of power, shaft diameter, module of gear, diameter of gear and pinion.

B. By using HPFM design model determine the values of machine parts for various different rpm that's 1200 rpm, 1500 rpm and 2000 rpm.

C. The utmost power output for 2000 rpm is 12.9 hp.

D. Module of gear is 8 for 2000 rpm is

VI. ACKNOWLEDGMENT

We are thankful to the project guide Prof. hemant baitule sir for their valuable guidance and encouragement carrying out this project work. We are also thankful to Dr. J.P Modak sir and G.D Mehta sir.

REFERENCES

[1] Dr. R. A. Kubde, shahajad khan, swapnil bodade, showbuddinmulla, roshan ughade, shubham lonkar, vitthal bangar, "Design and fabrication of manually operative wood working machine" , international journal for research in applied science and engineering technology (volume 5 issue IV) 2017

[2] M. P. Mohurle , D. S. Deshmukh, P. D. Patil, "Human power Using Bicycle Mechanism as an Alternative Energy sources" , international conference on global trends in engineering , technology and management (ISSN 2231-5381) (2016)

[3] D. Mohammed Rafi, Mr.B.Raja kumar, G.S.R. Nagamalleswar A ram, "Design and development of gear box for multi-praposed Milling Machine" , ANVESHANAS INTERNATIONAL JOURNAL OF RESEARCH IN ENGINEERING AND APPLIED SCIENCE (volume 1, ISSUE12) (2016)

[4] Prof. Vivek padole laxminarayan m. Patorkar, "Design and fabrication of pedal operated thresher machine" , IOSR Journal of engineering (ISSN[e]2250-3021 , ISSN[P] 2278-8719)

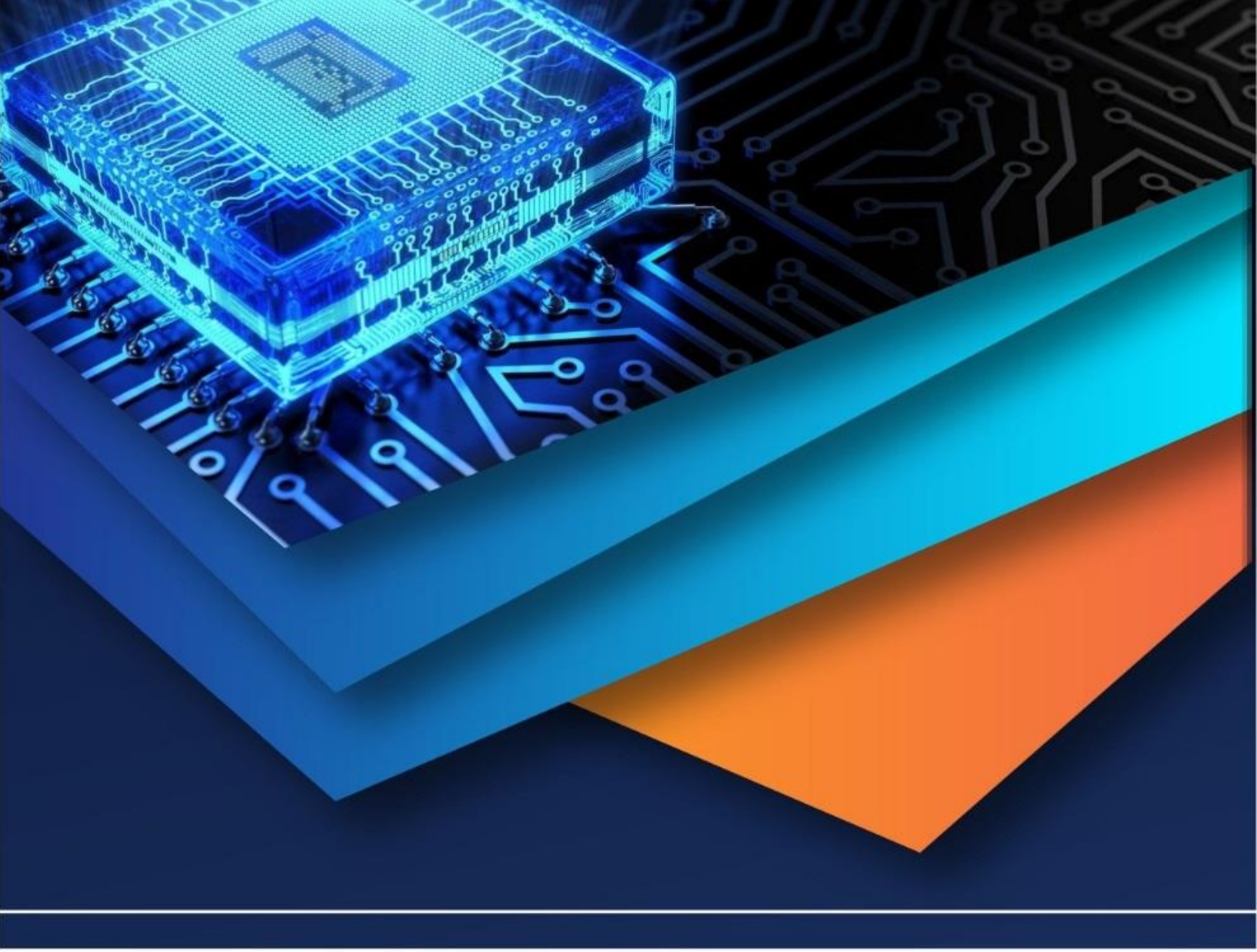
[5] S. G. Bahaley, Dr. A. U. Awate, S. V. Saharkar, "Performance analysis of pedal power multi-purpose machine" , international journal of engineering research and technology (volume 1 issue 5) (2012)

[6] Gaurang bhatawadekar, budye salman, nilesh chiplunkar, swapnil devrukhakar, singh akashdup, "Design and fabrication of pedal powered washing machine" , international journal of engineering research and general science (volume 3, issue 1, ISSN 2091-2730) (2015)

[7] P. B. Khope, j. P. Modak , "Design of experimental set up for establishing empirical relationship for chaff cutter energized by human powered flywheel motor" , international journal of agricultural technology (volume 9[4]:779-791) (2013)

[8] A. D. Dhole, J. P. Modak, "Design of experimental set up for establishing empirical relationship for chaff cutter energized by human powered flywheel motor" , Agric Eng lnt CIGR Journal (volume 14) (2012)

[9] k. S. Zakiuddin, H. V. Sondawale, J. P. Modak, "Human power an earliest source of energy and it's efficient use"



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