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A Hydraulic Mechanism Which Works Like an Engine

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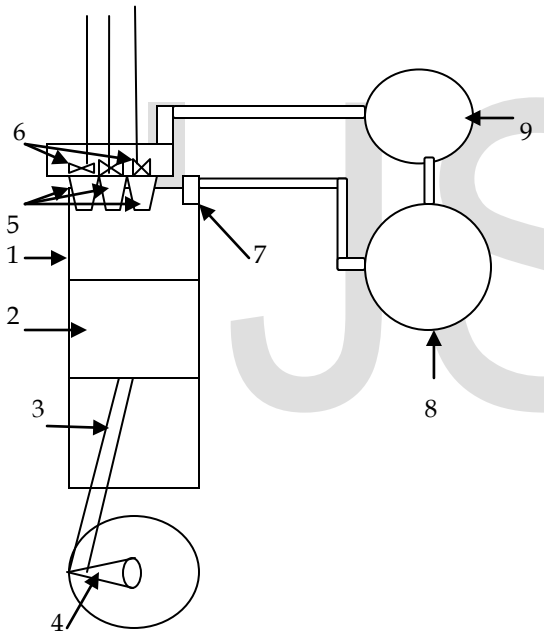
Abstract— Heat Energy produces during the combustion in engine & then it converts into mechanical work. But the exhaust gasses which contain (CO,CO_2, NO_x etc) are the main cause of air pollution. In this mechanism thrust of water jet is responsible for the reciprocation of piston. Like conventional I.C Engine this mechanism does not have several strokes like suction, compression, power & exhaust. In this case water comes through nozzle with high kinetic energy during suction stroke and send back to reserve during delivery stroke.

Index Terms— Nozzle, One-way Valve, Distributor, Thrust of Jet.

1 Introduction

THIS mechanism consists of cylinder, piston, connecting rod, crank, crank shaft like conventional engine and nozzles, pump, butterfly valve as accessories parts. Mechanism with different components are given bellow-



In given Fig- 1 (1- Cylinder, 2- piston, 3- Connecting Rod,
4- Crank, 5- Inlet valves (nozzles), 6- Butterfly valve,
7- Delivery valve, 8- Storage tank, 9- Pump)

2. Important Parts of The Mechanism

2.1 Cylinder

Like conventional engine this mechanism also has a cylinder. Cylinder should be made with those materials which has non corrosive effect against water like

2.2 Piston

This mechanism also has a piston where water will produce a high amount of thrust. The piston should make with those metals which can withstand high thrust of water jet & non corrosive to water.

2.3 Connecting Rod

This mechanism has a connecting rod which converts reciprocating motion of piston into revolution in crank shaft.

2.4 Inlet Valves (Nozzles)

Inlet valves are provided through which water jet can enter into the cylinder. Inlet valves are shaped like nozzles so that water jets can enter with high kinetic energy & apply high thrust on piston head. Number of nozzles depends upon the required output. Butterfly valves are provided at the entrance of the nozzles which control amount of water entering into the cylinder. These valves are operates by the accelerator of the mechanism o. One way valves are provided at the entrance of the nozzles which are open only in the direction of water jet during suction stroke & during the return stroke they remain closed.

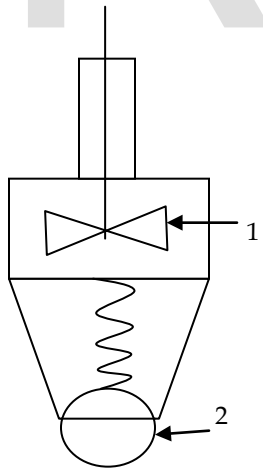


Fig- 2(Represents a nozzle along with butterfly valve (1) & one way valve (2))

2.5 Delivery Valve

Delivery valve/valves are provided to deliver water into the storage tank during the return stroke. One way valve mechanisms are also provided in delivery valves to allow them to open in the direction of delivery water. Number of delivery valves depends upon the number of nozzles used.

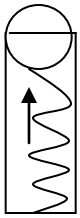


Fig- 3(Represents a delivery valve along with one way valve mechanism)

2.6 Water Circulating Pump

Water circulating pump is use to circulate water during suction stroke. Pump is run by electrical power produce by a dynamo (which takes power from crank shaft). But initially power should supply from battery to start the mechanism.

3 Working Principle

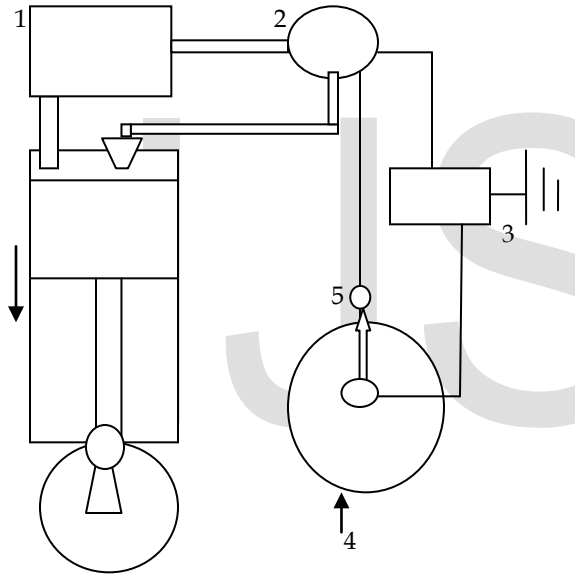


Fig – 4(1- Storage tank, 2- Pump, 3- Battery, 4- Distributor, 5- Lob of distributer)

Distributer is used to supply electricity to the circulating pump according to requirement. Distributer should rotate with the equal r.p.m of the crank-shaft. Initially when the piston is at TDC the arm of the distributer should touch the lob to connect the circuit (shown in fig-4). At that time circulating pump will start. So the water will circulate with the help of pump. When the circulating water passes through nozzles produces a high amount of thrust on the piston head. So the piston will start to move downward (TDC to BDC) & the distributer arm starts to rotate in clock-wise direction with the same r.p.m of the crank-shaft. When the piston is at BDC, the distributer completes half revolution.

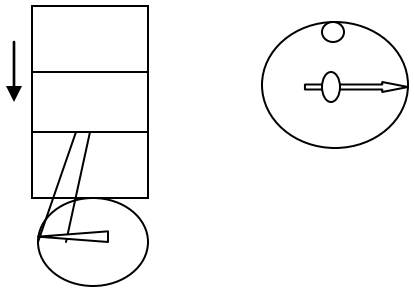


Fig- 5(a)

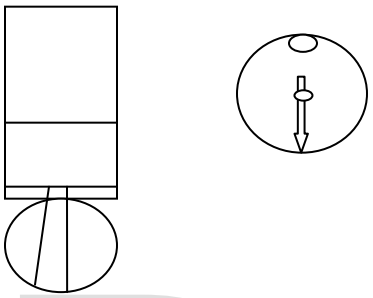


Fig-5(b)

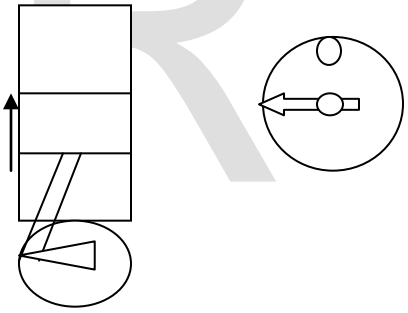


Fig-5(c)

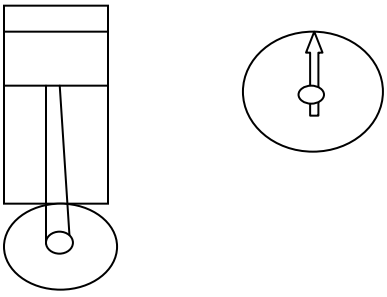


Fig-5(d)

Fig-5(a,b,c &d) represent different position of the piston along with the distributer arm. During the return stroke the

piston moves from BDC to TDC & water is circulating to the storage tank. At the end of return stroke most of water have been circulated. When the piston is at TDC, at the same time the distributer arm touches the lob, so the water again produces a thrust on the piston then the process is going on.

5 Equations For Power

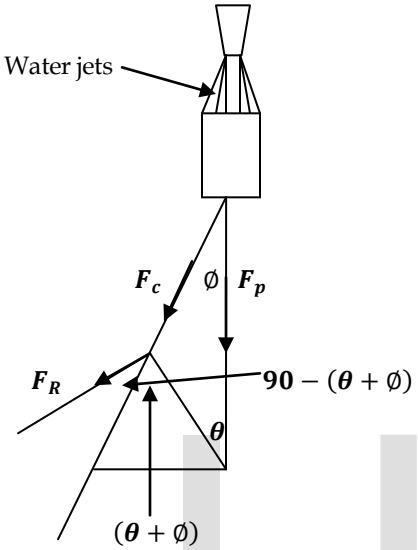


Fig- 6

$Velocity\ of\ the\ water\ jet = V$
$Velocity\ of\ piston = U$
$Time\ of\ water\ injection = t\ s$
$Mass\ of\ piston = m\ kg$
$Mass\ of\ water\ injected\ during\ t\ s = M\ kg$
$= \rho AVt\ kg$
$Where, A = Cross\ Sectional\ area\ of\ nozzle\ inlet$
$\rho = Density\ of\ water.$
$According\ to\ conservation\ of\ momentum$
$MV + 0 = mU + MU$
$After\ collision\ of\ water\ on\ the\ piston\ head\ water\ also\ moves\ downward\ with\ the\ equal\ velosity\ of\ the\ piston\ if\ we\ neglect\ the\ retardation\ of\ water\ do\ to\ formation\ of\ hydrodynamic\ boundary\ laye\ with\ cylinder\ wall.$
$mU = MV - MU$
$Now, force\ acting\ on\ piston = force\ exerted\ by\ water\ on\ the\ piston\ head.$
$= Rate\ of\ change\ of\ momentum\ of\ water$

$= (MV - MU)/t$
$= mU/t$
$So, F_P = mU/t$

$Force\ acting\ on\ connecting\ rod(F_c) = F_P/\cos\emptyset$
$Crank\ effort\ (F_R) = F_c\cos[90-(\theta+\emptyset)]$
$= F_c\sin(\theta+\emptyset)$
$Torque(T) = F_R r$
$Where, r = Crank\ radious$
$Power = 2\pi NT/60$

6 Multi Cylinder Mechanism

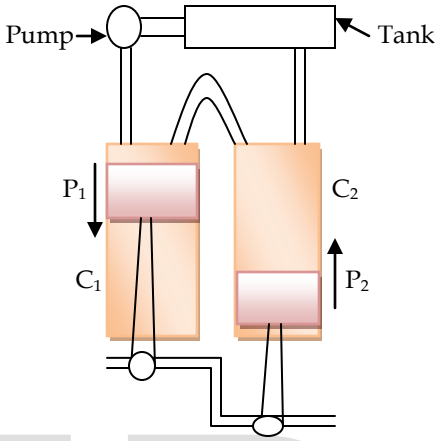


Fig- 7(a)

Fig- 7(a), represents a mechanism consists of two cylinder (C_1 & C_2) and two piston(P_1 & P_2) are connected with same crank-shaft. The working of inlet & delivery valve is just like single cylinder mechanism. The delivery valve of the cylinder-1 is connected with the inlet valve of cylinder-2. So the water releases from cylinder-1 is the source of inlet water at the inlet of cylinder-2.

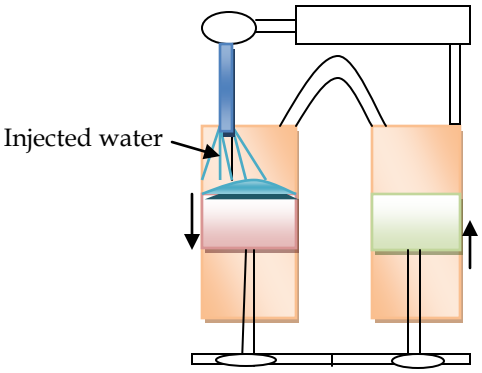


Fig- 8(b)

Water is injecting through nozzle on the head of piston-1. So the piston-1 is moving towards BDC & piston-2 is moving towards TDC i.e suction stroke is performing in cylinder-1 & delivery stroke in cylinder-2. So the delivery valve of cylinder-1 is close & no water is available at the inlet of cylinder-2.

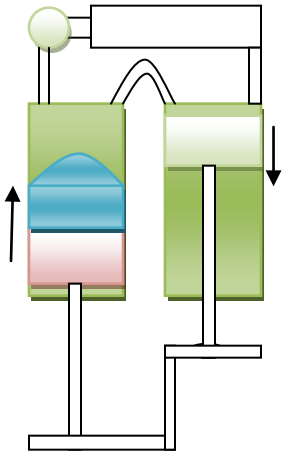


Fig- 8(c)

At the end of suction stroke the piston-1 is at BDC. The level of injected water has represented in fig- 8(c). Due to the thrust on the piston during the suction stroke high amount of torque is generated on the crank-shaft. Fig- 8(c) represents the stage just before delivery stroke at cylinder-1.

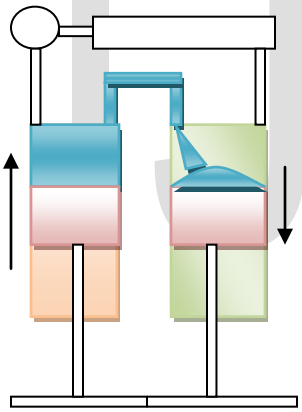


Fig- 8(d)

During the delivery stroke in cylinder-1, the piston-1 is moving towards TDC. The water also passes through delivery valve & injected into cylinder-2 on piston-2. So at that time suction stroke is performing in cylinder-2. The pressure drop inside the cylinder-2 provides access force to suck water. On the other hand piston-1 provides the accelerating force on the delivery water during delivery stroke in cylinder-1. The design of suction & delivery valve of cylinder-2 is just like cylinder-1.

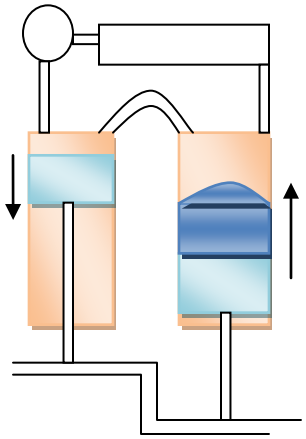


Fig- 8(e)

Fig- 8(e) represents the position of piston-1 after delivery stroke & piston-2 after suction stroke. Then again there will be a suction stroke in cylinder-1 & delivery stroke in cylinder-2 is shown in fig-8(f)

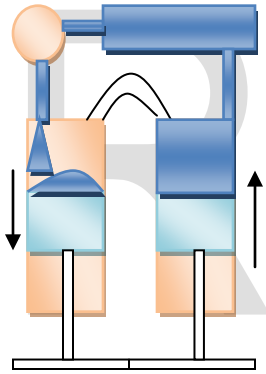


Fig- 8(f)

During the delivery stroke in cylinder-2 the water is circulating into the tank & on the other hand water is injecting on piston-1 with the help of pump & produces a high amount of thrust. The mechanism of injecting water in cylinder-1 is just like single cylinder mechanism. Then this process will continue. Similarly this mechanism can apply in 4-cylinder system also.

7 Proper Position of Inlet Valve (nozzle)

The nozzle should be placed at the centre of the cylinder head so that the injected water can spread around the piston head & produce an high amount of thrust on the piston.

8 Comparison with IC-Engine

1. In case of IC-Engine there are 4-strokes (suction,

compression, power & exhaust) in 4-stroke Engine & 2 strokes (1st stroke is suction+ compression & 2nd stroke is power+ exhaust) in 2-stroke Engine. But in case of this mechanism there are suction & delivery stroke. The suction stroke at a time performing suction & power strokes in this mechanism. And delivery stroke is analogous to exhaust stroke.

2. In case of IC-Engine valve mechanisms are controlled by cam-shaft which takes power from crank-shaft but in this mechanism valves are one-way valve. They only open with the help of water pressure in the direction of flow.
3. In the time of design we will use such materials which are non-corrosive to water. So materials will different from conventional IC-Engine.
4. No cooling system is required.
5. If this mechanism is employed in automobile the weight of the vehicle will decrease because many accessories parts of the present vehicle will not require.

9 Conclusion

This mechanism cannot produces huge amount of power like engine but can produces sufficient power to fulfill the minimum demand. This mechanism is acceptable for future fuel cries & energy insufficiencies.

Acknowledgment

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