nsu-pressedienst

VERÖFFENTLICHUNGEN DER NSU WERKE AKTIENGESELLSCHAFT NECKARSULM

Dear Editor:

The NSU-Wankel engine presented in this booklet is more than a new model or new type engine. The NSU-Wankel engine is a milestone and it is safe to say a revolution in the long development of modern combustion engines. We are pleased to disclose to-day this engine in detail.

We should not overlook the fact that much work is still to be done on application devices for the use of this engine. For instance, to drive a firepump, the task is relatively simple because the load and the number of revolutions remain constant. Such an application device is easier to develop than similar devices such as gear-boxes, reduction gears and other complicated assemblies necessary to make the engine propel a boat, tractor or airplane, all of which are subject to different fluctuations of load.

This does not mean that the engine is not well along in its development. It simply means that the other necessary parts of the driving or propulsion mechanism still need research and development.

One of the most difficult jobs is believed to be the fitting of the engine into an automotive vehicle because of the variety of conditions under which automobiles or trucks are driven. These varieties of conditions require all types of mechanisms to enable the engine to move the vehicle efficiently and smoothly.

Much has been done on this type of application in the laboratory, but more work and testing is necessary and this may take as long as another year.

Aside from the work done by NSU-Wankel, our American licensee and partner, Curtis Wright Corporation, of Woodridge, New Jersey, has been developing the engine for more than a year. We are happy to state that we thereby have acquired an enthusiastic, highly experienced and extraordinarily powerful partner. Curtiss Wright has announced that it expects to start production of engines in America for certain applications in appropriate sizes of the NSU-Wankel engine in the near future.

We are in constant touch with Curtiss Wright and we are jointly profiting by the work done in Germany and America.

Yours sincerely
NSU WERKE AKTIENGESELLSCHAFT
Press Office

i.A.

(Westrup) (Mundlos)

Neckarsulm, January 1960

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VERÖFFENTLICHUNGEN DER NSU WERKE AKTIENGESELLSCHAFT NECKARSULM

This is the first notice given about the NSU-Wankel-Engine by NSU on November 24th, 1959

Secret Revealed NSU Rotary Combustion Engine

Neckarsulm:

The NSU Werke in Neckarsulm today for the first time unveiled the secret regarding the many rumors about a sensational engine. We learned that it is a rotary piston engine developed in 6 years in the research department of NSU.

The new NSU engine has in contrast to the known reciprocating engines no reversing masses such as pistons, connecting rods, valves, valve springs or transmitting elements, but rotating parts exclusively permitting high revolutions without vibrations. It is, however, a genuine fourstroke engine with the economy permitted by the four stroke principle. Further advantages are a compact construction, cheapness of manufacturing, low weight, few individual parts and a minimum of required volume. A rotary engine, for instance, with a chamber size of 125 cc has a dry weight of only 11 kilogramm with a power output of 29 horsepower. The careful tests had the result that this engine is very longlived already today not requiring high octane fuels.

NSU in Neckarsulm is busy developing engines of small and medium power. Our American licensee, the well-known aircraft engine builder Curtiss Wright Corporation, of Woodridge, New Jersey, is primarily occupied with the development of other units, and some of them are planned for several thousands horsepower.

A practical rotary combustion engine has been a dream of inventors and engineers for more than a hundred years. The NSU-Wankel-Engine, so called after its inventor Felix Wankel, has shown results which are extraordinarely satisfactory and encouraging. Of course, the NSU-Wankel engine still requires a certain time of development and finishing just like the Diesel-Engine and the Gas-Turbine did in their time before mass production can be started.

NSU will soon divulge more details particularly its mode of operation.

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The End of a Centuries old Detour

This is how the NSU-Wankel-Engine was borne

History: The Wheel

We do not know of the simpliest and perhaps most important invention when and where it was borne. It is as old as it is modern. It is the wheel, that brings us the most logical of all movements that is the rotation. The wheel allows each point of its circumference to move continously and on its rim carries a street of infinite length.

This harmonic motion, was it too simple for the growing complexity of human thinking? Or was it above their ingenuity to drive the wheel thousands of years later also by means of a rotation? A technical detour made the power of steam or cumbustion gases move a reciprocating piston. For nearly three centuries we closed our eyes to the fact how unreasonable it really is to have to change this straight motion back into a rotation in order to link up with the rotating driving wheels.

Stories about the Combustion Engine

Today, we are at the limits of this type of design. The power increase of our reciprocating engines is blocked by the impossibility to raise the number of revolutions as desired. The forces of the reciprocating masses such as pistons, piston rings, connecting rods and their bearings grow with the square of their revolutions so that mechanically they can only be controlled up to a certain extent. The other measures for increased power are limited otherwise: Higher compression is limited by the properties of the fuel, and a larger cylinder volume by production costs and by the combustion process itself. A higher number of revolutions, however, costs nothing — provided one can handle them.

When the technical development had to go an awkward way, other awkward side developments had to follow. To make the reciprocating engine useful, a very complicated gas-exchange-system was required, itself being again of reciprocating character. It was just these parts which first refused to function at high revolutions.

New Solutions

The first to act logically was the ship industry that tried to get out of the dead end by means of the steam turbine. The aircraft industry followed as the piston engine could not keep in step with its tremendous development. This lead to the gas turbine which worked with rotating parts only like the steam turbine. But for small and medium capacities where the turbine fails on account of not being economical and having a bad partial load behaviour a "blank spot" remained on the map, today as well as ever.

Of course, suggestions were not lacking parallel to the development of the reciprocating engine to make pistons of various forms work with a rotating or circulating motion. But even the greatest minds so far gave up when they were confronted with the complicated geometry of such a system. Whoever had an idea ripe to be patented, had to shy away from another problem: The sealing of one or more interlocking rotary members against the surrounding volume which in most suggestions also rotated and which could be anything except a simple cylindrically shaped body.

Favourable Constellation

In 1951, two groups of inventive engineers crossed their ways. These were the NSU-Research men under Dr. Walter Froede and the Technical Development Laboratory of Felix Wankel.

The deciding progress was made in 1954. Wankel found an eight-shaped volume in which the triangular rotor could move in such a way that during its rotation three separate chambers of varying size were being formed. Would this system lend itself to become a four-stroke engine? And if so, would the rotor acting as a piston be capable to operate the gas exchange process? If such an engine was to become a practical reality, no complicated gas exchange mechanism was tolerable. Exciting like a well made film, each day and each week of this promising year brought new discoveries. In April 1954, the aim was reached. A rotary combustion engine working with a four stroke system in which the rotor itself controlled the gas exchange was borne.

New Horizons

But this new design would it survive in the rough practice? It was still only drawings on paper. In the following years, the technical basis for the construction of this engine was laid. Professor Baier of the Technical University Stuttgart defined the eight-shaped curve of the housing mathematically as a two-curve-epitrochoid and supplied the necessary information for a special grinding machine. Further, special tools had to be developed to make the rotor and the seals. The correctness of the principle was proven by models and rotary piston machines in the forms of pumps and compressors as intermediate stations of the technical development. One such supercharging compressor was used for the 50 c. c. NSU two-stroke engine used in making world records on the Salt Lake in U. S. A. The high efficiency of this supercharger in rotary form helped to obtain a power output of 260 h. p. / Liter. This was a much promising initial success.

On February 1st, 1957 the first rotary combustion engine was started on the test stand of the NSU Research department in Neckarsulm. After a few ignitions, a series of several minutes of ignition was to be heard and immediately one could measure an output of power. The first working rotary combustion engine of the technical history had started to work. The experimental engines, after improving the cooling and sealing elements, gave optimum power values of 29 h. p. at 17,000 r. p. m. with a chamber volume of 125 c. c. The specific fuel consumption of 230 g / Hp. h. and mean average pressures up-to 8.5 kg/cm² showed these test engines to be equivalent to the best conventional reciprocating engines.

The new principle being basicly proved, the Research Department of NSU soon started to design a type with a cinematic reversal. This form designated as circulating piston engine has the outer rotor stationary, while the inner rotor completes a kind of planetary circulating motion, thereby creating equally sealed and steadily varying chambers. Unbalanced masses does not occur. By this trick, unusually simple and light construction was achieved. The only moving parts remaining were the inner rotor and its excentric shaft. The intake and exhaust openings being activated during the circulation of the inner rotor were now fixed in the stationary housing and so was the spark plug. The mechanism grown to be a circulating engine from the former rotating engine was put to test early in 1958. With chambers of 125 cc as well as 250 c. c., a power output could be measured which allows further favourable prognosis.

With Common Goal

Impressed by the possibilities of the new engine, the American Aircraft engine company, Curtiss Wright Corporation, of Woodridge, New Jersey, decided to devote a large part of their research and development staff to the new engine under a license agreement concluded in October 1958, and they have made tremendous progress to-day.

While the practical testing did not start until only 2½ years ago, this NSU-Wankel-Engine as is was recently called has shown so excellent properties that it is not any more the question if, but only when mass production can be started. It will take some time yet but it must not be forgotten that the reciprocating engine has practicly taken 80 years of world-wide development to reach its present technical level. Adapting even a conventional engine for the usage in a road vehicle, for instance in Germany, takes alone two years.

Summarizing in comparison to the reciprocating four stroke engine, the advantages of this completely novel engine:

- Substantially lower weight;
- Fractional space requirement;
- Vibration-free running through lack of unbalanced masses;
- Noticeably lower requirements of octane hence fuel-indifferent;
- Simple design, only two moving parts;
- Lower production cost.

NSU known to be enterprising and open for technical development has lived up to this reputation by working with the rotational type engine. NSU was not the only company that knew of these possibilities, but it did not shy away from a problem which required great effort and expense. The achievements up to date seem to be extraordinary, even in our age of technical revolutions. This is the end of a long detour and the beginning of the logical engine.

General Description

NSU Wankel Engine is true Four-Stroke

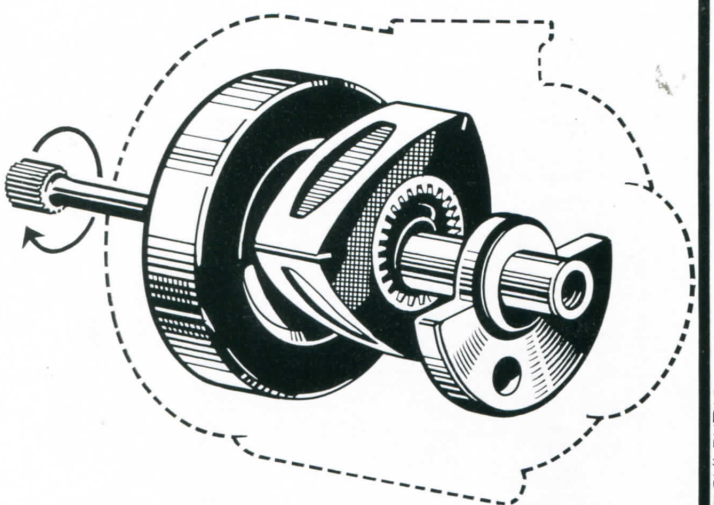
The four-stroke principle results in smooth operation and economic fuel consumption due to its operating processes being exactly determined under all loads.

As may be seen from the drawing the working volume moves inside of the housing during the individual "strokes". Thereby, the gases get into contact with steadily changing surfaces. All surfaces being cooled, the engine has a low knock sensitivity.

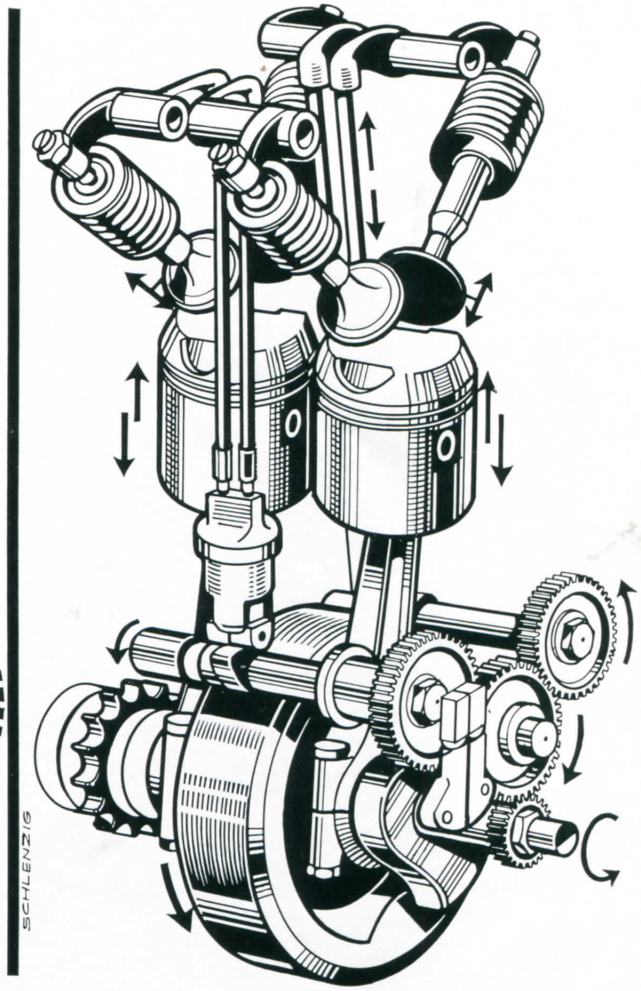
The small number of moving parts is impressive by which the fourstroke is accomplished within three independent working chambers. A reciprocating engine requires a comparetively much larger number of elements going up and down, turning, swivelling or circulating in order to govern the gas exchange.

Description of the Working System

The rotor of the new rotary engine resembles a curved triangle. It is rotating at $^2/_3$ of the shaft rotation in retarded motion mounted on an excenter. This means that the rotary speed of the rotor is only one third of the shaft revolutions referring to the housing. The corners of the curved triangle possess very small sliding velocities against the surrounding housing. In order to explain the complete four stroke process three revolutions of the excenter shaft must be observed. The chamber has its smallest size at 1, growing during the positions 2 and 3, while the intake is open. At 4, the intake stroke is finished. The chambers 5, 6 and 7 show the succeeding compression: At 7, the ignition is effected and during positions 8, 9 and 10 the power stroke occurs. At 10, the exhaust opens, letting the burnt gas escape during positions 11 and 12. At one, the whole cycle starts to be repeated.



NSU-Wankel Rotary Combustion Engine



Sample of a conventional vertical twin

For half a Century inventors and research engineers all over the world tried to develop a rotary combustion engine

Soon after inventing the first reciprocating piston engines, it became apparent that it is awkward, voluminous and expensive to change the reciprocating piston motion over into the turning shaft with a crank mechanism.

Reciprocating piston engines are limited in their speed of revolutions due to the inherent mass forces. Rotary or circulating piston engines can, similar to turbines, run noticably faster thereby granting much more power for a given size. A rotary engine in which one succeeded to eliminate valves or slides with a veritable four stroke system are of compact construction allowing considerable advantage also in production cost.