Conversion Of Environmental Energy

B.M. KONDRASHOV
Moscow, Russia.
e-mail: kbm@land.ru

In the present article are considered ways of low-potential energy conversion, making possible the generation of power, high-grade heat and "cold". They involve the use of scientifically valid and experimentally proven technical solutions, which are realized in ejector-nozzle devices of turbine engines. Unlike known free energy converters (using wind or solar energy), the effectiveness of environmental energy conversion in the fuel-free turbine discussed below engines does not depend on geographical, temporary or atmospheric conditions, while their power density is higher and could be compared with the power density of traditional heat engines. They may work either by using an open cycle and atmospheric air as the working medium, or by using a closed cycle in air-independent systems. The generation of the needed energy type by the fuel-free systems based on such turbine engines is performed directly in the place where it is being consumed. The absence of materials and devices connected with fuel usage in their construction makes the work more fail-safe, simplifies the construction and technology, reduces costs and enables these devices to be produced at most engineering plants, making the operation environmentally friendly.

The problems concerned with keeping up with society's growing energy needs are becoming more acute with each day. The reduction of hydrocarbon raw material reserves and the increase in energy consumption accompanied by the ever-worsening environmental situation require more effective and clean energy conversion technologies, because the existing ones are still not effective. The uneven heating of atmospheric gases, accumulating solar energy and compressed under the influence of gravity, causes atmospheric pressure changes, affecting the balance of the atmosphere. During its reestablishment, both potential and heat energy of air masses are transformed into kinetic energy. ***The transformation of atmospheric energy into the type that allows it to be used, is performed in this stochastic process.*** The advantages of windmills using this type of energy over heat-engines lies in the performing of mechanical work without any oxygen consumption and in the absence of exhaust gas production, while the disadvantages are: low energy density per working square unit and the inability to control wind velocity.

However, it is possible to break the atmospheric balance in order to transform the potential energy of air masses into kinetic energy by means of controlled local impacts (for instance, in ejector-type devices). By recreating the equilibrium broken by the active jet of the working medium, the atmosphere performs mechanical work, the amount of which depends on the degree, the method of impact and the parameters of the ejector devices as well. In the ejection process representing parallel adjunction to the stationary reactive jet, the efficiency factor and the additional mass adjunction coefficient m (characterizing the adjoining air mass to active jet ratio) are low because mixing and friction reduce the active jet speed C_{aj}. As a result, both the thrust and the kinetic energy of the reactive mass increase insignificantly.

In another process, that of consecutive adjunction (having another physical basis, which is not necessarily related to jet mixing), the impact of the pulsing active jet creates negative pressure in the ejector muzzle, when due to the unbalanced atmospheric pressure force air is adjoined and accelerated following each new active jet impulse. ***The process can take place practically without mixing the adjoined masses and reducing the active jet velocity,*** but only in a limited range of values and correlations of such main process parameters as design frequency, shape, duration, the velocity of active jet impulses, the speed of the approach flow, and the correlation of design values of the jet device and its ejector muzzle.

During the process of adjunction the following combined reactive mass is obtained:

$$TM = 1+m,$$

where 1 is the active jet mass and m is the adjoined mass, numerically equaling the adjunction coefficient m.

The effectiveness of the process is also characterized by the combined reactive mass velocity coefficient:

$$w_{tm} = C_{tm}/C_{pj},$$

where C_{tm} is the velocity of the combined reactive mass (C_{tm} equals C_{aj} which depends on the periodical pressure alteration inside the ejector muzzle); C_{pj} is the velocity of the pulsing reactive jet, produced by the working medium with the same parameters as observed during the formation of the active jet, but increasing in volume at constant pressure. Let us consider the types of energy conversion taking place inside engines with different thermodynamic cycles.

The first type refers to a jet engine with an ejector nozzle diaphragm and the working medium resulting from the fuel combustion that takes place inside the chamber of recurrent combustion. The process of adjunction in this case is discrete and consists of a pair of consecutive thermodynamic cycles repeated with a predefined periodicity. Each cycle has its own source of energy and working medium. In the first cycle of each period, the energy of the combustion products is transformed into the kinetic energy of the first part of the reactive mass, which moves in the ejector muzzle as a gas piston, creates negative pressure, and on its outflow acts on the turbine blades, thus creating angular momentum on the axle. Due to the negative pressure in the muzzle, both the potential and thermal energy of the atmospheric air, compressed by gravity, become the main source of energy during the second cycle. Under the influence of the difference in pressure this low-grade working medium expands and accelerates with a drop in temperature (***the difference between a natural stochastic process and the process being de-***
scribed is that the latter can be
arranged direction with design
parameters), forming during the
muzzle the second part of the reac
acts on the blades. Due to the ac
adjoined air mass, the pressure fal
thus increasing the potential dif
sure before the outflow of the ac
of the next period, and, respecti
energy of the present impulse. As a
ative pressure in the muzzle rises
ond cycle of this period, and the
air being adjoined also increases. T
formation of the energy of a low
during the previous period esta
tions for the increase of effective
transformation of another, high
in the next period.

Hence, in contrast to the process
junction, when the kinetic energy
jet is decreased by means of redis
initial energy on a greater gas mas
disturbance of atmospheric equi
ejector muzzle (under the influe
tive pulsing jet), creates a poten
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results in an increase of the activ
energy. As a result of this discret
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er, while the fuel consumption is a
times, corrected by the w_{tm} value, le
turbine engines of a traditional desi

After the start of the outflow of com
ucts, their pressure decreases in the
before the throat of the nozzle. The d
part expansion of the gaseous mass
the first cycle and so does its velocit
a decrease of decompression in the
reduction of velocity of the adjoined
served during the second cycle. The
of impulses of the combustion produc
period extrudes the "rear" part of the
mass, which has a lesser speed, out o
All this results in a partial mixing of se
eous masses, which decreases the eff
the whole process. However, exper
shown that even taking into conside
losses, the combined reactive mass n
netic energy totaling $E_{tm} = 0.5\,(1+m)$
many times exceeds the active je

$E_{aj} = 0.5\ C^2_{aj}$. By ejecting atmospheric air by the pulsing jet of combustion products, an increase in thrust totaling 140% was achieved. E_{tm} (taking into consideration the decrease of w_{tm} due to the losses caused by partial blending) is 2.4 times greater than the kinetic energy of the active jet E_{aj}. Thus, the major part of the power, created in this type of energy conversion is generated by means of transformation of both potential energy and low-grade heat of gases, compressed under the influence of gravity, into the kinetic energy of air mass. The effectiveness of such combined jet turbine heat engines should be evaluated by the total ***efficiency factor,*** which equals the ***efficiency factor*** of the Carnot cycle, increased by the product of the m and w_{tm} coefficients.

The second type. Experiments have shown that the best value of combustion products C_{aj} resides in the range of velocities which can be obtained by expansion of the compressed working medium without additional heating. Consequently, combustion products can be replaced by compressed air, while the combustion chamber can be replaced by a pneumatic accumulator. On the outflow of air from the pneumatic accumulator, the pressure at the throat of the nozzle remains constant during the cycle. That is why the "rear" part of the gaseous mass of the active jet's impulses, decreasing the effectiveness of the adjunction process, is not present, which practically excludes the mixing of consecutively moving separated air masses, and, therefore, the losses on their friction. The w_{tm} coefficient becomes greater than unity. Since C_{tm} equals C_{aj}, the kinetic energy of the combined mass will be greater than the kinetic energy of the active jet, i.e. E_{tm} is a minimum m of times greater than E_{aj}. The m parameter, which changes its value in a range from 10 to 50, depending on the parameters of the adjunction process, will exceed the value used in the process with the active jet of the combustion products, other conditions being equal. In order to increase the air pressure inside the pneumatic accumulator, different methods, as well as external energy sources, can be used. The energy needed to mechanically compress the air (ignoring compression losses), amounts to E_{aj} and ranges from only 1/10 to 1/50 of E_{tm}.

Such ***an energy balance allows compressing of the working medium by using the power generated in the processes of transformation of atmospheric energy into mechanical work during the previous cycles.***

Unsophisticated mathematical calculations show that it is sufficient to increase E_{tm}, obtained in the transformation processes by 44% in comparison with E_{aj} in order to provide for their self-maintenance. Surplus energy can be used by external consumers. If the value of the m parameter amounts to just **1**, while the efficiency factors of the turbine and the compressor are 0.85 and 0.8 respectively, ***the energy obtained in the previous cycles can be used for the compression of the working medium,*** leaving **24%** of the available E_{tm}.

Results of experiments have proven the possibility of atmospheric energy transformation during compression of the working medium at the expense of the power generated during its transformation in the previous cycles. When we extrapolate the increase of the kinetic energy by a factor of **2.4**, experimentally obtained in a less effective process of the consecutive adjunction of combustion products to the active jet, to a similar process which uses compressed air to create the jet, the energy left for external consumers (taking into consideration losses and compression expenses) will be not less than **34.2%** of E_{tm}.

According to the second law of thermodynamics, not all the energy of a single source is transformed into work in the proposed method – part of it is transformed into the heat of losses and into a high-grade heat during the mechanical compression of the working medium. This heat can be dispersed in the environment or used by consumers, which makes it possible to generate power at the same time. The temperature of the heat can be regulated depending on the degree of working medium compression and on the degree of its cooling before expansion. At the atmospheric temperature, the C_{aj} and C_{tm} values will reside in a range of the velocity coefficient л up to 2.45, which is sufficient enough to reach peripheral velocities, providing for a high ***efficiency factor*** of the turbomachines.

The air temperature in the processes of energy conversion falls. By controlling the volume of both the atmospheric air and the cold air on the exhaust, which are returned to ejector muzzles as adjoined masses, we can obtain air temperatures that can be used in air-conditioning systems. If the cold air of the exhaust, coming from one ejector nozzle is directed as adjoined masses to another ejector nozzle and so on, it can be cooled down to the extremely low temperatures used in cryogenic devices.

Thus, ***the atmospheric energy is simultaneously transformed into three types of energy, that is:***

mechanical energy, high-grade heat energy and into the "cold" of a design temperature.

This type of energy conversion uses open cycles. The exhaust gaseous mass is expelled into the atmosphere. It is cold and does not contain combustion products. The main energy sources are the low-grade temperature of atmospheric air and the gravity that creates the atmospheric pressure. The mechanical compression is performed at the expense of the power, generated during the atmospheric energy conversion, which takes place in previous cycles. That is why the devices, using the present method, are called ***atmospheric (gravitational) fuel-free heat jet engines***. Unlike the known free energy converters (using wind, solar or geo-thermal types of energy), the effectiveness of energy conversion in the proposed engines does not depend on geographical, temporary or atmospheric conditions, while their power density is higher and can be compared with the power density of traditional heat engines. The absence of materials and devices concerned with fuel usage in their construction makes the work more fail-safe, simplifies the construction and technology, reduces production costs and expands the area of application due to the simultaneous generation of three types of energy.

Let us consider additional ways of increasing the effectiveness and expanding the field of application of fuel-free engines using the following engine as an example (Fig. 1).

The engine consists of an ejector nozzle block, which comprises a convergent propulsive nozzle *1* and an ejector muzzle, the adjoining device *2*. The air-gas channel of the device and of the turbines *3* and *4*, mounted at the ends of the power shaft *5*, is situated inside this hollow shaft. The compressor rotors *6, 7* are located on the outside surface of the shaft. The output of the compressor stage *30*, which is not mounted on the shaft *5*, is connected via its return valve *20* to the pneumatic accumulator *18* of the working medium. The compressed air is fed into the accumulator through the valves *19* or *20*. The valve *21* provides for the design periodicity and for the duration of the outflow of the compressed air from the propulsion nozzle *1*. Negative pressure forms in the device *2*

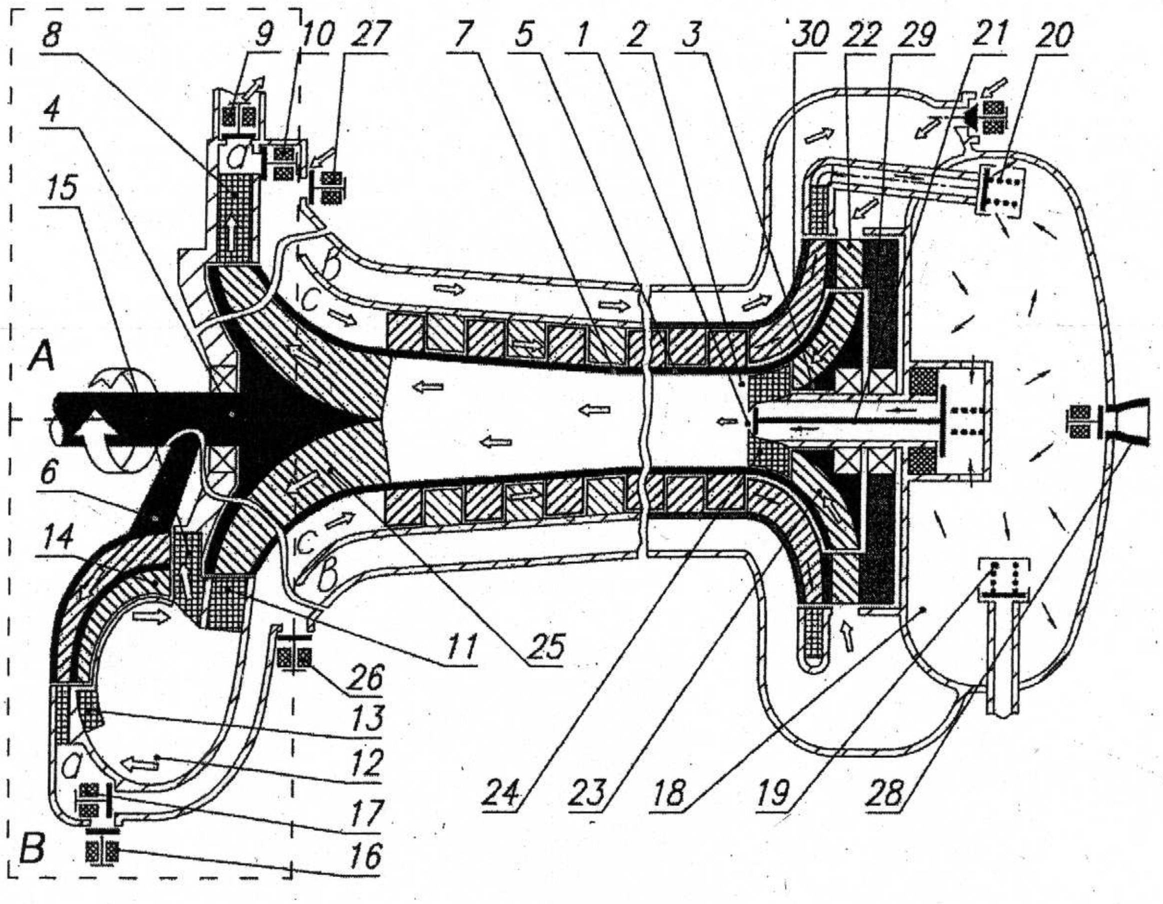

Fig. 1

following the air mass of the impulse. Under the influence of atmospheric pressure, the adjoined air accelerates following the air mass of the impulse through the valves *26*, *27*, blades *22* of the turbine *29*, blades *23* of the turbine *3*, and through the directing apparatus *24*. The degree of the negative pressure obtained in the device *2*, as well the time period of the pressure remaining stable, depend on the geometric parameters of the nozzle *1*, device *2*, their correlation and also on the thermodynamic parameters of the propulsive mass of the impulses. The degree of the negative pressure and the time period of its remaining stable influence the amount of the adjoined air, its velocity and the total head, creating momentum on the shaft *5* due to the effect of the inflowing air mass on the blades *23* of the turbine *3* and the effect of the combined reactive mass on the blades *25* of the turbine *4*, mounted on the other side of the shaft. The total power obtained is used by compressor drives *6*, *7* and by external consumers.

By compressing the mass processed in the compressor *7* at the expense of the E_{us} part, an increase in the effectiveness of the adjunction process can be achieved; the resulting mass can be bled to the environment at an increased pressure through the valve *9* and/or reused by feeding it through the valve *10* via the *в* and *c* channels. During this process, due to the negative pressure obtained before the compressor input *7*, potential difference of the pressure increases during the formation of impulses, which, in turn, leads to an increase in the active jet's velocity. The kinetic energy of the combined reactive mass also increases, accompanied by a decrease in temperature and by an increase in the momentum on the shaft *5*.

Negative pressure, used for augmenting potential difference of the pressure, may be obtained without additional energy consumption. For this purpose, jets flowing from the blades *25* of the turbine *4*, are spiraled (variant *B*) through the directing apparatus *11*. In the volume *12*, to which the outflow is directed, a vortex effect is created due to the remaining kinetic energy. The negative pressure created in the central part of the effect increases potential difference of the pressure during the expansion of the working medium. At the same time, the pressure of the combined mass increases in the peripheral part of the vortex created. The combined mass acts on the blades *25* of the turbine *4* via the directing apparatus *13*, and then (directly after compression in the compressor *6*) is expelled through the valve *16* and/or is directed for reuse through the valve *17*. In variant *B*, potential difference of the pressure can be further augmented at the expense of using the E_{us}, part by connecting the center of the volume *12* via the directing apparatus *15* to the compressor input *6*.

During the compression of the resulting low-temperature mass, energy consumption on the compression work is reduced compared to compression of air at the atmospheric temperature. That is why open-cycle engines can be used not only as power generating units, but as effective generators of a high-grade working medium used by more powerful fuel-free systems. They can also be used for the creation of low-temperature propulsion jets (in nozzles *28*) and for creating thrust. The effectiveness of the compression can also be increased by using birotating compressors *7* and *30* with the working wheels rotating in opposite directions.

The power density can be increased by heating the resulting low-temperature air instead, or on a par with the mechanically compressing the working medium to form the active jet. It will make possible the creation of a high-grade working medium using the heat from external sources (solar, geothermal etc.) before the expansion.

The third type. The process of consecutive adjunction can also be used to generate power, high-grade heat and "cold" outside of atmospheric conditions by transforming environmental heat energy in a closed thermodynamic cycle. Let us imagine that an atmospheric fuel-free jet engine is placed in an environmentally isolated space, filled with air or helium. During the operation of the engine, due to the cooling of the processed mass, both the temperature and pressure of the volume will decrease. The parameters of the adjunction process will change so radically that at some moment the value of E_{tm} will be insufficient to create the design power of the compressor, contracting the working medium. The degree of its contraction and C_{aj} will diminish with every following cycle. The process of adjunction will gradually fade out, and the engine, having "frozen", will stop.

It will not happen if the isolated space is used as a low-temperature heat absorber for the outflow of the processed gaseous mass, and is connected to the heat exchange device, while the output of the device is connected to the input of the adjunction device and the compressor in order to create a closed circuit. Part of the processed gaseous mass under the influence of the unbalanced force of gas pressure, appearing due to the negative pressure that forms behind the gaseous mass of the active jet's impulses, is directed to the heat exchange device. By obtaining heat and reducing the temperature of the environment, part of the processed gaseous mass is heated up to the design temperature before performing the functions of the adjoined masses of the following periods. Under the influence of the negative pressure created on the compressor's input, part of the processed gaseous mass is directed via the heat exchange device (or bypassing it) into the compressor where it is contracted for further use.

As a result, ***by heating up the processed gaseous mass in the heat exchange device, the process of consecutive adjunction in air-independent fuel-free jet engines with a closed cycle can be performed for an unlimited period of time. It does not depend on the pressure of the environment, which acts as a heater, i.e. a source of heat transformed into work.***

The difference between fuel-free engines with a closed cycle and those with an open cycle lies in the principle of heat exchange with the environment and in the possibility of modifying the pressure and temperature in the heat exchange device. Their effectiveness to a considerable degree depends on the temperature differential between the environmental source of heat and the heat exchange device before the heating up of part of the processed gaseous mass used during the following periods. By modifying the adjunction process, the pressure and temperature of the heat-exchange device, and the degree of compression of the processed mass before reuse, the engine's power can be controlled and the range of temperatures of the environmental heat sources that are used can be expanded.

On the basis of closed-loop engines, ***air-independent autonomous fuel-free energy systems*** of a broad power range and for different applications can be created. Their operation would be possible under any environmental conditions: in outer space or under water, making possible the transformation of its low-grade heat into the three needed types of energy. If ponds, glaciers, soil and the atmosphere are used as sources of heat, the control over their aggregative state can be achieved. A local alteration of climatic conditions, depending on the scale of the fuel-free systems application, is also possible.

In conclusion, I would like to emphasize the following point: **the reactive thrust and the kinetic energy of the combined reactive mass, obtained as a result of the process of consecutive adjunction, exceed the thrust and the kinetic energy of the active jet**. The proposed fuel-free methods of energy conversion are based on this statement, **which was verified in experiments**.

The principle of augmenting the kinetic energy is the same for all three methods: the augmentation takes place during the reestablishment of equilibrium by the gaseous masses of the low-grade working medium, which is broken by the gaseous mass of the active jet's impulses in the ejector muzzle. The adjoined masses may accelerate practically without any friction loss. Due to their acceleration, the velocity of the active jet also increases, compared to its velocity during the outflow to the constant pressure area. The amount of the increase in kinetic energy augmentation depends on the correlation of the main parameters of the process, and also on the correlation of the design parameters and the proportion of the ejector device. Turbulent mixing and friction of the gaseous masses, which drastically decrease the effectiveness of the adjunction process, are absent only in a narrow range of optimal values of parameters.

Thus, an inexhaustible and natural free energy source can be effectively transformed without any harm to the environment into three types of energy, consumed directly on the site of their generation. Such energy generation can be performed regardless of the geographical position and environment conditions and will make it possible to do away with the need for development and transportation of energy carriers, the use of long-distance transmission circuits, and the accumulation of the energy generated. The production of such systems is much easier and more effective compared to the production of analogous traditional systems, and is possible at the majority of factories that produce propulsion systems.

The proposed methods of energy transformation and the construction of turbine engines, using these principles, are intellectual property objects, protected by a Russian Federation patent. According to the Patent Cooperation Treaty (PCT), an international application has been filed. The implementation of these objects will yield great benefits to those who have signed the Treaty. Various legal forms of mutually beneficial cooperation are possible, from license agreements to joint patenting in countries of production. A version of this article, containing energy balance calculations, a schematic diagram of a fuel-free turbine engine, the description of its working principle, and additional explanations and references, can be sent by e-mail by the author on request.