(No Model.)

A. DESGOFFE.
ENGINE.

No. 551,854. Patented Dec. 24, 1895.

Fig. 4. Fig. 1. Fig. 5.

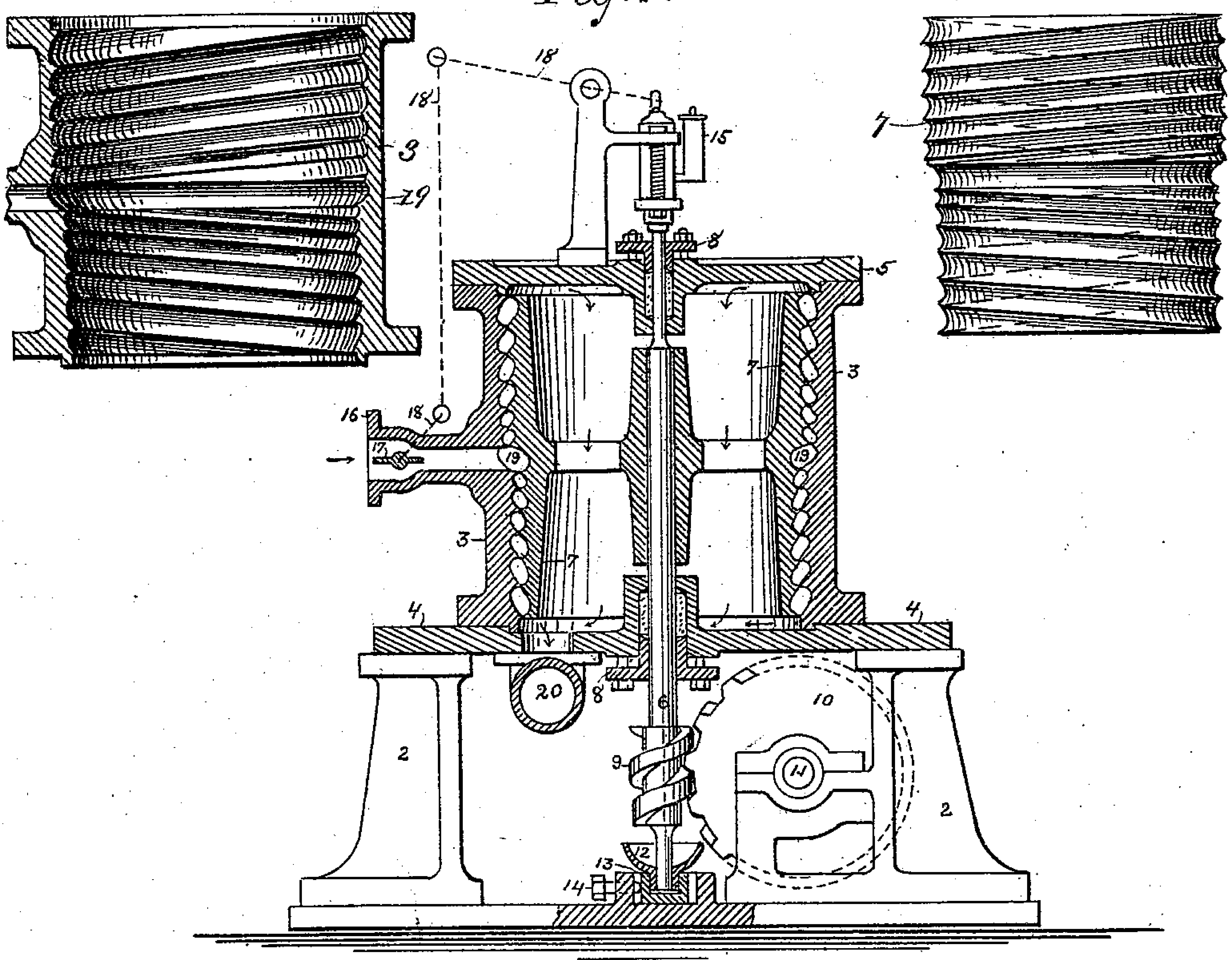


Fig. 2.

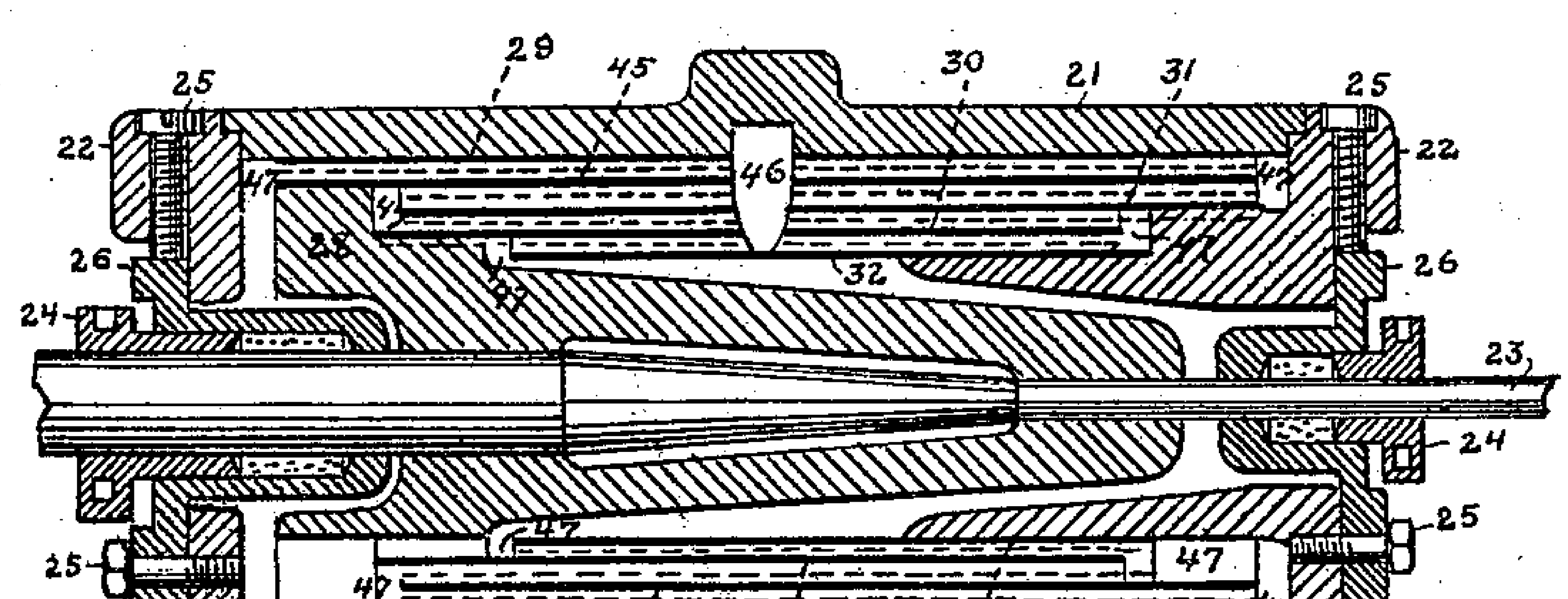
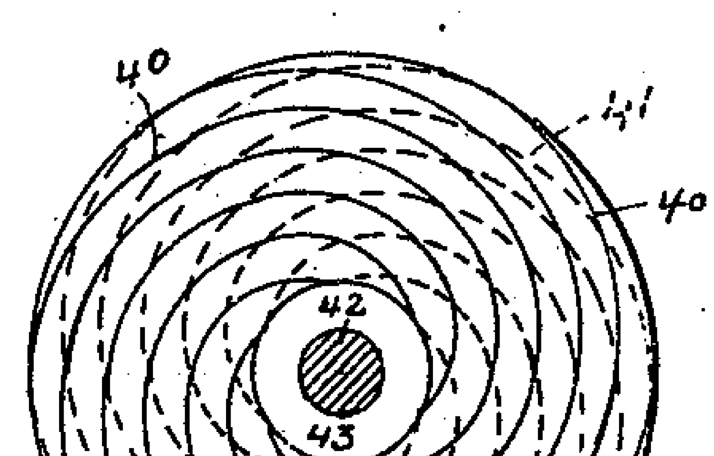


Fig. 3.



Witnesses:

Inventor:

UNITED STATES PATENT OFFICE.

AUGUSTE DESGOFFE, OF ODESSA, RUSSIA.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 551,854, dated December 24, 1895.

Application filed November 10, 1891. Serial No. 411,524. (No model.) Patented in Germany June 14, 1888, No. 43,452; in Belgium January 8, 1890, No. 89,115; in France January 23, 1890, No. 203,322; in England April 16, 1890, No. 5,768, and in Italy May 20, 1891, No. 27,538/81.

To all whom it may concern:

Be it known that I, AUGUSTE DESGOFFE, a citizen of France, residing at Odessa, in the Empire of Russia, have invented certain new and useful Improvements in Engines and Motors, (for which Letters Patent have been granted in Germany, No. 43,452, dated June 14, 1888; in France, No. 203,322, dated January 23, 1890; in Belgium, No. 89,115, dated January 8, 1890; in Italy, No. 27,538/81, dated May 20, 1891, and in Great Britain, No. 5,768, dated April 16, 1890,) of which the following is a specification.

My present invention relates to structures by means of which the energy of a fluid is converted into mechanical motion. The fluid employed may be water, steam, any kind of gas, (explosive or otherwise,) hot air and the like.

My invention consists of certain novel parts and combination of parts particularly pointed out in the claims concluding this specification.

The following is a description of the engines illustrated in the accompanying drawings; but it will be understood that my invention is not limited to the precise devices and combinations of devices here illustrated and described, as various modifications thereof may be made without departing from the spirit of my invention, and without exceeding the scope of the claims concluding this specification.

In the accompanying drawings, Figure 1 illustrates a vertical section through an engine embodying some of the features of my present invention. Fig. 2 is a longitudinal section through an engine also embodying some of the features of my present invention. Fig. 3 is a plan view diagrammatically indicating the application of my invention to structures in which the opposing surfaces are planes or disks. Fig. 4 is a vertical section of the cylinder shown in Fig. 1, and Fig. 5 is an elevation of the piston shown in Fig. 1.

I will now describe the structures illustrated in the accompanying drawings, which drawings, read in connection with this description, will enable any person skilled in the art to employ my invention in forms which are at present preferred by me.

Referring to Fig. 1, 2 2 are the base-pieces on which the cylinder and piston are supported. 3 is a cylinder set upon said base-piece provided with a lower head-piece 4 and an upper head-piece 5, attached by any suitable means. 6 is a piston rod or shaft to which the piston 7 is keyed, said piston consisting of a hollow cylinder set inside of the enveloping cylindrical case 3. The heads 4 and 5 of the case are perforated to permit the shaft 6 to pass through them, and each of these heads is provided with a stuffing-box 8, to prevent leakage at the points where the shaft passes through said heads. 9 is a worm keyed to said shaft 6, and 10 is a gear-wheel set in journals 11, supported on an extension of the base-pieces 2 2. The power developed in the device is taken off the shaft 11.

12 is an end bearing of the shaft 6, preferably made of antifriction metal, set in an adjustable box 13, provided with set-screws 14. This end journal is also supported on the base-piece 2 2.

15 is a governor of any suitable construction, but preferably constructed as described in an application for Letters Patent filed by me.

16 is the inlet-passage for the admission of steam or other fluid.

17 is a valve for controlling the admission of the fluid. The governor 15 is connected with the inlet-valve 17 by means of the connecting-rods 18 18 18, (shown in dotted lines,) so that when the speed of the engine unduly increases the governor 15 will operate to cut off, more or less, the steam, and when the speed of the engine unduly diminishes the valve of the engine will operate to increase, more or less, the quantity of steam admitted.

19 19 is the inlet-port, and it consists of a groove cut entirely around the interior cylindrical surface of the case 3 and entirely around the exterior cylindrical surface of the piston 7 at right angles to the axes of said cylinders. 20 is the exhaust-passage through which the steam is discharged. The case 3 is provided on its upper section with spiral threads or grooves traced in one direction and on its lower section with spiral threads or grooves traced in the opposite direction. The upper section of the exterior surface of the cylindrical piston 7 is provided with spiral grooves traced in one direc-

tion and the lower section is provided with spiral grooves traced in the opposite direction. The opposing spiral grooves on the cylinder and piston on both the upper and lower sections, however, cross each other—that is to say, if the threads on the upper section of the case be traced from left to right, the threads on the lower section of the case will be traced from right to left, and the threads on the upper section of the piston will be traced from right to left, and the threads on the lower section of the piston will be traced from left to right. In both sections the surfaces of cylinder and piston on which the threads are cut are, preferably, not in actual contact.

The generic idea involved is covered by a pending application filed by me on or about October 21, 1890, bearing Serial No. 368,812. The system referred to is termed by me the "antispire system," and by that name I shall refer to it in the specification.

The operation of this engine may be thus described: Steam is admitted through the inlet-passage 16 and through the circumferential port 19, where it divides, one portion passing up and the other down through the two separate antispire systems arranged above and below the inlet-port. As the threads on these two systems are traced in opposite directions, the passage of steam through both, but in opposite directions, exerts a force in both sections to revolve it in the same direction, so that the sum of the power produced in both is combined and is transmitted through the shaft 6 to the shaft 11, from which the power is taken. That portion of the steam which enters the several threads in the upper system flows down through the passages cut in the center of the piston to the exhaust-passage 20, as illustrated by the arrows. That part of the steam which passes through the lower system goes directly to said exhaust-passage. I have learned from experience that the maximum of useful effect under ordinary conditions will be produced when the inclination of the threads on both the cylinder and piston is seventeen degrees forty minutes; but other inclinations may be adopted. It is not essential, however, that the inclination of the threads on the opposing surfaces be the same, as they may differ, more or less, if preferred. When the worm and gear, such as 9 and 10, are employed to transmit the power developed to the shaft from which the power is taken, I prefer that the worm 9 be also made with threads inclined at seventeen degrees forty minutes, although, of course, other inclinations may be employed. This arrangement permits regulating the number of revolutions of the piston to the requirements of transmission with the least possible loss of power. Instead of admitting steam midway between the cylinder-heads and causing it to pass in both directions through the threads engraved on the opposing cylindrical surfaces, it might be admitted at one end and discharged at the other. I prefer, however, to admit it as shown and to discharge it at both ends, because in this way friction on the journals is diminished. If the steam passed in one direction only, there would be present in the device a longitudinal thrust, which is cast on the journal-bearings or on one of the heads of the case. By passing the steam in both directions counteracting thrusts are developed, which may be made to exactly balance one another and thereby to relieve the parts of this extra work. Not only this, but by proper proportioning of parts, the weight of the piston also may be taken off the journals by developing in the device an upward thrust equal to the downward thrust developed by the passage of the steam plus the weight of the piston and attendant parts. This may be accomplished by making the upper section of the piston of greater diameter than the lower section. I have indicated this with slight exaggeration so as to make the difference more plain, in Fig. 1 of the drawings, in which it will be seen that the opposing surfaces on which the oppositely-inclined threads are cut are of greater diameter in the upper section of the structure than in the lower. If both were of exactly the same diameter, it is obvious that the end bearing of the shaft would be obliged to support the weight of the piston and of its attendant parts, including the weight of the worm 9 and the longitudinal thrust on the shaft incident to the operation of said worm in combination with the gear-wheel 10. It is also apparent that if the diameter of the upper section be increased, so that there be developed there an excess of longitudinal thrust just equal to the weight of the piston and its attendant parts, as aforesaid, the end bearing of the shaft will be relieved and the friction there diminished or entirely removed. In this way friction may be reduced to the minimum. I therefore prefer to make the piston and cylinder in this form, although in the broad sense my invention will be present in structures which do not involve this improvement.

Other ways of accomplishing the same result might be employed. Thus an excess of work may be done in the upper cylinder by utilizing there more steam by suitable proportioning or inclination of grooves.

In all cases the steam envelops the piston all over its periphery and acts to keep it centered in its case. As the steam escapes from the antispire at a very low pressure, the joints and stuffing-boxes may be made comparatively loose, permitting the steam itself to act in some degree as a lubricant between the metallic parts to prevent heating and to diminish consequent wear, if desired.

When expanding-fluids, such as steam, are employed, I prefer to suitably proportion the acting parts to utilize the expanding power of the fluid. This may be done by making the spiral grooves between the piston and its case of gradually-increasing cross-section from the point where the steam is received to the point where it is discharged. This also is indicated in Fig. 1 in a somewhat exaggerated form to make this feature more clear. To obtain the best results, the coefficient of expansion of the fluid employed will determine the rate at which the capacity of these grooves increase from the inlet to the outlet. The stronger the pressure of the fluid at the inlet-port the more rapidly the capacity of the grooves should expand for a given length of thread, or with a given rate of expansion the length of the threads should increase. It is also obvious that the pressure of the steam diminishes as it passes through the grooves. To obtain the corresponding effect of the different pressures throughout the entire length of an antispire system, the inclination of the screw-threads may vary in a corresponding manner by increasing the inclination of the threads as they approach the outlet. When this arrangement is adopted, I prefer to have the average or medium inclination form an angle of seventeen degrees forty minutes. I prefer to employ threads of the same inclination on both the piston and the case; but as the capacity of the threads on the piston is usually made somewhat greater than the capacity of the threads on the case, the inclination of the threads on the piston may be decreased proportional to this difference in capacity.

Each antispire system may be composed of any number of threads. The capacity of the threads in Fig. 1 is shown on an exaggerated scale, and hence the number of threads, as shown, is less than I ordinarily employed in such a structure. The principles of operation, however, are clearly indicated by said drawing, and the exaggeration referred to is adopted for the purpose of more clearly illustrating the general principles on which the structure operates. The capacity and shape of threads on both the piston and the case may vary according to the character of fluid employed. I prefer in general, however, to make the depth of these threads about one-third their width. If the threads are too deep, a quantity of fluid will escape without effecting the maximum action, and if they are too small, the maximum amount of effective fluid cannot pass through them.

The power developed may be increased by simply increasing the length of the apparatus, as by keying a plurality of cylinders on a single shaft, inlet and outlet ports being arranged at suitable distances apart. The power of these engines may also be increased without increasing the velocity or the diameter or the length of the apparatus, by placing a series of systems one inside of the other, as indicated in Fig. 2 of the drawings.

The following is a description of the apparatus illustrated in said last-mentioned figure: 21 21 is a cylindrical case provided with head-pieces 22 22, attached thereto by any suitable means. Each of these head-pieces is provided with a flanged cup 26, attached by set-screws 25 25. The flanges of this cup form a portion of the head-piece and the concavity forms a stuffing-box 24. 23 is a shaft passing through the head-pieces and through said stuffing-boxes. The interior cylindrical surface of the case 21 is provided with spiral threads. Keyed to the shaft 23 is a cylindrical tapered piece 28. Attached to this piece 28 are hollow cylinders 45 and 30. Attached to a cylindrical projection from the head-piece 22 are the cylinders 31 and 32. The interior surface of the case 21 (marked 29) is provided with spiral threads inclined in one direction. The exterior surface of the cylinder 45 is provided with spiral threads inclined in the opposite direction. The interior surface of the cylinder 45 is provided with spiral threads inclined in the same direction as are the threads on the exterior surface of said cylinder, and the exterior surface of cylinder 31 is provided with spiral threads inclined in the opposite direction. The cylinder 30 on both faces is provided with spiral threads inclined in the same direction as are the spiral threads on the cylinder 29, and the exterior surface of cylinder 32 is provided with spiral threads inclined in the same direction as are those on the exterior surface of cylinder 31. This forms a system of concentric cylinders, each alternate cylinder being stationary and the intervening cylinders movable. 46 46 is the inlet-port. 47 47 47 are the outlet-ports. The dotted lines in the drawings diagrammatically indicate the oppositely-inclined threads above described.

When constructed as shown in the drawings, the steam enters by the inlet-port 46 and divides, part passing through the antispire systems on the right and part through the antispire systems on the left, exhausting through the ports 47. In this case the systems on both sides are, preferably, identical, because the cylinders are horizontal and not vertical. Instead of having the steam enter at the center of the cylinders and flow both ways, the same compensating effect might in this structure be produced by having steam pass through the entire length of a pair of cylinders in one direction, and through the entire length of another pair of cylinders in the opposite direction, as will be readily understood.

Instead of having the opposing surfaces of the piston and case cylindrical or tubular they may be of any other suitable form—as, for instance, that shown in Fig. 3 of the drawings, in which circular disks are shown with helicoidal threads of opposite inclination engraved thereon. Referring to Fig. 3, which is an end view of two disks 40 and 41, 41 being behind the front disk 40, the full helicoidal lines indicate, diagrammatically, the threads engraved upon the opposite side of the front disk, and the dotted helicoidal lines indicate, diagrammatically, the threads engraved upon the corresponding side of the back disk 41. It will be readily understood that these grooves engraved on plane surfaces, inclined in opposite directions, will operate in substantially the same way as do the spiral grooves on the cylindrical surfaces shown in Fig. 1. Preferably one of these disks is held stationary and the other is carried on the shaft 42, to which it is keyed. The acting fluid is admitted at or near the center of the disks through the annular space 43, and thence passes radially and is discharged in a suitable outlet-passage at the circumference.

The structures above described might be employed to receive and utilize any fluid under pressure. It will be understood that the qualities and characteristics of the fluid employed and the pressure at which it is received will, of course, modify to a certain extent the proportions of the parts. For instance, if water instead of steam be employed, suitable modification will be made in the structure in view of the fact that water is incompressible and non-elastic, and that the adhesion of its molecules among themselves is greater than is the adhesion of the molecules of steam or any gas-like substance. The capacity of the threads or grooves, therefore, should be greater when such a fluid is employed than when steam or gas is the operating fluid. As the velocity of revolution will depend upon the height of the charge and the capacity and inclination of these spiral threads, they may be constructed so as to give the precise number of revolutions to effect the perfect utilization of the power expended.

In this specification I have called the inner movable cylinder the "piston," and the outer stationary cylinder the "case," but it will be understood that the inner cylinder may be made the stationary part and the outer cylinder the movable part, or that both the inner and outer cylinders may be movable.

I have described a few of the modifications which may be employed in the practice of my invention, but I have not endeavored to describe all the modifications which might be suggested, as the object of this specification is to instruct others skilled in the art to practice my invention in forms which are at present preferred, and to understand its nature; and it will therefore be understood that the mention by me of a few modifications is not intended to exclude others not referred to, but which are within the spirit and scope of my present invention.

Certain features of improvements illustrated and herein described are not essential to the several features of my invention, broadly considered. All this will be pointed out in the concluding claims, as in a given claim the omission there of reference to an element, or the omission of reference to the particular features of the elements contained, will be understood to be a formal declaration of the fact that the omitted elements or features are not essential to the operation of the invention covered by said claim.

Having thus described several structures involving my present invention, what I claim, and desire to secure by Letters Patent, is—

1. In an engine, the combination of a plurality of bodies provided with opposing surfaces, each provided with continuous threads, the threads on the opposing surfaces being inclined to cross each other and increasing in capacity from the inlet to the outlet.

2. In an engine, the combination of a plurality of bodies provided with opposing surfaces, each provided with continuous threads, the threads on the opposing surfaces being inclined so as to cross each other, the inclination of the threads increasing from the inlet to the outlet passage.

3. In an engine, the combination of a plurality of bodies provided with opposing surfaces, each provided with continuous threads, the threads on the opposing surfaces being inclined so as to cross each other, said threads increasing in capacity and inclination from the inlet toward the outlet.

4. In an engine, the combination of a plurality of bodies provided with opposing surfaces, each provided with continuous threads, the threads on the opposing surfaces being inclined so as to cross each other, forming a laminated structure, the alternate plates being connected together.

5. In an engine, the combination of a plurality of bodies provided with opposing surfaces, each provided with continuous threads, the threads on the opposing surfaces being inclined so as to cross each other, and increasing in inclination from the inlet toward the outlet passage, the average or medium inclination of said threads forming, preferably, an angle of seventeen degrees forty minutes.

AUGUSTE DESGOFFE.

Witnesses:
EUG. WARE,
C. MEURINE.