(No Model.) 2 Sheets—Sheet 1.

A. DESGOFFE.

PUMP.

No. 551,853. Patented Dec. 24, 1895.

Fig. 1.

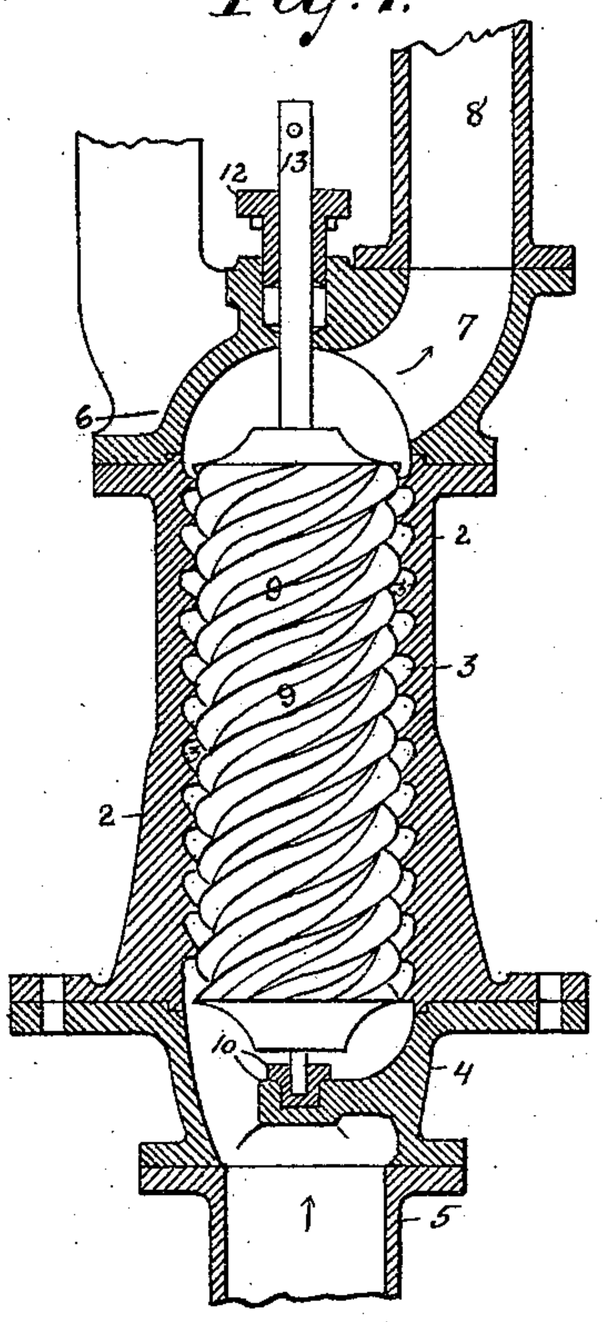


Fig. 2.

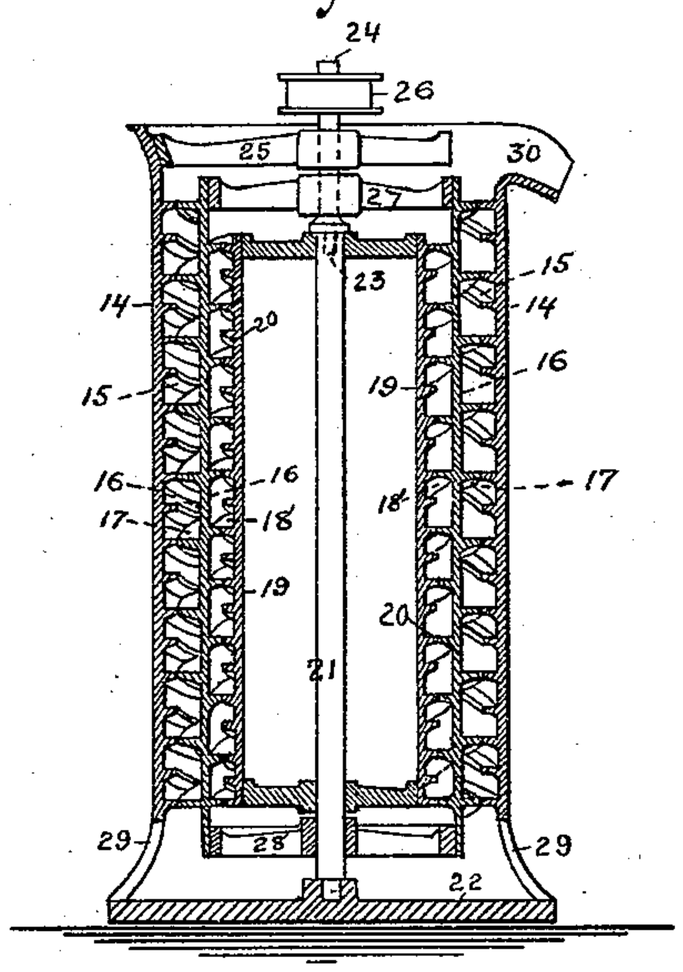
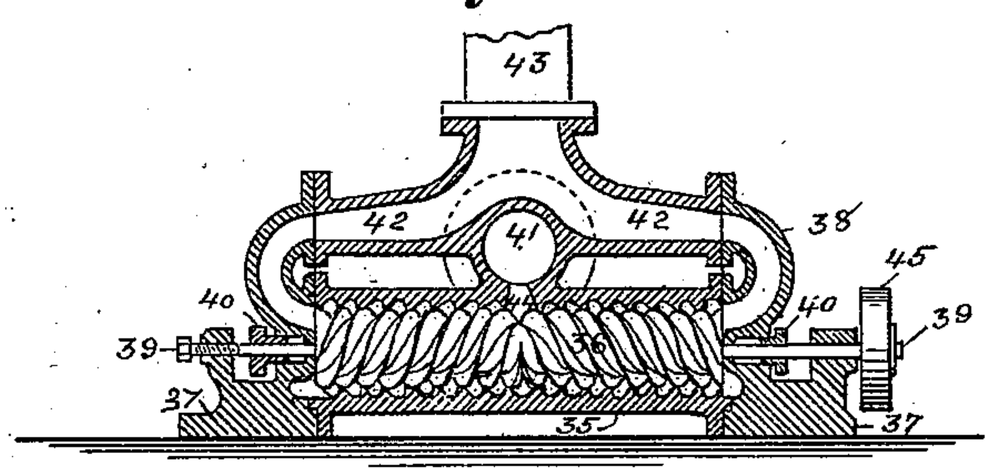


Fig. 3.



Witnesses.

L. Mennine

Luy Ward

Inventor.

A Desgoffe

(No Model.) 2 Sheets—Sheet 2.

A. DESGOFFE.

PUMP.

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Fig. 4.

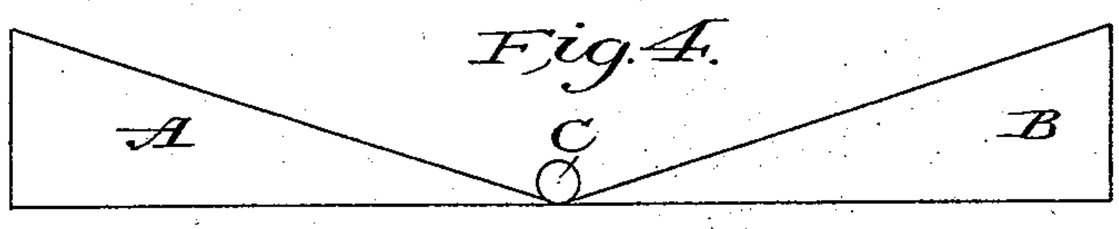


Fig. 5.

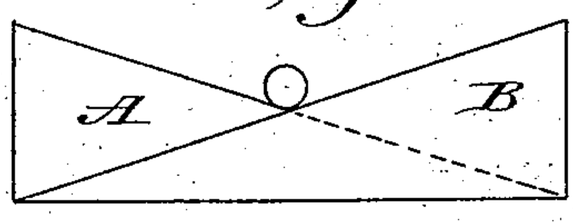


Fig. 6.

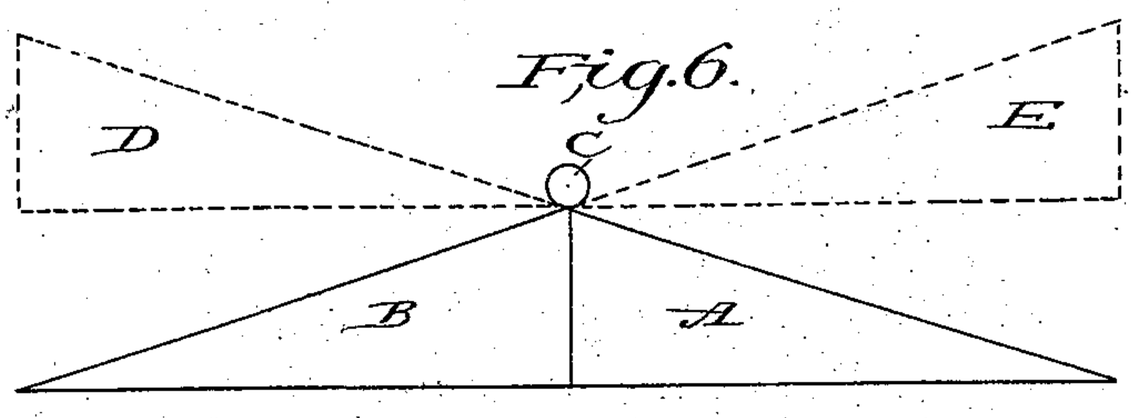


Fig. 7.

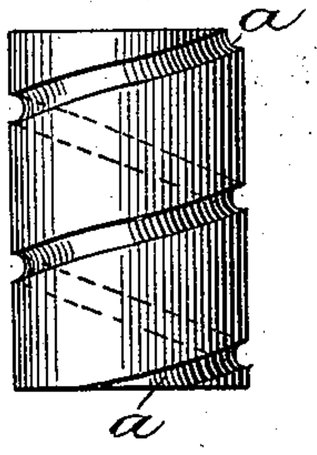
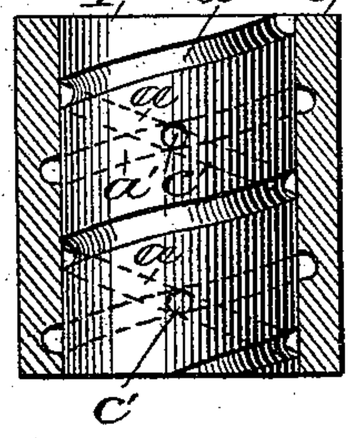


Fig. 8.

Fig. 9.



Witnesses.
M. Wilson
Charles J. Rathjen

Inventor.
Auguste Desgoffe
by Gifford & Pulle
Attys.

UNITED STATES PATENT OFFICE.

AUGUSTE DESGOFFE, OF ODESSA, RUSSIA.

PUMP.

SPECIFICATION forming part of Letters Patent No. 551,853, dated December 24, 1895.

Application filed November 10, 1891. Serial No. 411,523. (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, 1890, No. 27,538/81.

To all whom it may concern:

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

My present invention relates to pumps, blowers, and the like; and it consists of certain novel parts and combinations of parts pointed out in the claims concluding this specification.

The following is a description of the pump illustrated in the accompanying drawings; but it will be understood that my invention is not limited to the devices and combination 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, Figures 1, 2, and 3 illustrate longitudinal sections through different pumps. Figs. 4, 5, 6, 7, 8, and 9 are diagrammatic views illustrating the general principles on which my invention operates.

In each of the figures the pump shown contains one or more of the features of the invention covered by these Letters Patent.

For the purpose of instructing persons skilled in the art to which my application appertains, or with which it is most nearly connected, to practice my invention in forms which are now preferred and to understand its nature, I will now proceed to describe the structure illustrated in the accompanying drawings, which show three of the many devices in which my invention may be present.

Referring to Fig. 1, 2 is a cylindrical case, the interior surface of which is provided with a plurality of continuous threads or grooves 3 3. Attached to the lower end of said cylindrical case is a hood 4, into which the inlet-duct 5 empties. Attached to the upper flanged end of the cylinder 2 is a cover 6, into which the upper dome-shaped end of the case-cylinder is formed. Said cover is provided with the exit-passage 7, emptying in the exit-duct 8. 9 is a cylindrical piston made to set within the case 2 and preferably made a trifle smaller than the case, so as to be a loose fit. The piston 9 is journaled at the lower end in a box 10, preferably made of antifriction metal, and removable so as to be replaced when worn out, which box is set in a projection on the lower hood 4. At the upper end the piston is journaled in a perforation through the upper part of the cover 6. 12 is a stuffing-box to prevent leakage at this point. 13 is the piston-shaft extending outside of the chamber containing the working parts, to which power is applied in any suitable manner to cause the piston 9 to revolve. This piston 9 has engraved on its periphery a plurality of continuous threads. The threads engraved on the interior surface of the case 2 incline in the opposite direction to those engraved on the periphery of the piston 9—that is to say, if the threads on the case are cut from right to left, the threads on the piston are cut from left to right, and if the threads on the case are cut from left to right, the threads on the piston are cut from right to left. Hence the threads on the piston and on the case, on opposing surfaces, are inclined at an angle to each other.

In an application filed by me October 21, 1890, Serial No. 368,812, I have described what I term the "antispire system" and its application to several structures. In general terms it may be stated that the system is embodied in a structure having a plurality of opposing surfaces, each provided with continuous threads, the threads on the opposing surfaces being inclined so as to cross each other. The threads having a relative inclination with reference to each other form, theoretically, a series of triangles placed point to point, and when these threads are applied to cylindrical surfaces the base of the triangle may be regarded as the circumference of the cylinder, the vertical side of the triangle the pitch of the thread, and the hypotenuse the inclination of a thread through one revolution.

It is obvious that a particle, either fluid or solid, by the relative movement of such triangles, if placed in a position to be influenced by both, will be advanced or raised. It is, therefore, obvious that the revolution of the piston 9 will cause any fluid contained within the case to move therethrough and to be expelled from the exit-pipe with a given force or velocity. The speed at which said fluid will move is proportional to the velocity of the piston, other things being equal. The general principles upon which these structures operate will be understood by reference to Figs. 4, 5, and 6, in which the triangles A, B, D, and E are shown. In each of these triangles the base may be regarded as representing the circumference of a cylinder internally or externally provided with a spiral thread or groove, the vertical side as the pitch of said spiral thread or groove, and the hypotenuse as the inclination of said thread or groove throughout one convolution. C illustrates a particle of fluid or any other substance acted upon by these threads. Assuming that the triangles A and B are placed point to point, as shown in Fig. 1, and that a particle of fluid rests between them at the point of junction. If both these triangles be now moved toward each other when they have reached the relative position indicated in Fig. 5 the particle C will have advanced to the position there indicated. When, continuing the same motion, these triangles have reached the position indicated in Fig. 6, the particle C will have advanced to the position there indicated, where it rests between the approaching triangles D and E to operate in turn and in the same way upon the particle until it is discharged with a given velocity or at a given pressure. If these triangles represent the circumferences of two concentric cylinders and the inclination or pitch of the screw-threads engraved on their opposite surfaces in opposite directions, it is obvious that, if both cylinders move, when each has made one complete revolution any particle contained between the threads will be moved a distance equal to the common pitch of their threads, assuming that the pitch of the threads on both surfaces is the same. It will also be obvious that if one of said triangles remains stationary while the other moves that the particle will be raised a distance equal to the pitch; but it will take double the time to move it this distance than it would if the two triangles were moved at the same time. This general system of operation I term the "antispire system." Figs. 7, 8 and 9 illustrate the manner in which this antispire system may be applied to cylindrical parts. Fig. 7 shows a cylinder having the groove *a* cut on its exterior surface. Fig. 8 shows a longitudinal section through a hollow cylinder having the groove *a'* cut on its interior surface. The grooves or screw-threads on the interior cylinder F (shown in Fig. 7) and on the exterior cylinder G (shown in Fig. 8) incline in opposite directions. In Fig. 9 the cylinder F is shown in place within the cylinder G.

C', Fig. 9, indicates a particle of fluid at the intersections of the oppositely-inclined threads, and from what has been said it will be readily understood how the motion of one or both cylinders will operate to impart motion to said particle.

The operation of the device shown in Fig. 1 may be thus described, assuming that the structure be employed to pump water, for example: The entrance-pipe 5 is attached to the reservoir of water to be elevated. The exit-pipe 8 leads to the reservoir into which the water is to be delivered. Power is applied by any suitable means to the shaft 13, causing the piston rapidly to revolve. The water will then flow through the entrance-pipe and will be expelled through the exit-pipe into the reservoir.

Referring to Fig. 2, 14 14 is a cylindrical case, the interior surface of which is provided with screw-threads 15 15, inclined in one direction. 16 is a movable piston arranged within said case, provided on its exterior surface with screw-threads 17 17, inclined in the opposite direction. This piston is in the form of a hollow cylinder and on its interior surface is provided with screw-threads 18 18, inclined in the same direction as are the screw-threads on its exterior surface. 19 is a central cylindrical fixed abutment provided on its exterior surface with screw-threads 20 20. 21 is a stationary axle seated at its lower end in the bed-plate 22 of the pump. To this axle the central cylindrical abutment 19 is rigidly attached. The upper end of this axle 21 is bored, forming a cavity 23. 24 is a shaft journaled in the cavity 23. 25 is an arm extending inward from the exterior fixed case and forming a journal-bearing for the shaft 24. 26 is a pulley keyed to the shaft 24, by means of which power is applied to cause the said shaft to revolve. 27 is a web keyed to the shaft 24 and rigidly attached to the piston 16. 28 is a web on the lower end of the piston, journaled on the fixed axle 21. 29 29 are inlet-passages and 30 is the outlet-passage.

The operation of the device shown in Fig. 2 may be thus described: Power is applied to the pulley 26, causing the piston 16 to revolve. Water is admitted at the base of the device through the openings 29 29. This water is admitted to both systems of antispire on opposite sides of the piston, passing simultaneously through both systems and is discharged through the outlet 30, according to principles which have been before described. One of the advantages of this form of structure is the fact that a larger quantity of water can pass through the pump in a given period of time, and the device is therefore especially advantageous in cases where a large quantity of fluid is to be elevated. Of course, the same principle may be extended by placing an indefinite number of cylinders one inside

the other, in which case each alternate cylinder will be movable and the intermediate cylinders fixed.

Referring to Fig. 3, 35 is a cylindrical case and 36 is a cylindrical piston placed within said case. The case 35 is placed horizontally and is provided with extensions 37 37 forming journal-bearings for the piston-shaft 39. 40 40 are stuffing-boxes to prevent leakage at the points where the piston-shaft passes through the case. 41 is an inlet-pipe and 42 42 outlet-passages leading to the outlet-pipe 43. 44 is an inlet-port extending around the interior surface of the case 35. On one side of this inlet-port the case is provided with spiral threads inclined in one direction and on the other side of said port the case is provided with spiral threads inclined in the opposite direction. The same is true of the spiral threads on the piston on the two sides of the inlet-port 44. In each system, however, the threads on the piston and those on the case are inclined in opposite directions.

The operation of the device shown in Fig. 3 may be thus described: Water is admitted by the inlet-pipe 41 to the port 44, whence it divides, one half being propelled through the antispire system on the right and the other being propelled through the antispire system on the left. The water passing through both systems is delivered by means of the passages 42 42 to the common exit-pipe 43. The power to operate the piston is applied to the pulley 45. One of the principal advantages of arranging the systems as shown is the fact that the longitudinal thrust on the piston developed on one system is opposed to the longitudinal thrust developed in the other system. Thus they balance each other and friction is reduced to the minimum. When the piston is set horizontally, as shown, it is advantageous to these systems alike, so that the same amount of longitudinal thrust is developed in each. If, however, the piston be set in a vertical position, it is obvious that the lower journal-bearings would have to support the weight of the piston and its attendant parts. In that case it is advantageous to have the system which develops the upward longitudinal thrust do more work than that which develops the downward longitudinal thrust, so that the upward thrust will not only balance the downward thrust, but will also counterbalance the weight of the piston and its attendant parts. Such excess of thrust may be obtained in any suitable manner. This structure also has in it two antispire systems and, other things being equal, has the capacity of passing in a given period of time twice as much water as if a single system were employed. In the same way the water may be admitted to the center of the structure shown in Fig. 2 by suitable modifications of the operating parts, in which case four independent antispire systems would be present and the structure would have the capacity of passing four times as much water as a pump of the same size having but a single antispire system, other things being equal. These structures are capable of pumping or forcing fluids of any density. If they be designed to force air the threads should be smaller than if designed to pump water, and if designed to pump a denser fluid—such as tar, molasses, oil, and the like—the capacity of the threads should be increased, when their number will be correspondingly diminished. Preferably, the entrance-pipe below the pump is provided with any ordinary form of check-valve, (not shown,) so as to keep it full of water to avoid inconvenience and delay in starting the flow. If preferred, the system on the inside and outside of Fig. 2 may work in opposite directions, so that the longitudinal thrust developed in both will balance each other, when the longitudinal thrust developed in the larger system will balance the thrust in the smaller system and will also sustain the weight of the piston and its attendant parts. It may also be remarked that the antispire system, (shown in Fig. 1 placed vertically,) by receiving water at its top and discharging it at its bottom, may be constructed so as to relieve the journals of weight, provided that the weight of the piston and its attendant parts is equal, or approximately equal, to the longitudinal thrust developed in propelling the water.

Without further description it is obvious to any one skilled in the art that the case may be made the movable part and the cylinder the fixed part, or that both case and cylinder may be made movable. The threads are preferably of the same capacity and same inclination throughout their length, although they may vary, if desired. I prefer to give the threads on both the cylinder and the case the same inclination, although this is not necessary. The maximum useful effect, I believe, is produced when these threads are inclined at an angle of seventeen degrees forty minutes. Instead of having the opposing surfaces of the piston and case cylindrical or tubular, they may be of any other suitable form, as long as they have the threads crossing at an angle on the opposing surfaces.

In the foregoing specification I have referred to a few of the modifications which may be employed in practicing my invention; but I have not endeavored to specify all the devices and combinations of devices which may be devised, the object of this specification being to instruct persons skilled in the art to practice my present invention and to understand its nature, and I desire it to be distinctly understood that mention by me of a few modifications is in no way intended to exclude others not referred to, but which are within the spirit and scope of my invention.

Many of the details illustrated and above described are not essential to the several features of my invention, broadly considered. All this will be indicated in the concluding

claims, as in a given claim the omission of an element, or the omission of the particular features of the elements contained therein, is intended to be a formal declaration of the fact that the omitted features or elements are not essential to the operation of the invention covered by the claims.

I do not in this application specifically claim the combination, in a pump, of a moving and stationary part having continuous threads in their opposing surfaces, the threads on each surface being inclined so as to cross the threads on the opposing surface at an angle, as such matter is covered in my pending application, Serial No. 411,521, filed November 10, 1891.

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

1. In a pump, the combination with an inclosing case, a piston and means for applying power to the piston, of water elevating means applied thereto constituting two separate systems, each system consisting of a plurality of opposing surfaces, each provided with continuous threads, the threads on the opposing surfaces being inclined so as to cross each other, said systems being arranged within the same case.

2. In a pump, the combination with an inclosing case, a piston and means for applying power to the piston, of water elevating means applied thereto constituting a plurality of systems of opposing surfaces, each provided with continuous threads, the threads on the opposing surfaces of each system being inclined so as to cross each other and suitable inlet and outlet passages.

3. In a pump, the combination with an inclosing case, a piston and means for applying power to the piston, of water elevating means applied thereto constituting a plurality of systems of opposing surfaces, each provided with continuous threads, the threads on the opposing surfaces of each system being inclined so as to cross each other, both systems being rigidly connected together so that the end-thrust developed in one is counterbalanced by the end-thrust developed in the other.

AUGUSTE DESGOFFE.

Witnesses:
C. MEUERINE,
EUG. WAR.