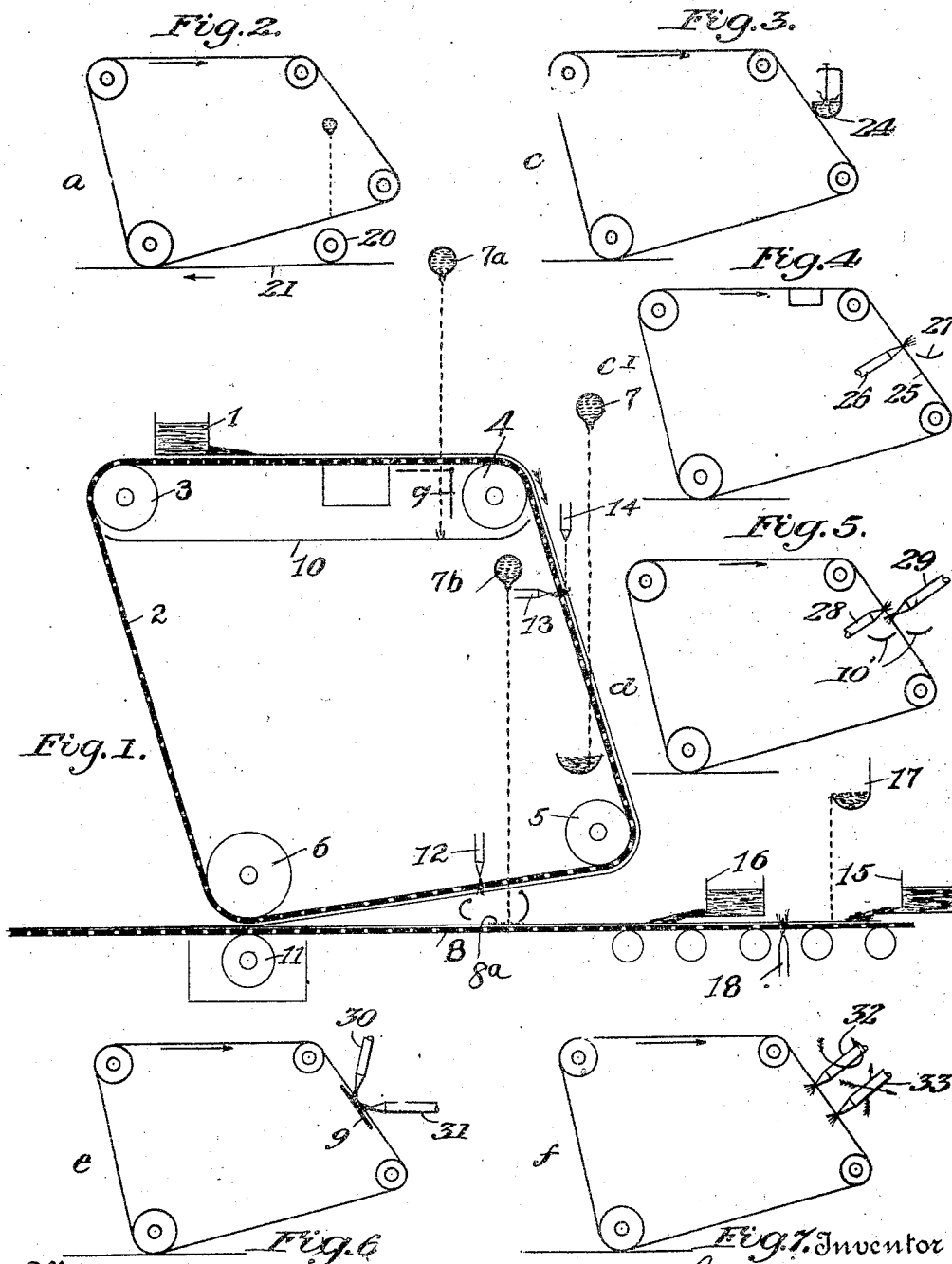


B. ZARNOWIECKI.
MANUFACTURE OF MARBLED PAPER.
APPLICATION FILED FEB. 13, 1913.

1,152,467.

Patented Sept. 7, 1915
3 SHEETS—SHEET 1.



Witnesses
R. J. Hulsizer
E. Daniels

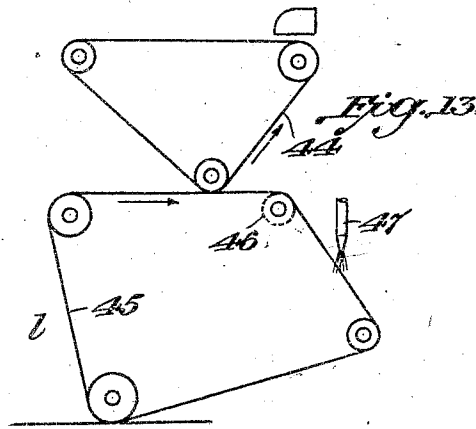
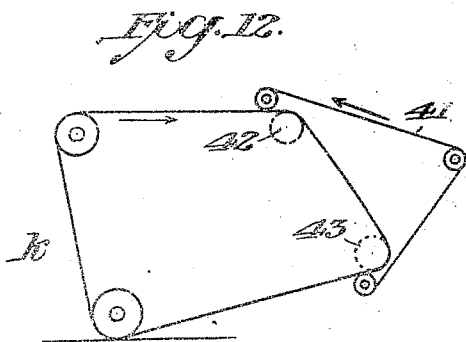
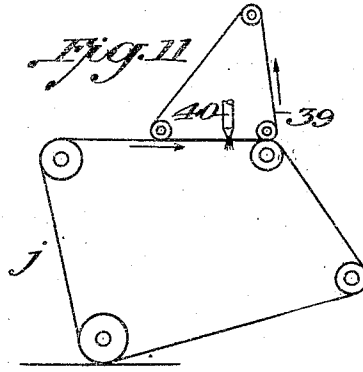
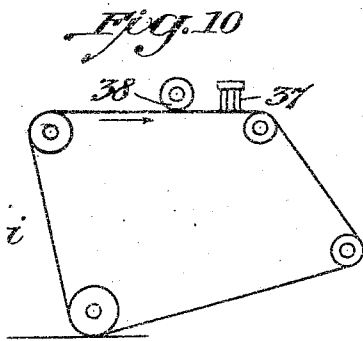
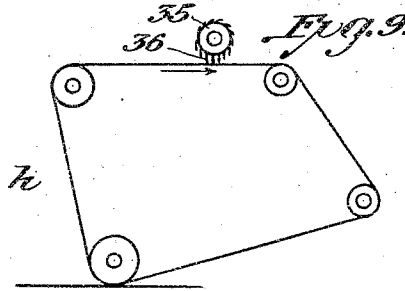
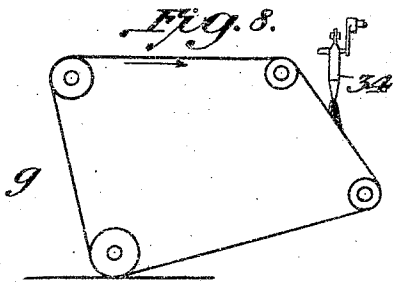
Inventor
B. Zarnowiecki,
by *James T. Krimm*
Attorney.

B. ZARNOWIECKI.
MANUFACTURE OF MARBLED PAPER.
APPLICATION FILED FEB. 13, 1913.

1,152,467.

Patented Sept. 7, 1915.

3 SHEETS—SHEET 2.



Witnesses:

E. C. Tate.

N. P. Leonard.

Inventor:

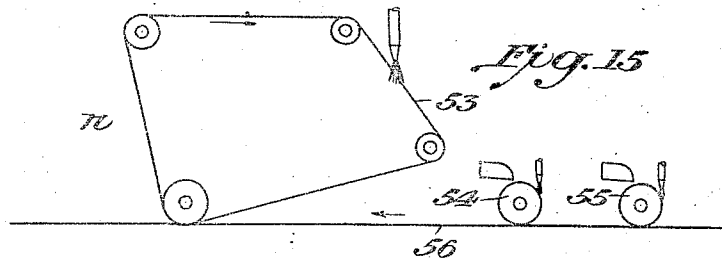
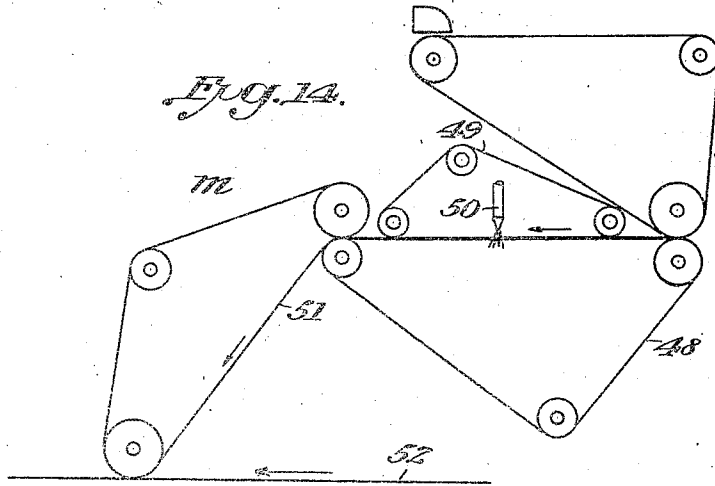
Bozumił Zarnowiecki

By *Reynolds Townsend & Brichman, attys.*

B. ZARNOWIECKI.
MANUFACTURE OF MARBLED PAPER.
APPLICATION FILED FEB. 13, 1913.

1,152,467.

Patented Sept. 7, 1915.
3 SHEETS—SHEET 3.



Witnesses:
E. C. Tate.
N. P. Leonard.

Inventor:
Bozumił Zarnowiecki,
by Pyrus Munnich & Swickles, Attys.

UNITED STATES PATENT OFFICE.

BOGUMIL ZARNOWIECKI, OF GR. LICHTERFELDE, NEAR BERLIN, GERMANY.

MANUFACTURE OF MARBLED PAPER.

1,152,467.

Specification of Letters Patent.

Patented Sept. 7, 1915.

Application filed February 13, 1913. Serial No. 748,213.

To all whom it may concern:

Be it known that I, BOGUMIL ZARNOWIECKI, a citizen of the Empire of Germany, residing at Gross-Lichterfelde, near Berlin, Germany, have invented certain new and useful Improvements in the Manufacture of Marbled Paper, of which the following is a specification.

My invention relates to a process of manufacturing figured or marbled papers by applying to an unbroken and still moist paper web, regularly or irregularly disposed fiber-complexes or groups, which are then pressed into the unfinished web and the thus-treated paper web then finished in the usual way. According to this invention, these fiber-complexes are produced by displacement from a second still moist web arranged to move in proximity to the first-mentioned web and may be either portions completely displaced from the second web, or those residual portions of this web, which latter has been subjected to the action of displacing agents hereinafter referred to.

As suitable means for removing the portions of fibers, there may be employed, for instance, liquids which are dropped on or sprayed over the paper web, compressed air driven from the fine openings of a jet-pipe, or any other mechanical device. In this process the unbroken, unfinished paper-web may either be couched upon the paper-web, or it may be formed by causing the paper pulp for it to run on the previously-broken-up second layer of fibers. Furthermore, the portions of fibers removed as before-mentioned may be thrown upon the intact paper-web by a pressing device. In order to obtain by the new process papers colored on both sides, or, if required, variegated papers, the paper-web already figured on one side may also be figured on the other side by applying a second paper-web broken up according to this process.

By this process it is possible to obtain patterns of every kind, constantly varying and diversified, and of an exceedingly characteristic appearance. Such effects cannot be produced, even for instance by the known processes for producing figured papers in which there is treated only one single paper-web, or one of two united paper-webs, but in which only occasional breakings or only displacements of the coherent fibers are obtained. By the new process it is also possi-

ble to manufacture very thin and smooth papers.

In the accompanying drawings—Figure 1 shows, diagrammatically, a side elevation with parts in section, of one form of apparatus for carrying out the process; Fig. 2 shows, diagrammatically, a modification in which the fiber complexes are first deposited upon a supplementary distributor, and then upon the paper-web; Fig. 3 shows, diagrammatically, a means for dashing water, or very thin paper-pulp which may be of a different color, against a traveling paper-web; Fig. 4 shows, diagrammatically, squirting a fluid against the back of the paper-web; Fig. 5 shows, diagrammatically, means to redistribute fiber-complexes on the front of the paper-web after having been displaced from the rear as in Fig. 4; Fig. 6 shows, diagrammatically, means for spraying a plurality of thin paper-pulps upon and through a paper-web against a rebound plate; Fig. 7 shows, diagrammatically, moving jet-pipes delivering a fluid against a paper-web; Fig. 8 shows, diagrammatically, an oscillating jet-pipe delivering a fluid against the paper-web; Fig. 9 shows, diagrammatically, a roller provided on its periphery with strips of felt, which contact with the paper-web; Fig. 10 shows, diagrammatically, a felt covered roller and a plurality of reeds contacting with the paper-web; Fig. 11 shows, diagrammatically, a traveling stencil in operative relation to the traveling paper-web, and a pressure-fluid delivering device, delivering a fluid through the stencil on the paper-web; Fig. 12 shows, diagrammatically, a suction roller and pressure-fluid delivering roller underneath the paper-web, cooperating with the traveling stencil to displace the fibers; Fig. 13 shows, diagrammatically, a suction roller underneath a traveling felt-support for a paper-web, and a jet-pipe arranged to deliver a fluid against the traveling paper-web; Fig. 14 shows, diagrammatically, means for displacing the fibers of a paper-web on a supplementary carrier, and then transferring the fiber-displaced paper-web to another paper-web; and Fig. 15 shows, diagrammatically, means for super-imposing a plurality of layers of different colored fiber-complexes upon another paper-web.

In Fig. 1, the pulp flowing from the stuff-box 1 on to the wire cloth 2 is hit at an acute

angle by a drop of water falling from the dropping device 7 (the drops if preferred being projected with some force) which is placed above the slanting portion of an endless wire cloth passing over four quadrangularly-arranged rollers 3, 4, 5, 6, the drops striking the paper-web between rolls 4 and 5. Thereby oval groups of fibers are produced, with downwardly-thickened edges.

10 If the water-drops are caused to fall, however, from a dropping device 7^a located between the rolls 3 and 4, onto the upper, horizontal part of the wire-cloth and upon a very thin layer of fibers, the patterns produced by these drops show, after couching,

15 a circle inclosing a point which becomes thicker toward the center.

If the water-drops are allowed to fall on the lower horizontal part of the wire-cloth, between the rolls 5 and 6 and through the wire, for instance from a dropping device 7^b, the drops detach and carry fiber-complexes down with them, whereupon the fibers still adhering to the wire-cloth and passing

25 between the rolls 6 and 11 may either be couched upon the specially-prepared continuous paper-web on the endless wire 8, and the drops loaded with the detached fibers collected and removed, or the drops loaded with paper-fibers may be allowed to fall upon the paper-web on the endless wire 8, as indicated at 8^a. Furthermore, the paper-fibers or fiber-complexes carried along with the drops, as well as the fiber-groups still adhering to the wire 2, may be put on the continuous paper-web. The attachment of the fiber-complexes carried along with the drops to the paper-web can be effected

30 either by allowing the drops to fall directly upon the paper-web, as by 7, 7^a, or by allowing them to first fall upon wire-cloth and then couching upon the paper-web the groups of fibers thus formed; or by depositing groups of fibers upon a supplementary distributor, such as a wire-cloth cylinder 20, as shown in Fig. 2, and then causing the paper-web 21 to run upon the groups of fibers formed upon this intermediate wire-cloth.

50 In order to effect the desired breaking up of the layer of fibers, or the throwing off of fiber particles, there may be employed, instead of water-drops, water sprayed under high pressure, or compressed air, delivered for instance by jet-pipes 12 and 13. The action of the jet-pipes may be periodical, and they may moreover be arranged so as to move laterally, as shown in Fig. 8. When employing water, which drains through the

55 layer of fibers to be broken up, or which drops through it, for instance from the device 7^a, Fig. 1, there may be provided a rebound piece 9, on that side of the wire-cloth which is free from paper-pulp. The gutters

60 10, 10' indicated at certain points in Figs.

1 and 5 serve to collect and drain off any liquid.

By causing streams of water to fall periodically, for instance from an overflow-gutter 17, Fig. 1, particular effects are obtained, accordingly as to whether the water strikes on a slanting or a horizontal surface of the web. Peculiar effects are also produced by running very thin paper-pulp, or pulp of a different color, onto the

70 layer of fibers to be broken up. Water or very thin paper-pulp of a different color may also be thrown against the layer of fibers on the oblique part of the wire-cloth 23, as in Fig. 3, by means of some system

80 of ladles 24, whereby peculiarly displaced patterns are obtained.

If water is thrown from the back of the wire-cloth 25 against the layer of fibers to be broken up, as by a jet 26, Fig. 4, and

85 the water is drawn away by a suction apparatus or gutter 27, the breaks in the paper-web have an indented edge. If colors are sprayed at an acute angle, for instance by means of spraying nozzles 14, Fig. 1, onto

90 the fibers or groups of fibers which have been partly displaced from the surface of the wire-cloth, or lifted up in consequence of the breaking up of the layer of fibers by pressure applied from the lower or inferior

95 part of the wire, for instance by means of air or a liquid pressed from jet-pipes 13, then the groups of fibers are colored on one side. The groups of fibers thus treated have, after being couched upon the other paper-

100 web, a relief-like appearance on the paper. The water which has penetrated from the back, as from 28, Fig. 5, and the fibers carried along with it, can be collected or thrown

105 back on the wire-cloth by means of compressed air as from the jet 29. In the latter case a more blurred pattern is obtained. If two such layers of fibers of different color are couched upon the paper-web, one over the other, the marbling becomes tricolored.

110

By periodically spraying on the paper-web diluted paper-pulp of different color, as by means of high pressure-water-pipes, 30, 31, Fig. 6, at different angles and from

115 different sides, from nozzles which may be movable, for example as shown in Fig. 8, if preferred using a rebound plate 9 close behind the wire, as shown in Fig. 6, peculiar cloudy pictures are obtained. Peculiar breakings of the layer of fibers may

120 also be obtained as in Fig. 7, by means of differently arranged and differently moving jet-pipes 32, 33 from which air or water is pressed.

When water is pressed from jet-pipes 34, Fig. 8, which, while oscillating like a pendulum over the slanting part of the wire, periodically act upon the layer of fibers at an acute angle, the so-called tiger-spotted pattern is obtained. A rotating roller 35

130

provided along its length with strips of felt, 36, Fig. 9, and acting upon the layer of fibers produces the same effect.

Other means for breaking up and displacing the layer of fibers are, as shown in Fig. 10, stiff tissues, cloths, or ropes 37, and rollers coated with felt 38, whalebone reeds arranged in the form of rollers or rods, or similar devices with a rotary or sliding action, such as described in U. S. Patent 1,052,716.

Clearly-defined patterns can be obtained by means of a stencil 39 made for instance of india-rubber cloth, Fig. 11, running along with the wire-cloth and lying close to it. The pressure device 40, Fig. 11, or 43 of Fig. 12, is caused to act through this stencil upon the layer of fibers to be broken up. This stencil may also be arranged so as to run more quickly or more slowly than the wire-cloth, or to move laterally thereto. When using a stencil 41, a suction-roller 42 may be employed as shown in Fig. 12, instead of the pressure-device 40 of Fig. 11, for breaking up the layer of fibers in a determined pattern. In using a press-roller, this roller may replace one of the guide-rollers 4 or 5, of Fig. 1.

A layer of fibers couched from the wire-cloth 44, upon a felt 45, as in Fig. 13, may be treated in such a manner that the felt 45 with the layer of fibers runs over a suction roller 46 provided with slits, which sucks up the fibers in strips, through the felt. If a spray of water driven by high pressure from jet 47 is now caused to act at an acute angle upon the layer of fibers, the fibers which have not been sucked up are massed together. The pattern thus obtained shows, after being couched upon the paper-web, edges thickened on one side.

Some working methods may also be carried out upon an entirely impermeable substratum as in Fig. 14. For instance a layer of fibers running on canvas 48 can be treated with the aforementioned stencil 49 and a water-spray 50. The fiber is thereby partially floated, and must first be taken up by a felt 51 running through a press and then transferred onto the paper-web 52.

Multicolored marblings may, as shown in Fig. 15, be produced by couching one over the other several different layers of fibers previously treated upon a number of wire-cloths 53, 54, 55. The thus-prepared much broken-up layer of fibers is then transferred to the base paper-web 56. For this method, cylindrical wire-cloths are also suitable, and it is not necessary that the wire-cloths be deeply covered.

The drawing in Fig. 1 also illustrates means for practising the new process when using endless wire-cloths, or when it is intended to make papers with patterns on both sides. In this case the paper-pulp for

the layer of fibers to be broken up runs from a supply pipe 15 onto the endless wire-cloth 8, and is then treated by means of one of the above-mentioned devices for breaking up the layer of fibers. By properly applying those devices, almost any effects can be produced obtainable by using a frame-wire. The drawing illustrates, for instance, the use of liquid-streams flowing from a gutter 17, and of air or a liquid pressed from a jet-pipe 18 placed at the lower side of the wire and penetrating through the wire. Upon the layer of fibers broken up as above-mentioned or by any other means, if preferred by simultaneously using stencils or suction- or pressure-rollers, the paper-pulp for the real paper-web is run. In order to obtain papers colored on both sides, a second broken-up layer of fibers, produced for instance by the frame-wire arrangement, can be applied to the upper side of the paper-web in the above-described manner, by couching or throwing it on the latter.

I claim—

1. The process of manufacturing figured papers, which consists in applying to and pressing into an unfinished paper web additional fiber-complexes produced by displacement of the fibers of another paper web.

2. The process of manufacturing figured papers, which consists in displacing the fibers of a paper-web by the action of a fluid fiber-displacing agent to form fiber complexes, and then incorporating said fiber-complexes into an unfinished paper-web.

3. The process of manufacturing figured papers, which consists in displacing the fibers of a paper-web by the action of an oscillating fluid fiber-displacing agent to form fiber complexes, and then incorporating said fiber-complexes into an unfinished paper-web.

4. The process of manufacturing figured papers, which consists in displacing the fibers of a paper-web by the action of a pressure-fluid fiber-displacing agent to form fiber complexes, and then incorporating said fiber-complexes into an unfinished paper-web.

5. The process of manufacturing figured papers, which consists in displacing the fibers of a paper-web by the action of an intermittently-acting fluid fiber-displacing agent to form fiber-complexes, and then incorporating said fiber-complexes into an unfinished paper-web.

6. The process of manufacturing figured papers, which consists in displacing the fibers of a paper-web by the action of a pressure-fluid fiber-displacing agent passing through said paper-web to form fiber-complexes, and then incorporating said fiber-complexes into an unfinished paper-web.

7. The process of manufacturing figured

- papers, which consists in displacing the fibers of a paper-web by the action of a pressure-fluid fiber-displacing agent passing through said paper-web to a rebound-plate, deflecting said pressure-fluid from said plate against said paper-web, said pressure-fluid thereby producing fiber-complexes, and incorporating said fiber-complexes into an unfinished paper-web.
8. The process of manufacturing figured papers, which consists in displacing the fibers of a paper-web by the action of an intermittently-acting pressure-fluid fiber-displacing agent to form fiber-complexes, and then uniting the resulting paper-web and fiber-complexes with an unfinished paper-web.
9. The process of manufacturing figured papers, which consists in displacing the fibers of a paper-web by dashing thereupon a mass of fibers suspended in a fluid fiber-displacing agent, thereby forming fiber-complexes, and uniting said paper-web with an unfinished paper-web.
10. The process of manufacturing figured papers, which consists in displacing the fibers of a paper-web by coöperating fluid and solid fiber-displacing agents, thereby forming fiber-complexes and uniting said resulting paper-web and fiber-complexes with an unfinished paper-web.
11. The process of manufacturing figured papers, which comprises displacing the fibers of a colored paper-web by a fiber-displacing agent to form fiber-complexes, and uniting the resulting paper-web and fiber-complexes with the fiber-complexes of another paper-web.
12. The process of manufacturing figured papers, which comprises displacing the fibers of a colored paper-web by a mass of fibers suspended in a fluid fiber-displacing agent, thereby forming fiber-complexes, and uniting said paper-web and fiber-complexes with a plurality of other colored paper-webs and fiber-complexes.
- In testimony whereof, I affix my signature in presence of two witnesses.
- BOGUMIL ZARNOWIECKI.
- Witnesses:
ARTHUR KUHN,
WOLDEMAR HAUPT.