UNITED STATES PATENT OFFICE.

JOSEPH VANNINI, OF NEW YORK, N. Y.

IMPROVEMENT IN THE MATHEMATICAL OPERATION OF DRAWING LOTTERY-SCHEMES.

To all whom it may concern:

Be it known that I, JOSEPH VANNINI, of the city, county, and State of New York, have invented an Improvement in the Mathematical Operation of Drawing Lottery-Schemes, of which the following is a specification.

Now I proceed to the explanation of my plans of lotteries, and will commence with an explanation of the principles on which a lottery may be formed by combination of number or numbers on each ticket.

To form a lottery of ninety numbers by ternary combinations, I begin to explain that any set of numbers in succession are assumed, commencing with No. 1. In the present instance ninety numbers are taken. Of these combinations of three numbers each are made to the amount of all the combinations of which they are susceptible. The series of 1 2 3, 1 2 4, 1 2 5, &c., to 1 2 90 will give eighty-eight tickets. The series of 1 3 4, 1 3 5, 1 3 6, &c., to 1 3 90 will give eighty-seven tickets, continued in the same manner till you come to 1 89 90. The number 1 will then be repeated eighty-eight times in the first series, eighty-seven in the next, and so on, giving a series in arithmetical progression, the first term of which is 1, the common difference 1, and the last term 88, the sum of which is expressed by this formula: $\frac{88 \times 89}{2} = 3,916$, giving the repetition of No. 1 in the tickets. It can be shown that each of the ninety numbers will be repeated an equal number of times. Therefore $3,916 \times 90 = 352,440$, the numbers of all the numbers contained in the tickets. The formula is reducible to the following: $\frac{88 \times 89 \times 90}{6} = 117,480$, the numbers of tickets—that is, the three highest of the numbers used multiplied into each other and the product divided by six, and their last product divided by ten will give the number of combinations and the number of tickets used in the scheme—that is to say, there will be one hundred and seventeen thousand four hundred and eighty combinations of three numbers each and only eleven thousand seven hundred and forty-eight tickets, each of them having on it ten ternary combinations—that is,

ten combinations of three numbers each. With the same rules, $\frac{88 \times 89 \times 90}{6} = \frac{117,480}{20} = 5,874$, there will be one hundred and seventeen thousand four hundred and eighty combinations of three numbers each and only five thousand eight hundred and seventy-four tickets, each of them having on it twenty ternary combinations, or twenty combinations of three numbers each. With the same rules a ticket may be formed with 35 56 84, one hundred and twenty and more combinations on them.

The tickets in this lottery will begin with No. 1 2 3 to 1 89 90, next with 2 3 4 to 2 89 90, next the same with 3 4 5 to 3 89 90 till you come to 88 89 90. You will then have all the combinations of three numbers that can be made out of the ninety numbers—that is to say, you will have one hundred and seventeen thousand four hundred and eighty ternary combinations. Place on each ticket ten of those ternary combinations at random, then you will have eleven thousand seven hundred and forty-eight tickets with ten ternary combinations, as in diagram A. With the same rules divided $\frac{117,480}{20}$ you will have five thousand eight hundred and seventy-four tickets with twenty ternary combinations on them, and so on, by dividing 117,480 by 35, 117,480 by 56, 117,480 by 84, 117,480 by 120, &c., you may form a lottery with any numbers of ternary combinations on each ticket. Ninety ballots are made having the ninety numbers in succession on them. These are put into a box or wheel and five of them are drawn out at random. This is the whole drawing which decides the fate of one hundred and seventeen thousand four hundred and eighty ternary combinations.

The five numbers drawn out of the ballot box or wheel are susceptible of ten combinations of three numbers each. Suppose 1 2 3 4 5 to be the numbers drawn, then 1 2 3, 1 2 4, 1 2 5, 1 3 4, 1 3 5, 1 4 5, 2 3 4, 2 3 5, 2 4 5, and 3 4 5 are such combinations. These I shall call prizes of three numbers each, and the tickets whose three numbers correspond with three numbers of any one of the drawn ballots shall be

prizes of three numbers each. These tickets will not draw prize or prizes of one or two numbers each again. I also form binary combinations of ninety numbers. I commence with the series 1 2, 1 3, to 1 90, which will give eighty-nine tickets. The series 2 3, 2 4, to 2 90 will give eighty-eight tickets, continued in the same manner till you come to 89 90. The number 1 will then be repeated eighty-nine times in the first series, eighty-eight times in the next, and so on, giving a series in arithmetical progression, the first term of which is 1 and the last term 89, the sum of which is expressed by this formula: $\frac{89 \times 90}{2} = 4,005$. The numbers of tickets—that is, the two highest of the numbers used—multiplied into each other and the product divided by two, and their last product divided by ten, will give the number of combinations and the number of tickets used in succession in the scheme. It can be shown that each of the ninety numbers will be repeated an equal number of eighty-nine times. Therefore $\frac{89 \times 90}{1} = 8,010$, the number of all the numbers contained in the tickets. These formulas are reducible to $\frac{88 \times 90 - 4005 - 400\frac{5}{10}}{2}$, given ten binary combinations, or combinations of two numbers on each ticket, as in diagram C.

The five numbers drawn out of the ballot box or wheel are susceptible of ten combinations of two numbers each, thus 1 2 3 4 5 be the drawn numbers. Then 1 2, 1 3, 1 4, 1 5, 2 3, 2 4, 2 5, 3 4, 3 5, and 4 5 are such combinations. These I shall call prizes of two numbers each, and the tickets whose two numbers correspond with two numbers of any one of the drawn ballots shall be prizes of two numbers each. These tickets will not draw prizes of one number each again. To form the extra ticket or tickets having on them one single number the number 90 must be multiplied by 1 and divided by 5, as in diagram C, which will give the result of eighteen tickets each having on them five single numbers. The five numbers drawn out of the ballot box or wheel are susceptible to five extra numbers, or five prizes of one number each. These I shall call prizes of one number each. Now the formation of this lottery of ninety numbers with five drawn ballots consists of only eleven thousand seven hundred and forty-eight tickets, each ticket having on it five extra numbers, ten binary and ten ternary combinations. The formation of a ticket in this lottery will be as thus:
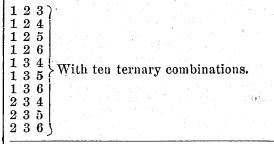
Diagram C.

$\left.\begin{array}{l} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array}\right\}$ Of five separate numbers.

Diagram B.

$\left.\begin{array}{l} 1\ 2 \\ 1\ 3 \\ 1\ 4 \\ 1\ 5 \\ 2\ 3 \\ 2\ 4 \\ 2\ 5 \\ 3\ 4 \\ 3\ 5 \\ 4\ 5 \end{array}\right\}$ Of ten binary combinations.

Diagram A.

$\left.\begin{array}{l} 1\ 2\ 3 \\ 1\ 2\ 4 \\ 1\ 2\ 5 \\ 1\ 2\ 6 \\ 1\ 3\ 4 \\ 1\ 3\ 5 \\ 1\ 3\ 6 \\ 2\ 3\ 4 \\ 2\ 3\ 5 \\ 2\ 3\ 6 \end{array}\right\}$ With ten ternary combinations.

The prizes of one, two, and three numbers each will be regulated according to the price of the above eleven thousand seven hundred and forty-eight tickets. The only profit arising from this lottery will be the usual discount of fifteen per centum on the prizes.

Now I shall explain the mode of selling the tickets in this lottery.

In every eighteen tickets of ternary and binary combinations there will be eighteen tickets having on them five extra numbers, embracing all the ninety numbers, from 1 to 90. So in every parcel of eighteen tickets each there will be found five extra tickets having on them the five drawn numbers or prizes of one number each. In every eight hundred and one tickets, each having on them ten binary combinations, there will be found twenty prizes of two numbers each. Those ten prizes of three numbers each are at random. If only a few tickets are sold to adventurers by the managers, it may so happen to find them all sold.

Lotteries on the same principle may be formed with less or more numbers of tickets; also with names or alphabetic letters representing the number or numbers of tickets; also with even numbers; also with odd numbers; also with even and odd numbers separately; also with more or less extra binary and ternary combination of numbers on each ticket, on the same principle as above stated. As my second patent right has expired I will, if I see fit, add it to my new patent, and decide the fate of both lotteries by one drawing.

Difference between my former and present plans of drawing lotteries.—In my former plans a ticket has only three numbers on it. In this new plan a ticket consists of five separate numbers on each—tickets with ten combinations of two

numbers each, and tickets with ten combinations of three numbers each, giving to adventurers a chance to draw several prizes. In my former plans a lottery of ninety numbers is formed of one hundred and seventeen thousand four hundred and eighty tickets. In this new plan those of one hundred and seventeen thousand four hundred and eighty tickets are reduced to only eleven thousand seven hundred and forty-eight.

.What I claim as my invention, and desire to secure by Letters Patent, is—

The mode herein described of forming lottery-schemes by making tickets with a series of ternary and binary combinations with extra numbers on each ticket, and diminishing the number of tickets in every lottery and regulating the drawing in the manner set forth.

JOSEPH VANNINI.

Witnesses:
    HENRY STONE,
    JOHN H. TITCOMB.