

during the interval since the immediately previous division. I shall call this species of assurance *tontine*.

5. The proportion of the pure premium income to be divided should be so determined that the sum payable at death shall be as little as possible affected by the duration of the assurance, especial care being taken that it shall, at any rate, not diminish with an increasing duration of the assurance. In order to effect this I propose that, provisionally, and until the working of the section itself yields data for a more precise estimate, the portion of the pure premium to be divided shall be that which remains after making the same reserve that would be required for healthy lives paying the same premium and having entered at the same age. By this apportionment of the premium the expenses of management would be defrayed from year to year, and a reserve would be accumulated to meet the time when the temporary insurance premium would be in excess of the level pure premium. As soon as this time had arrived the sum periodically divisible would have to be greater than the whole premium income of the corresponding interval, the balance being made up by the accumulation at interest of those portions of the earlier premium income which had not been divided.

6. As an illustration of the scheme in its simplest form, let us suppose a thousand persons, all aged thirty-five, insuring simultaneously, and let us suppose there are no subsequent admissions and no lapses. Let each of these persons pay a pure annual premium of £2 during life, which will, as nearly as possible, assure £100 on a healthy life of the same age, and let the annual expenses of management be 5s. per head (*i.e.*, $12\frac{1}{2}$ per cent. of the pure premium).^{*} The income of the first year is £2,250, of which £250 is required for management expenses. Of the remaining £2,000, together with interest accrued thereon, a certain portion is to be equally divided among the representatives of those dying during the year. To find what portion is to be so divided we must ascertain what proportion of the pure premium payable by a healthy life for insurance of £100 would have to be reserved at the end of a year's assurance. From the ordinary valuation-tables we find this reserve to be £1 3s. 7d., or nearly $60\frac{3}{4}$ per cent. of the pure premium. Hence the sum to be divided in the first year would be about 40 per cent. of £2,000, *plus* £80 for interest, or about £880. Had the lives been of average health, about nine deaths might have been expected to take place during the year. Let us suppose, then, that four times this number takes place. Then £880 will be divisible among thirty-six persons, giving about £24 to each, while £1,200 is carried to the reserve fund.

7. In the second year the office starts with a reserve fund of £1,200, which earns about forty-eight pounds' worth of interest during the year. As there are now 964 policyholders, the premium income of the year is £2,169, of which £241 is expended in management, leaving a net premium income of £1,928. Adding £77 for interest, £1,200 for reserve from previous year, and £48 for interest on same, we have a total fund of £3,253. Of this the valuation-tables show that £2 8s. must be reserved on each policy, or £2,314 in all. This leaves £939 for distribution among the claimants of the year. Let us suppose them to be again thirty-six (thirty-six out of 964 being a somewhat higher death-rate than thirty-six out of 1,000), then each will receive about £26. The further progress of such a fund is indicated in the subjoined schedules.

8. For several years the sum divisible will be smaller than the net premium income; but from and after a certain date it will always be in excess of that income, and it will eventually exceed the premium income and revenue from interest taken together, and thus begin to trench on the reserve. Two questions therefore present themselves—namely, (1) Will the reserve, diminished according to this law, hold out till the last life is extinct? (2) Will it be exhausted by the failure of the last life? The answers to these questions must, from the nature of the case, obviously be in the affirmative, and researches on the mortality of under-average lives tend to show that the practical result will be that the longest lives will obtain larger sums than those who die early.

9. We have thus examined the simplest case that can occur. In practice of course the conditions will be more complicated. The insurants will not all be of the same age, they will not enter simultaneously, they will not desire to insure for the same amounts, and we shall not be able to make payments to the representatives of those who die soon after entry. Let us examine how these complications severally affect the working of the scheme.

10. Where persons, entering at the same age, desire to be insured for different amounts it is, of course, only necessary to make their premiums proportioned to the sums for which they wish to be insured. It is impossible to quote a definite premium per £100, since no fixed sum can be guaranteed at death; but it is possible to assume an abstract unit of assurance, to which a stated premium shall correspond, and the right to which shall constitute a single *tontine share*. Persons could then be allowed to purchase one or more shares, and would pay premiums in proportion to the number of shares purchased. In the case of a person purchasing a plurality of shares, his death would count in the *tontine* division as a plurality of deaths, and the sum receivable by his representatives would therefore be in proportion to the number of his shares. It is hardly necessary to add that, in ascertaining the amounts to be respectively divided and reserved in accordance with the principle enunciated in section 5, the premium for each share should be treated as in all respects a separate premium.

It would probably be advisable to permit insurance for fractional parts of a share, such as three-quarters of a share, one-and-a-half share, two-and-a-quarter shares, &c.; but I would fix a minimum limit (say, £1) to the premium receivable from a single individual, *i.e.*, I would not allow any individual to purchase so small an amount of insurance that his premium would fall short of £1; or, if it were thought desirable, for the sake of insuring funeral benefits to the poorer classes, to go below this limit, I would make the premiums payable proportionately larger, so as to cover the proportionately greater cost of management.

^{*} I ignore, for the sake of simplicity, the fact that the initial expenses of management would be much heavier than those which periodically recur.