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*On Reversionary Life Interests as Securities for Loans. By T. B. SPRAGUE, M.A., Vice-President of the Institute of Actuaries.*

[Read before the Institute, 25 November 1872.]

OF all the securities proposed to insurance companies, reversionary life interests are the most troublesome to deal with in the ordinary way of mortgage; and the objections to so dealing with them have been considered by many actuaries so serious, that they have laid down the rule that the only safe way of making an advance on the security of a reversionary life interest is by way of reversionary charge. The transaction, they think, should be in the nature of a sale rather than a mortgage, a portion of the reversionary life interest being sold in consideration of the present advance.

When a borrower applies for a loan on a reversionary life interest, he generally expects to be called on to effect an insurance of about the same amount as would be required to secure a loan on an immediate life interest; and it is difficult to make him understand why a greatly larger insurance is necessary to protect the lender. The reason becomes obvious enough when we consider what remedy a lender has in the event of the borrower failing to pay his interest and premiums. In that case, there appear to be three possible courses open to the lender. First, he may, by agreement with the borrower, allow the premiums and

interest to accumulate at compound interest; or, secondly, he may sell the reversionary life interest; or, thirdly, foreclose. Suppose the amount of the insurance that has been effected to be such as would be required in the case of an advance on the security of a life interest in possession, or to exceed the sum lent by about 20 per-cent. Then, if the first of the above courses is adopted, and the interest and premiums are allowed to accumulate at compound interest, it is clear that in a very few years, (probably within three years, under the circumstances supposed) the accumulated amount of the loan will exceed the insurance, and a further insurance will become necessary to protect the lender from loss by the death of the borrower. Should the borrower be still in good health, no difficulty arises. If, however, he has fallen into bad health, and his life is only insurable at a greatly increased premium, the value of his reversionary life interest will be much reduced; and unless the sum originally lent was but a small fraction of the value, the lender may probably find that the security is worth less than he has lent upon it. But it may happen that the borrower's life has become wholly uninsurable. If it were then certain that he would die within a short term of years, the difficulty would be met by increasing to a moderate extent the original amount of the insurance; but, as is well known to all persons familiar with life insurance business, a person whose life is practically uninsurable may nevertheless live for ten or even twenty years; and if the borrower's life in the case supposed should be extended in this way, the accumulations at compound interest would make his debt very greatly exceed the amount of the insurance, so that the lender would receive on the death of the borrower only a small part of the sum due to him. It appears then that, in this case, in order to protect the lender completely, the full insurance that will be ultimately required should be effected (or arranged for) at the outset when the loan is originally granted. Secondly, suppose that the lender attempts to sell the reversionary life interest; then since the purchaser will in no case receive any income until the death of the life tenant, and will receive nothing at all if the reversioner should die before the life tenant, he will of course require to have an insurance on the reversioner's life sufficient to cover the probable amount of the accumulations at compound interest of his purchase money and the premiums which he may pay before he comes into possession of the reversionary life interest. Here the same difficulty meets us; for, under the circumstances supposed, a new insurance will have to be effected when

the reversionary interest is put up for sale, and it may happen that the reversioner's life has become uninsurable; in which case the reversionary life interest will be perfectly unsaleable. Lastly, if the lender forecloses, he practically becomes the purchaser himself, and the same remarks apply.

From these considerations we conclude that, in order to make a loan in the ordinary way of mortgage on the security of a reversionary life interest, an insurance on the reversioner's life must be either effected or arranged for at the outset, of sufficient amount to render the reversionary life interest practically saleable, at such a price as to return the lender the amount of his advance with all arrears of interest and premiums and legal costs. Suppose, for example, that the life tenant is 60 and the reversioner 30, then a reversionary annuity of £1000 will be worth £4276, and the policy necessary to protect a purchaser fully will be £14,286 (see the tables appended to my paper "On the Valuation of Reversionary Life Interests" vol. xiv, pp. 432, 3). The annual premium on this policy will be £319. 13s.; and the very largest sum that could be lent on the security of the annuity would be £3500. In this case, then, the amount of the insurance exceeds four times that of the advance, even when we take the smallest margin consistent with safety. Taking the interest at 5 per-cent, the annual sum which the borrower is required to pay is £495, or more than 14 per-cent on the advance. If the loan is to be allowed to accumulate at compound interest, of course the amount that could be advanced is greatly reduced. Thus, for example, if in the above case the interest and premiums are to accumulate at 5 per-cent compound interest for 5 years, the sum to be lent must be so fixed that the accumulated amount of the debt at the end of the five years shall be so much less than the then value of the reversionary annuity that there is no doubt, in the event of that annuity being sold, the lender will receive the full amount of the debt and costs. The value of the reversionary annuity of £1000 and the policy of £14,286, at the end of the five years will be very nearly the same as that of a similar annuity on a life of 30 expectant on the death of 65, which the table referred to above gives as £5227. The accumulated amount of the debt at the end of five years should therefore not be more than about £4700; whence it follows that the original loan should not be more than £2229, so that the insurance is no less than 6.4 times the sum lent.

In all the cases we have considered, it is to be observed that the large policy is not required at the outset of the transaction, but is

only necessary for the purpose of guarding against the risk of the borrower's life becoming uninsurable. If the loan is to accumulate at compound interest, it appears at first sight as if an increasing insurance, which should always exceed the amount of the accumulations by a fixed sum, would meet the requirements of the case, as being sufficient to protect the lender and calling for the smallest possible payment from the borrower. But on closer examination this will, I believe, be found to be impracticable. In order to meet the borrower's convenience, the term of the accumulation would have to extend until the death of the life tenant; but unless the latter were of a very advanced age, probably no insurance company could be persuaded for any reasonable consideration to grant an insurance increasing yearly until his death. If the term of accumulation and the term for which the policy increases is to be a moderate term of years only, some new arrangement will have to be entered into at the expiration of that term; and whatever the nature of that arrangement may be, a further insurance would be required beyond the insurance already arranged for, and we are thus again met by the risk of the life having become uninsurable. If instead of effecting at once the full insurance that is necessary to protect fully the security, an increasing insurance is effected which increases by annual steps thro' a course of, say, 20 years, till it reaches the full amount, the cost to the borrower will be somewhat reduced. If, in this case, the premium on the increasing insurance is a uniform one, the saving to the borrower will, I believe, be comparatively unimportant. This, however, is a point which appears to require further investigation. On the other hand, insurance companies would be reluctant to grant such an increasing insurance at a premium increasing proportionately. The immediate cost to the borrower may be reduced by effecting the insurance on the ascending scale of premium or on the half-premium plan; but this involves a still greater increase of his ultimate payments, if the reversion does not fall in early.

The foregoing arguments appear to prove beyond all question that in general it will be much more satisfactory, both for borrower and lender, that the advance should be made by way of reversionary charge rather than by way of mortgage. Altho' the necessity of a large insurance is amply demonstrated, the terms of the mortgage appear so onerous to the borrower that the transaction is likely to bring a lender into disrepute. Generally speaking, the borrower is not in a position to pay the interest on the loan and the premiums on the heavy insurance necessary to secure the advance properly;

and the only way in which he can practically find the means to do so is by borrowing further sums from year to year as his payments grow due, by which means his indebtedness accumulates at a truly frightful rate. If, however, the advance is made by way of reversionary charge, he is called on for no payment until he comes into possession, and he knows exactly what payments he will then have to make out of the income he receives. On the other hand, the lender will receive nothing until the death of the life tenant. This circumstance renders the transaction almost always an unsuitable one for an individual lender, but forms no objection when the lender is a life insurance company; in fact, almost all life insurance companies, and more particularly the young and growing companies, have constantly sums coming into their coffers from premiums, interest, and repayment of loans, for which they are seeking investments; and it is only in the case of a very old company, in which the outgo largely exceeds the income, and the invested funds have to be realized in order to pay the claims, that transactions of this nature are quite unsuitable.

I shall, therefore, throughout the remainder of this paper, consider that the lender is a life insurance company; and I take this opportunity of repeating what I have said on a former occasion, that I think transactions of this nature are extremely well suited for the investment of the funds of well established and prosperous life insurance companies. Altho' an office making large advances by way of reversionary charge runs the risk in every case of sustaining a loss on the investment, through the life tenant and the reversioner jointly living beyond their expectation, yet it is fully compensated for this risk by the chance it has of making a profit by the early death of the life tenant in other similar transactions, and the increase of its insurance business caused by the large insurances they introduced.

Assuming, then, that the advance is made by way of reversionary charge, it is to be observed that the arrangement admits of various modifications, which I propose to consider briefly. It may firstly be stipulated that the borrower shall pay an annuity, to run from the day of the death of the life tenant until that of his own death; and in this case it is usual to name beforehand a sum for which the annuity can be redeemed, at the option of the borrower, at any time after it has become payable. It may, secondly, be stipulated that the borrower shall, upon coming into possession, pay a fixed sum to the office; and in this case it is necessary to add that, until he pays such sum, he shall pay interest

upon it at a fixed rate and also the premiums on policies sufficient to secure the charge. Each of these methods has its own advantages for the company. In both, the company must, at the time of making the advance, effect policies for the whole term of the borrower's life of such an amount as is considered sufficient to secure the transaction. In the latter case, where the office is entitled to demand payment of the charge on the death of the life tenant, and of course has the usual power of sale, which it can exercise whatever may be the state of health of the borrower, justice requires that the policies shall become the property of the borrower, from the date when he becomes liable to pay the charge. They will then be treated as mortgaged to the company to secure the amount of the charge and interest due to it; and any excess of insurance beyond that amount will belong to the borrower's estate. It seems open to question whether the policies should not be considered in this light from the very outset. The office will naturally effect policies without profits, because the cost of such is less than that of participating policies. In the former case, it will be more advantageous to the company to effect policies with profits, for the reason that in fairly successful offices, the bonuses declared on a policy greatly exceed in value the difference between the participating and non-participating premiums. Then, if the borrower does not exercise his option to pay off the charge, the company has the benefit of the bonuses accruing from time to time on the policies, which may easily, if the offices have been well selected, increase the rate of interest realized by one per-cent per annum. If the borrower redeems the annuity, his right to the policies is matter of arrangement, and it seems fair that the bare policies should be assigned to him, the bonuses being retained by the company. It is clearly unjust that the policies should belong absolutely to the company; but as the company is under no obligation to effect participating policies, it is reasonable that if it pays the higher premium required for them, the bonuses thus gained should be, in any event, its property. When the terms of the advance are arranged in the latter of the above methods, the company, in addition to the right of requiring payment of the charge, has the advantage of being subject to a smaller deduction for income tax; for this is calculated only on the interest, whereas, in the case where the company receives an annuity, the tax is calculated, not on the portion of it which represents the interest on the cost, but on the full amount. As I mentioned in my paper above referred to, when the advance is made in the former of the above



methods, it seems the best course in practice for the company to effect at the outset policies considerably less than the amount required fully to protect the security, trusting that the bonus additions to the policies will increase the sum assured to a sufficient extent by the time the annuity becomes payable.

In the case where the amount borrowed is very small in comparison with the value of the reversionary life interest, so that the reversionary charge is either less or but little more than a year's income of the property charged, it is sometimes thought sufficient, instead of effecting a policy for the whole term of the reversioner's life, to effect one on his life against that of the tenant for life and for, say, 3 years longer. In this case it is of course stipulated that the borrower shall pay a fixed sum on coming into possession; and it is anticipated that if he should fail to do so, or to make some other satisfactory arrangement, within, say, a year after the death of the life tenant, the company would have no difficulty in going into receipt of the rents or other income, and obtaining the full amount of the charge with interest, premiums, and costs, before the expiration of the insurance.

The formula for the amount of the reversionary charge in this case is precisely the same as that by which the value of a contingent reversion is found. The value of 1 to be paid by the borrower aged  $x$ , on the death of the life tenant aged  $y$ , if he is then alive, is

$$1 - (P + d)(1 + a_{xy})^*;$$

$P$ , in the case under consideration, denoting the annual premium for an insurance on the life of  $x$  against  $y$  and for 3 years longer. This assumes that the amount of the insurance effected is the same as that of the reversionary charge. It is true that in practice the reversionary charge will bear interest from the day of the death of the tenant for life, and that the lender may also have to pay the premium on the policy, and law costs; but as by supposition the income of the mortgaged property is large in comparison with the loan, and if the borrower should die there will be always current income available towards paying the charge, it seems unnecessary to require a larger insurance than for the amount of the loan. It is of course provided, that until the borrower pays the amount of the charge and interest, he shall pay the premiums that fall due on the policy, those which fall due before the death of the life tenant being paid

\* If a single premium is payable for whole world license or for an insurance against the birth of issue, this must of course be subtracted from the above formula.

by the lender. If now the policy is drawn in the ordinary way, it may happen that the life tenant dies the day after the lender has paid a premium, so that the borrower would have no premium to pay for a year; and, on the other hand, the life tenant might die the day before the premium fell due, in which case the borrower would immediately have to pay a premium. To avoid this inequality, it seems better to provide that the premiums falling due before the life tenant dies shall be commuted by a single payment, and that the first premium to be paid by the borrower shall fall at a fixed time, say 3 or 6 months after the death of the life tenant. Taking the interval as 6 months, the policy would not be on the life of  $x$  against  $y$  and 3 years longer, but on the life of  $x$  against  $y$  and  $2\frac{1}{2}$  or  $3\frac{1}{2}$  years longer. It seems, in fact, only fair to the borrower to give him a fixed time, from the day of his coming into possession, in which he can pay the charge and interest without being called on for any additional payment on account of premiums. Assuming the reversioner to have come into possession, he may prefer, if in good health, instead of paying the charge, to borrow the amount on mortgage of his life interest in possession, effecting a policy for the whole term of his life; or he may prefer to pay the charge out of income. In the event of his choosing the latter alternative, it is only fair that as his debt is reduced, the insurance to secure it should be also reduced; but this is a matter of detail which it would be quite unnecessary to insert in the deed.

Another method which has been suggested for the purpose of reducing the cost of the transaction to the borrower is to effect a policy on his life, subject to a low premium during the life of the life tenant, and a larger premium afterwards. It is clear that the premium to be paid during the joint lives must be not less than would be required for the insurance of  $x$  against  $y$ ; and assuming arbitrarily a premium somewhat larger than this to be payable during the joint lives, it is a simple matter to calculate what premium should be payable after the death of  $y$  in order that the present value of the total premiums may be equal to the ordinary whole life premium on  $x$ . But in practice this arrangement is not applicable; for under it the borrower has an option for which the company has no equivalent. If the life tenant should die soon,  $x$ , if in good health, would be able to effect an insurance for the whole term of his life at a rate considerably lower than the agreed rate, and there would be nothing to prevent him going to another company and borrowing from them in the



ordinary way on his life interest in possession a sufficient sum to pay off the company. On the contrary, if *y* should live to a great age, the company would be bound to continue the policy on the life of *x* at the agreed rate. Thus, then, if the contract turns out to the disadvantage of the borrower, he would be able to repudiate the agreed terms, while if it turns out to the disadvantage of the company, they would be bound to them. It is therefore necessary to arrange the terms somewhat differently, and the simplest course appears to be to agree that the policy may be continued in force after the death of *y* by payment of the ordinary premium for *x*'s then age. In order to compensate the office for the risk of *x* being then in bad health, the premium payable during the joint lives should be greater than the premium for a contingent insurance, and might perhaps be taken equal to the premium payable during the joint lives for an insurance of *x* against *y* and for 3 years longer. Supposing this arrangement resorted to, the company still runs the risk that the joint lives of *x* and *y* may be so long extended that the premium to insure *x*'s life on the death of *y* would be very large; and the value of his life interest consequently diminished. It is therefore clear that this arrangement could only be resorted to with advantage when the value of the security is very ample, and the life tenant is of advanced age.

Altho', as we have seen, it is generally the best both for borrower and lender that advances of the kind we are considering should be made by way of reversionary charge, there are sometimes circumstances which render it undesirable. The tenant for life may be in a bad state of health, or what comes to the same thing, the reversioner may believe, if he does not hope him to be so; and in this case, the reversioner will be extremely unwilling to enter into a contract by which, if his anticipations of the tenant for life's early death should be realized, he would be a heavy loser. A second case which may happen is that the reversioner may have an income sufficient to pay premiums and interest without being in a position to charge that income. This may be the case if he, for instance, has a large allowance from his father, or has married a wife with a large income settled on herself, but paid quarterly to his bankers. Another instance which has recently come under my notice, was one where the borrower had a considerable present life interest in foreign securities, which insurance companies do not consider suitable security for a loan, but he had also a reversionary life interest in real property in England, which is considered an unexceptionable security. In such cases as these it is no longer

true that it is best both for borrower and lender that the advance should be made by way of reversionary charge. Probably in almost every case where it is proposed to raise money on the security of a reversionary life interest, the borrower in the first instance protests more or less strongly against an arrangement by which he will be a heavy loser if the life tenant should happen to die early, overlooking the fact that if the advance is made by way of mortgage, and the life tenant should live to an advanced age, he would have to pay ultimately a much larger sum than under the other arrangement. In general, the actuary should disregard these protests, and insist on the advance being made in what he believes to be the best method for all parties; but he should not lay down one inflexible rule. He should rather be prepared to consider each case on its own merits, and to admit of a departure from his general rule when special circumstances call for it.

The skilful actuary will further not content himself with considering every possible way by which he can protect the interests of his company without any regard to the interests of the borrower, as almost appears to be the policy adopted in some instances; but he will, in the first instance, endeavour to ascertain the lowest possible terms on which the transaction can be carried out with advantage to the company. Having ascertained these, it by no means follows that they will be the terms quoted to the borrower, but he will know that everything beyond is clear profit; whereas, if he has simply proceeded on the plan of making the office safe, he will not in the result know what is the real profit on the transaction, and it may happen that the terms quoted by him when examined by an impartial actuary are found so exorbitant as to bring his company into disrepute. The actuary may in fact consider himself to be an adviser to a certain extent in the interest of the borrower; for it will be his aim to quote the lowest terms consistent with a fair remuneration to the company. Applying these principles, now, to the above mentioned cases, it must be admitted that if there is a moral certainty of the borrower being able punctually to pay interest and premiums, he may fairly require the loan to be made by way of mortgage. He may furthermore very fairly object to being charged at once with the premium on the large insurance which we have seen is necessary to make the security saleable in case of his default. That large insurance only becomes necessary when the security has to be sold, nor will it assist matters at all for the insurance to be an increasing one, for so long as the borrower keeps down the payments required of him,

the necessity for an increase of the insurance will not arise, and he may as properly object to pay the premium on the increased insurance as he objected in the first instance to pay a premium on the large insurance necessary fully to protect the security.

We see, then, that the lender requires no increase in the assurance, so long as the borrower pays his interest and premiums regularly. If the borrower should make default and it should become necessary to sell the reversionary life interest, a larger insurance will certainly be required, but in that case we have seen that the larger amount of insurance is not immediately required by the purchaser, and that it would sufficiently well answer his purpose to have an increasing insurance. What is wanted, therefore, is an insurance that shall be capable of increase at the option of the assignee of the policy, subject to such conditions as may be agreed on. This, so far as I know, is an entirely novel mode of carrying out the transaction, but it may interest the members of the Institute to know that it is not a mere theoretical proposal, but that under my advice a considerable loan proposal has been recently carried out by means of it.

It would be objectionable to give the option of increase to the borrower himself, because he would be almost certain to exercise it to the disadvantage of the insuring company in the event of his falling into bad health. It may, of course, still happen, when the option is only given to an assignee, that a collusive assignment may be made by the borrower for the mere purpose of exercising the option, but the risk of this is not so great. The risk of loss to the company through this cause is also greatly reduced by the circumstance of the increase in the sum assured taking place, not all at once, but by stages extending over a series of years, which arrangement, as we have seen, will be a sufficient protection to the purchaser. In the case I have already alluded to, a present insurance of £20,000 was effected by the borrower, which was subject to increase up to £40,000. Two policies for £10,000 each were issued, each with an independent option attaching to it, by which means an additional facility would be given to the purchaser of the life interest without any detriment to the company, and on each of the £10,000 policies was placed an endorsement to the following effect :—

In consideration of the within mentioned annual premium, it is hereby agreed that the X Company will, on the application of any *bond fide* assignee of the within written policy at any time during the lifetime of A. B., the father of the within mentioned

assured, and during the continuance of this assurance, grant, without further evidence of health, an increasing assurance on the life of the said assured, commencing at the sum of £1000 and increasing at the rate of £1000 a year up to £10,000, the premium on each £1000 of the said assurance being calculated according to the published rate of the said company for an age five years older than that of the said assured at the date of such application, provided that the said company shall not be bound to renew the said increasing assurance from year to year, unless the within written assurance is also continued in force.

For the protection of the offices granting this insurance, more especially considering its novel character, it was thought desirable to limit the option as far as is consistent with its being effectual for the purpose for which it is required, and for this reason it was stipulated that the right of exercising the option shall only continue during the lifetime of the tenant for life. On his death the borrower comes at once into possession of the income, and if it has not been necessary to sell his interest during the lifetime of the tenant for life, the original policy will be amply sufficient to secure the advance after the death of the tenant for life.

When a loan proposal is carried out in this way, it must not be overlooked that every year which passes without the option being exercised, increases the premium that would have to be paid on the new insurance, and consequently diminishes the value of the life interest supposed to be in possession. It is clear, therefore, that this could not be entered into as a permanent arrangement, except in cases where the margin is ample, and the life tenant is advanced in life.

It remains to consider on what terms such a policy might be practically granted by an office. It is clear that as an option is given to the holder of the policy, which option may possibly be exercised greatly to the detriment of the office, it is right that the office should receive a fair equivalent for this option. At present there seems no means of calculating the money value of this option with anything like scientific accuracy, but in the particular case to which I have already referred, it was considered sufficient to charge an additional 5s. per-cent per annum on the amount of the original policy, and on the above terms several first-class offices agreed to share the risk.

The principles here adopted may without difficulty be extended to the case of advances made on contingent reversions, to which many of the preceding remarks apply with very little alteration.

The following account of the discussion which followed the reading of the paper is abridged from the *Insurance Record*.

Mr. A. H. BAILEY—The council having referred Mr. Sprague's paper to me, I at first thought I had an easy duty to perform—viz., to decide whether it was a suitable paper to be read in this room. I am sure the meeting will be unanimous in their opinion that it is very suitable for discussion by this Institute. But Mr. Sprague has informed me that the duty of referee extends beyond this—that he is expected also to express his opinion upon the paper submitted to him by the council, which adds considerably to the burden of the referee's duty. In turning the matter over in my mind, I have felt that there is a peculiar difficulty in discussing this subject here. Most of the gentlemen in this room are interested in these transactions on behalf of the lenders; and if we could hear counsel for the borrowers, perhaps additional light would be thrown upon the subject. While I agree with Mr. Sprague that transactions of this nature are well suited for the investment of the funds of an assurance company, there are, notwithstanding, some difficulties in the way. One arises from the apparent, perhaps, rather than real severity of the terms on which these transactions are effected. It would be very difficult indeed to persuade any borrower that if, for every £1 he borrows, he has to pay, say, £4, he is not hardly used. The result is that an assurance company, rightly or wrongly, acquires a certain amount of repute for hard dealing. But there is a more serious difficulty, and that is how to deal with these transactions as a matter of book-keeping. If a considerable sum is advanced, a large amount has to be disbursed annually for life assurance premiums, and, as we all know, the value of reversions, looked at in the ordinary way, increases so slowly that it would hardly do not to credit the account with interest; otherwise, if there are many of these transactions, the average rate of interest on the whole funds would apparently be reduced. I believe it is the practice of some offices to credit year by year 5 per-cent on their outlay. If they do that, the account in the ledger, in the words of the paper, "accumulates at a truly frightful rate," and the amount apparently advanced on these transactions is considerably in excess of the value by any ordinary estimate. This is an inconvenience for which I have never yet heard any practicable remedy suggested. Still, notwithstanding these difficulties, I am bound to say that I think the balance of advantage is in favour of the assurance companies, and that these are very desirable transactions for them. I cannot think they are equally desirable for the borrower.

The case which Mr. Sprague has instanced at the end of his paper, is an interesting, but an extremely rare case. As a rule, reversionary annuitants are in possession of but small immediate means, and it is very seldom indeed that there is any hope that the premiums and interest can be kept down by them. In former times attempts were made to carry these transactions out by way of mortgage, but they almost invariably broke down and proved unsatisfactory. Sometimes efforts were made to give sureties for the premiums and interest, but solvent sureties are not easily found if the borrower is not in a position to keep up the payments himself; and it

may be laid down as a cardinal rule in all investments, that it is unwise for an assurance company to enter into transactions with a borrower which there is no reasonable prospect of the borrower himself being able to carry out. I, like many others, have turned over in my mind whether any way could be devised by which loans could be granted on securities of this description on apparently less onerous terms to the borrower. There are two classes of reversionary interests,—one in which the borrower is tenant in tail; the other in which he is tenant for life in reversion. In many of these cases he is tenant in tail,—because, as is well known, by the law of this country land can be settled only for twenty-one years beyond the life of any person in existence at the period of settlement;—and if he be tenant in tail, although he cannot grant a charge on the fee simple in reversion, if he succeeds to the property he then will be in a position to disentail; and before he succeeds, he can covenant to disentail. In this case it appears to me that the grant of a reversionary charge with an assurance effected on the life of the borrower against that of the tenant for life and for a short term longer, would fairly well meet the case. In the other case, where the borrower is only tenant for life, it has occurred to me that some such arrangement as this might be made. The advance might be made by way of reversionary charge, computed, not by the formula—

$$1 - (P + d)(1 + a_{xy}),$$

which Mr. Jellicoe first suggested, and which is one I have never used for myself, for the reason that in all these reversionary transactions, as far as I know, the lenders never do purchase these annuities,—but by the old-fashioned one

$$A_{xy} - A'_{xy},$$

where  $A_{xy}$  is the value of the reversion at the death of the joint lives at the current rate of interest, and  $A'_{xy}$  the single premium for the contingent assurance; and then the borrower should endeavour to induce the assurance companies—(and I really see no reason why they should object)—to grant an assurance on the life of  $x$  against  $y$  by a single premium, and undertake to grant a whole term assurance on the life of  $x$  when  $y$  dies, without reference to the then state of health of  $x$ . Of course a higher premium than the ordinary one should be charged, but I see no reason why they should not enter into a transaction of that sort.

Before I sit down, perhaps I may be permitted to express my opinion of the value of papers of this kind to students and younger members of the Institute. There is no difficulty in learning from any of the textbooks the theoretical investigations required to determine the value of reversionary life interests, but to deal with these interests in practice is matter of considerable difficulty. I have for one been a little surprised, as an examiner of the Institute, at finding that, whereas the candidates come up in large numbers for the first year's examination, and in respectable numbers for the second year's, they come up in very small numbers indeed for the third year's examination, which, it appears to me, is by no means the most difficult of the three. The only reason I can find for this state of things is that the information re-



quired for the third year's examination, which is very necessary for the practice of an actuary, is not to be acquired by books; and therefore I conceive that the opportunity which Mr. Sprague has given us to-night, as well as on previous occasions, of getting at some of the knowledge which floats about and is current in assurance offices, is of great value to the junior as well as the senior members of the Institute.

Mr. MACFADYEN—The first part of the paper shows the onerous nature of the terms requisite to protect the mortgagee of a reversionary annuity,—the second indicates various modes in which the *purchase* of such annuities can be arranged,—and the third treats of the manner in which a borrower, if still obstinate enough to mortgage rather than to sell, may have the terms made, if not easy, at least as easy as they can well be. Examining, as the other parts are connected, the second section first, I find that Mr. Sprague, in commenting on the final disposal of the policies of assurance, though willing to hand them over to the seller on the payment of the charge, considers the purchaser should retain the bonuses. Looking at this in connection with the statement that profit policies for less amount than will be ultimately required should be taken out, it seems to me scarcely fair to the seller if he has had deducted by the purchaser in the price given these profit premiums, to retain from him on settlement that part of the bonus equivalent to the difference between the full amount required at the non-profit rate and the sum actually assured. In short, whether it be bonus or otherwise, the seller, on redemption, is entitled to an insurance policy equal in amount to that which the premiums he paid would purchase by the non-profit rates of the office. If, beyond this, the buyer chooses to enter into a speculation by paying an additional premium for profits, of course, as the seller has not been charged this addition, he has no claim to the results. With reference to the first part of the paper, since it is requisite that the full ultimate assurance amount be secured from the first, it is obvious that the borrower is called on to pay a sum calculated on the assumption that he omits to pay premiums and interest from the commencement; and this, even though he make no such default whatever, or at most, for only part of the time. So it is clearly the borrower's interest to be what he is credited with being, and sell his reversion rather than retain it at such a cost. On the other hand, as is proved in the paper, the lender can demand no less. In fact, there is an *à priori* probability in favour of default and uninsurableness going together, as the one may be a direct consequence of the other. Since then, as in the credit system in ordinary business, the borrower must pay a higher price, however punctual he may be in his payments, simply because he might have been a defaulter, all that can be done for him is to make this extra payment as light as possible. Mr. Sprague considers the objections to doing this by an ordinary increasing assurance insuperable, but thinks it might be done by an optional increasing assurance. Taking the actual instance given in the paper, and comparing an insurance of £20,000 increasing to £40,000 with an insurance of £20,000 with an option to increase to £40,000, of the two risks, since there are no means of valuing this option, the former seems to me much the preferable to the society.

No doubt the latter, if it can be obtained at a less rate, will be cheaper for the borrower. On the other hand, it is clear that in the former case the society gives value for the premiums received in the shape of a life insurance, and on the settlement of the transaction this assurance will become the property of the borrower. Of course, I am here assuming that the premiums and interest are paid regularly by the borrower, as if not, he has no grievance in the amount he has to pay. He may not want this large assurance any more than the gentleman, borrowing from certain money-lenders, wants the pictures given him as part of his loan, but at least, unlike the pictures, it is not sold him at a fancy price, but its cost is the result of mathematical calculation. In the latter case, unless by instinct the right value of the option has been hit upon, somebody is aggrieved. Either the office has not sufficient remuneration for the risk undertaken, or the borrower has his pictures sold him at a fancy price. Indeed, if the option principle is to be introduced at all, it seems to me more thorough, if a dealer in such transactions is making the advance, to directly assume that a certain number of borrowers will become defaulters and uninsurable, and calculate accordingly. It may be urged that there are no data for fixing what this number will be. Very true, but there are just as many as for fixing the premium for an optional increasing assurance.

Mr. R. P. HARDY—Mr. Sprague, I believe, after the lengthened study he has given to this question, has been unable to suggest a method more generally applicable than that which is ordinarily adopted. In some cases a low rate of premium during the joint lives of the successive tenants can be charged; and in others, no doubt, an office would be disposed to grant an increasing assurance for a limited term. The particular case which Mr. Sprague instances must be the one case in a hundred. Borrowers always object to the advance being made by way of reversionary charge, and solicitors are very loth to take upon themselves the responsibility of advising a client to enter on a transaction which may ultimately prove detrimental to his interest. They all, therefore, naturally endeavour to make you entertain the transaction by way of accumulation. I have seen some such cases so carried out, and I think they will be found to be safely based, but they are very difficult indeed to manage, and the personal covenant of the borrower must be of some value. [Mr. BAILEY, "That is very rare."] Mr. Bailey thinks there is a difficulty in representing these transactions in the books of account, so as not to show a falling off in the interest revenue. I do not see that that ought to be the case. If you have a fair number of transactions of about equal amount, it is probable that a sufficient number will fall in in every quinquennium to justify the office allowing, say, 5 per-cent every year on the account. That is the case with offices dealing in moderate-sized reversions, and they will be found to fall in with some regularity; and if you look at the profit made, you will find it comes as nearly as possible to the rate of interest at which you have valued. Mr. Bailey says further, that most of these borrowers are tenants in tail, but I should say that eight out of every ten borrowers are tenants for life. The conveyancer, in framing a settlement, takes good care to give a tenant in tail no allowance out of the estate, so that when

he comes of age he has nothing to live upon, and his only means of obtaining a subsistence is by consenting to bar the entail, and to convert his estate into one for life merely. In the less frequent case of a nephew, who is in succession to an uncle, he is no doubt a tenant in tail; or at the best has only a base fee; and therefore it is that in most of these cases you have to provide for a whole-term assurance; but where the income is sufficiently large, you may rely upon the formula Mr. Sprague has given, taking receivership of the rents, and recouping yourselves out of income. I have drawn up a formula which may be conveniently used in those cases where you desire to make a loan by way of accumulation. It is, of course, more expensive in the end, but I believe it satisfies the prejudices of the borrower, who always imagines you are going to take advantage of him. The formula is—

$$1 - (P + d)(1 + a_{n-1} + n-1|ax_y)$$

It represents the amount that can be advanced for every £1 of assurance. You retain in hand the value of an annuity certain of  $P + d$  for the term agreed on, and you further reserve an annuity-due of  $P + d$  upon the joint lives of the successive tenants deferred  $n$  years. By the end of  $n$  years the debt has grown exactly to the amount of the assurance, and there then becomes constituted an annuity-due of  $P + d$  for the remainder of the joint lives, which will prevent the debt growing to any further extent. The effect of this method may be illustrated by taking the case mentioned in the paper, where the ages of the lives are 60 and 30. For every £1000 advanced by way of surcharge, the fixed sum to be paid would be, say, £3480. By the method of account for, say, twelve years, the total advance grows by stages to £5060 as its ultimate amount, the less amount that would be paid in the event of the early falling in of the reversion compensating for the excess over the fixed charge which would become due in the event of the transaction outlasting the average term.

Mr. A. BADEN—Mr. Sprague has said that these transactions form very desirable investments for insurance companies, and so no doubt they do in the majority of cases. But there is one caution which should be attached to them: that we should not lose sight of the consideration of the character of the reversionary life tenant. In the kind of transactions that assurance companies have to carry out, this consideration is generally reduced to a minimum, the families in most cases being honourable and of good repute, and may be considered in a great measure answerable for every one of their members. But occasionally cases do arise, of which we have two remarkable instances before us in the case of the claimant to the Tichborne estates and the heir to the Aberdeen peerage, where, either from vice on the part of the expectant, or from eccentricity, or both causes combined, there is great danger of the reversionary life tenant getting out of the way and concealing his whereabouts, and in consequence creating great difficulty on the part of the office in proving his death, or, in fact, in knowing what to do at all.

The PRESIDENT—In the way which I think Mr. Jellicoe first suggested of dealing with these questions, it was supposed that the lender purchased an annuity during the joint lives sufficient to pay premiums and interest. I never heard that that principle was ever carried out

in practice ; but if it were carried out it would meet Mr. Bailey's difficulty as regards book-keeping. There is a difficulty no doubt in dealing with these questions in the ledger. You must credit a certain amount of interest. Whether it is prudent to take credit for the whole interest you are expected to receive, is doubtful. For myself, in a case of this sort where money has been advanced at 5 per-cent, I have never taken credit for more than 4 per-cent. If it should so happen that the reversion falls in early, there is something to the credit of profit and loss. The method suggested at the end of the paper is, I suppose, with the view of making the transaction less costly than by the ordinary way, and Mr. Hardy seems to have hit upon a plan of further reducing the cost. There is no doubt that a borrower is always staggered—or, at all events, his solicitor is—at the amount of the reversionary charge. To meet that difficulty, I have in two or three cases offered to do it simply as a mortgage by way of accumulation ; but, in that case, you must take care to have a larger assurance, I think, than what you would otherwise provide for, because, as you can gain nothing by that means but your rate of interest, you cannot afford to run any risk. In all these transactions it is very important that we should look to the character of the borrower, because if he goes beyond the limits allowed by the policy, it becomes a serious matter, unless it is provided for in the first instance ; and if it is provided for, it helps to make the transaction more costly.

Mr. SPRAGUE—Mr. Bailey has referred to the advantage we should derive if we had here what he calls the “counsel for the borrower,” to examine the question from a borrower's point of view ; but I think that, to a considerable extent, the line I have taken obviates the necessity for that. I have pointed out that we are to consider first of all, as a mathematical problem, what are the very lowest terms on which we can undertake these transactions. It is a similar case to that of a man engaged in large contracts—ship-building, for instance,—he first of all endeavours to ascertain what will be the actual cost of building the ship, and then he considers what he shall add for his profit on the contract ; just in the same way, I consider what will be the actual cost to a company of going into one of these reversionary transactions, and then I charge something more for profit. The question as to the way of treating these advances, as regards the book-keeping, is one which I did not think it necessary to touch upon. My own practice has been to charge no interest at all on the accounts of reversions purchased. I find, as a matter of fact, that when a valuation comes round, if I have debited a reversionary annuity simply with the premiums paid, the cost in the ledger exceeds the value of the reversionary annuity, so that it has to be reduced, and if interest had been added, a still larger reduction would be necessary ; and if it should happen in the short period of five years that out of ten or twelve large reversions purchased not one had fallen in, there might be a large amount of interest to be written off, which would look a very awkward item. Of course if an office buys absolute reversions, they always increase in value, and that increase in value may be set against the reduction in value of the reversionary annuities. But if all the reversions, both absolute and contingent, have been debited with interest every year, it must sometimes happen that there is no

source whatever out of which to provide for the reduction in value of reversionary annuities. In the office I am at the head of, I debit no interest at all; and then when a reversion does fall in, there is a considerable amount of profit which is available for any purpose required, or which may be simply carried into account as balance of profit and loss. With regard to the two classes of borrowers mentioned by Mr. Bailey, it will be noticed that my paper is confined to the consideration of a reversionary life interest, properly so called. A tenant in tail does not properly come under the same class as a borrower who has only a reversionary life interest, because we know that by legal arrangements lawyers can give us a charge upon the fee simple, provided the tenant in tail should survive the tenant for life.

The PRESIDENT—What you call a “base fee.”

Mr. SPRAGUE—Yes, the tenant in tail can at once, by executing a disentailing deed, obtain a “base fee,” or an interest in the estate, which lasts so long as he or any of his descendants (or male descendants if the estate is settled in tail male) shall be living—subject, of course, to the interest of the life tenant; and when the tenant for life dies, the tenant in tail, by executing another deed, can acquire the fee simple of the property. The practical means by which a borrower’s “base fee” can be most effectually made a security for an advance is a matter of so much interest that I may not, perhaps, be occupying your time too long if I describe it. The borrower, having cut off the entail and acquired a base fee, executes a power of attorney, authorizing the lender and his solicitor, and perhaps half-a-dozen of his clerks, or any one of them, as soon as the tenant for life is dead, to execute the necessary further disentailing deed. Then that deed is prepared, and as soon as ever intelligence is received of the death of the life tenant, one of the persons named in the power of attorney executes the deed, and the thing is done without any further consent on the part of the borrower being necessary. Several names must be inserted in the power of attorney to provide against the risk of the attorney dying before the life tenant. The risk of the borrower dying before the life tenant is met by effecting insurances on his life against that of the life tenant; and the very remote risk of his dying after the life tenant, but before the disentailing deed is executed (as, for instance, both being drowned by the upsetting of a boat, and the younger man surviving the elder for a quarter of an hour), is met by making the risk under the contingent policies last for, say, three months after the death of the life tenant.

With reference to the formula—

$$1 - (P + d)(1 + a_{xy})$$

Mr. Bailey remarks that it is Mr. Jellicoe’s formula, and only applies when an annuity is actually bought; but if he looks at it a little closer he will find it is exactly the same formula as is really used in the process he describes, the only difference being in the rate of interest. In Mr. Jellicoe’s method,  $d$  is taken at 5 per-cent, and the annuity on the joint lives is taken at  $3\frac{1}{2}$  per-cent, say; but if you take  $d$  at 6 per-cent, and the annuity on the joint lives also at 6 per-cent,—that is exactly the same thing as the ordinary formula for the value of a reversion at 6 per-cent. For

$$A_{xy} = 1 - d(1 + a_{xy}), \text{ and } A'_{xy} = P'_{xy}(1 + a_{xy}).$$

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It is curious to note how the same identical formula will bring out different results, the difference being in the rate of interest. If, for instance, in the above formula  $P$  were taken as the net premium, the formula would be the absolute bare value of the reversion at 6 per-cent. The case which Mr. Bailey has mentioned, of the office undertaking to grant a whole-life assurance on the death of the tenant for life, whatever may then be the state of the borrower's health, is one which he will see I have fully considered in the paper. I now pass on to consider what Mr. Macfadyen has said. He does not quite see, I think, the use of the optional increasing assurance I have proposed. If you have an ordinary increasing assurance, no doubt if the borrower wants the insurance, the cost of it to him beyond the net premium is less than that of the optional increasing assurance; but the fact is, in many cases he does not want the increase of the insurance at all; and it is not, as Mr. Macfadyen supposes, like having a picture given him for part of his loan, for if the picture is a good one it will rather increase in value in time, but if a man has a large increasing assurance, he pays his premiums for the current risk, and has nothing to show for them afterwards. So that when a man is forced to effect such an assurance, which he does not want, it is no answer that it is an increasing assurance and he has had the benefit of it. He is exactly in the position of a man who is obliged by a money-lender to take a large quantity of wine that he does not want, which he cannot sell, which will turn sour if not drunk, and which he is therefore constrained to give away to his friends. By effecting this optional increasing assurance on the contrary, he knows the worst of it, and he has to pay a certain consideration, 5s. per-cent per annum. The company gets that consideration; the man pays it and does not grudge the money, because he gets the insurance he wants, and is saved the larger outlay for the increasing insurance which neither he nor the office wishes for, and which is of no value to anybody except his heirs if he should chance to die before the loan is paid off. So that the optional increasing insurance appears to me to give exactly what is wanted, and at the lowest possible price. The question mooted by Mr. Baden as to the character of the borrower is no doubt one of great importance, and has to do not only with reversionary life interests, but with life interests in possession. It is necessary in dealing with both of them to take care that you leave a sufficiently large margin to make it worth the while of the borrower to come forward from time to time and claim the surplus. If proper care is taken to have a margin, you may be sure, when the tenant for life dies, the reversioner will come forward and claim his interest. Mr. Tucker has told us that he never heard of the case of an annuity being actually bought. I do not know how it may be with regard to reversionary annuities, but I am informed there is one large old insurance company in the city that always buys an annuity when it buys a reversion, and thus entirely gets rid of the difficulty as to the interest account.

MR. BAILEY—Buys it from itself?

MR. SPRAGUE—No, it does not grant annuities; but actually purchases the annuity elsewhere.