

be inculcated amongst the staff. Such a habit, together with a spirit of pride in efficiency, is encouraged by the provision of good mess rooms and other facilities for the comfort and well-being of the staff.

CONCLUSION.

The greatest scope for economy in the use of permanent-way materials lies in the use made of serviceable material. A system of well-sited and properly designed and equipped central permanent-way stores depots will provide the most efficient method by which such material can be collected, graded, repaired, and distributed. The fullest advantages of centralization can be obtained by combining with the central permanent-way stores depots, other manufacturing and storage depots, to obtain full benefit from common facilities, supervision, and staff.

Whilst the cost of establishing such depots is now much higher than in the past, so, in equal measure, is the monetary value of the economies they will produce.

ACKNOWLEDGEMENTS.

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The Paper is accompanied by two sheets of diagrams and seven photographs, from which the folding plates have been prepared.

Discussion.

The Author, introducing the Paper, observed that on the last night of 1946, the first whole year of peace, it was a depressing thought, though perhaps a challenge to the ingenuity of railway engineers, that they were facing a year in which greater shortages in some materials had to be anticipated than had ever been known before, even in the middle of the war. The most startling news received recently had been the huge reduction in the timber supplies forecast for 1947. Most railway engineers had doubtless already drawn up track relaying programmes for 1947 based on a normal supply of timber and sleepers, and they were faced with the problem of cutting their programmes to about one-half of the normal. The only way in which the reduction in supplies could be met was by

making existing material last longer and by making the maximum use of sleepers and timbers recovered from the track. Even so, instead of overtaking arrears of maintenance they saw themselves losing ground, and to a large extent they were unable to prevent it. Clearly the importance of conserving timber during 1947 would be crucial. Stocks would have to be brought down to the minimum levels and timber sent to the lineside only for essential works where execution was imminent.

A very careful control of stores would be required, and organizations which already possessed central stores depots would be in a stronger position to meet the stringent conditions which would have to be faced. Systems working on a district basis of stores control would have a more difficult task in ensuring that the standard of material used in each district was uniform throughout the system. There could be no doubt that the District Engineer could and would make the best use of the material available in his district within the confines of his district. But conditions in districts varied; one might have a high proportion of primary lines and another a higher proportion of less important lines which could be relaid in used material. The first district would have a surplus of good-quality used material which would be badly needed in the second. In theory, direct transfers between districts should be simple, but in practice difficulties often arose. The independent control of a central depot in grading material and dispatching it where it was most urgently required ensured uniformity of quantity and quality of material supplied which could be achieved by no other means.

In the Paper, he had suggested that it was very doubtful whether the reconditioning of used, small, permanent-way materials was a paying proposition; and he would be very interested to hear the views of others on that point. The yardstick in normal times was money, but in times of material famine other considerations might have to be taken into account. It was beyond question that the reconditioning of points and crossings paid well. They were complicated articles, the value of which lay largely in the high cost of manufacture and much less in the cost of the raw material which went to make them. To what extent, however, did it pay to attempt to recondition the basic simple articles? Abroad the practice had gone further than in Great Britain. In France, for example, surplus short rails were welded into long lengths and put into running lines. In the United States of America, it was customary to crop rail ends where there was heavy batter, re-drill the rails, and use them again. In France a certain reconditioning of used sleepers was also carried out in the depots and split sleepers were re-bound with hooks or fastened with S-clamps; screw-holes were re-blocked and bearing surfaces adzed.

Perhaps something might be said for similar activity in depots in Great Britain in the coming year. It was difficult, however, to obtain convincing proof that it was an economic proposition to attempt to repair or recon-

dition such small items as spikes, bolts, screws, fishplates, and the like. The normal formula to apply was that the cost of reconditioning the article, plus the scrap value, should be lower than the cost of the new article ; but the three factors in the formula were variable and would vary annually, particularly at the present time. The cost of reconditioning the article should include a proportion of depot overhead costs and of depreciation costs on the plant installed to carry out the reconditioning. It should also be borne in mind that a reconditioned article was never so good as a new article, and a higher proportion of failures had to be expected. He believed, therefore, that on the whole it was best not to recondition small, simple articles, but to realize their value as scrap and to confine activity largely to points and crossings, and possibly to rail treatment.

At present in the Southern Area of the London and North Eastern Railway central stores depots were in the process of design. At the outset, the problem of location had presented difficulty owing to the geographical lay-out of the area, which did not lend itself easily to centralization. The area consisted of three more or less separate railway systems—the old Great Northern, Great Eastern, and Great Central Railways. The Great Central Railway was dense in the Manchester–Sheffield–Nottingham area, and had a long tentacle reaching out to Marylebone, whilst cross-country lines intercepted the old Great Northern main line at Doncaster and at Retford. The Great Northern system was dense in the Leeds–Doncaster area, and also in the London area, with the East Coast main line connecting the two. The Great Eastern system was compact in East Anglia. The area as a whole, therefore, was dense in the London area and in the Northern industrial areas, and the centre of gravity was in between. The lay-out could be illustrated by the analogy of the dumb-bell, where the centre of gravity was the centre of the hand-grip, equidistant between the two main masses.

Clearly to restrict the aggregate mileage of engineer's traffic to the minimum two depots were needed, one central to the Northern part of the system and the other central to London and East Anglia. That was what was being planned, and the sites would probably be in the Sheffield and Cambridge regions—although that matter had not yet been finally decided. The internal lay-out of the depots would probably follow in the main the details outlined in the Paper, and provision would probably be made for building a rail-welding shop in the Northern depot, if not in both. It was proposed to provide a very large space under the Goliath or gantry crane to obtain the best possible use from the installation ; it would deal not only with rail handling but also with the loading and unloading of points and crossings coming to the depot for refitting. The cost of providing an additional length of gantry or a Goliath crane was small in comparison with the cost of the whole installation, and was a good investment in view of the enhanced utility obtained.

The gravity method of handling sleepers in use at Darlington was very

good indeed where sleepers had to be examined individually for grading, and required no expensive plant; but a gravity dock of that kind was not easy to fit into a level site, owing to the difference in level between the inwards and outwards sidings required to give the necessary fall, which would normally be at least 12 feet. Mobile cranes had some advantages in dealing with sleepers, but there was always the difficulty of slinging, which was rather slow. It might be worth while to consider the construction of a gantry crane for that work where the turnover was high, with specially-designed cradles to deal with ten or twenty sleepers at a time, on the detachable tray principle, to facilitate picking up and unloading. Provision had also to be made at such depots for the reception and dismantling of whole sections of track as taken up by the crane method, and, since that method was spreading as more cranes became available, it might form an important function of the depots. It was intended that the assembly of new sections of track should continue to take place at the lay-out grounds of the District Engineers, but in the future some of that work might be done in the central depots—at least for jobs in the immediate vicinity.

The possibility of a swing-over to flat-bottom track as a standard should not be overlooked in the design of depots. It did not necessarily call for any special handling facilities, but it would certainly involve the use of further types of material which would have to be held in store. So many of the present-day conditions were completely abnormal that it was difficult to judge what standards to use in designing storage spaces, and considerable flexibility should be allowed. For example, if the present timber famine was prolonged it might be necessary to consider the storage and handling of concrete sleepers as a normal function of the depot.

In the Southern Area of the London and North Eastern Railway there were at present eleven districts, each having its own depot. Some were handling certain commodities for the whole area; for example, Sheffield received and distributed all new rails. The approximate total number of men employed on stores duties in the whole area was about 270—an equivalent figure which took account of the part-time employment of relaying gangs on purely stores duties. It was anticipated that eighty men would be required to serve each of the two central depots, and that each district would require an average of five men to be engaged on purely stores duties. Thus the comparable total under the new arrangement would be 215 men, representing an estimated saving of fifty-five men.

It was realized that the present was not a good time to plan any big development, and whilst the London and North Eastern Railway were planning to carry out the project to which he had referred, it was impossible to estimate the time which would be required to obtain a supply of gantry or Goliath cranes and to find the labour to carry out the considerable work involved. The idea of grouping all engineers' workshops and stores in one place, which had been outlined in the Paper, was not entirely visionary, for

in fact, such a depot, situated at Moulin Neuf, near Paris, served the old *Nord* Railway, which was now part of the French National Railways. That depot was 150 acres in extent, and provided a general store and workshop for nearly all of the material required by the engineering department of the section which it served. It contained 25 miles of sidings and many acres of workshops, and employed about 850 men. The railway provided the housing for many of the workmen and their families, with schools, restaurants, laundries, and other communal facilities. He had not access to the economics of that vast project, but he could not imagine that the thrifty French would launch such a scheme were they not certain that a saving would result.

The depot contained stores of every kind of new and serviceable material required by the department. It was very adequately equipped with handling plant, and also contained sawmills, a creosoting plant, a points and crossings manufacturing shop, workshops for the manufacture and repair of signalling equipment, a concrete materials shop and depot, electric rail-welding plant, a sleeper reconditioning yard, a fishplate repair shop, a general depot, and a maintenance shop for heavy plant. The equipment included three gantry cranes for rail and sleeper handling and for the points and crossings shop and the store yard. The depot undertook every activity listed on p. 13, *ante*, except that it had no foundry; in France that was less important than in Great Britain, because the tonnage of cast iron used in France was considerably lower, there being little or no chaired track.

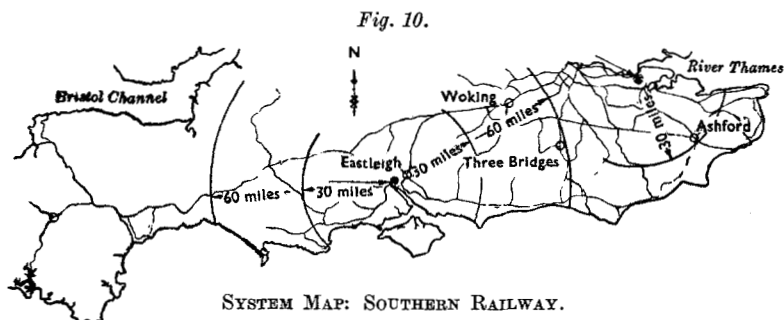
It was, perhaps, fruitless to speculate on the reaction which the nationalization of railways might have on the engineering departments; but it seemed clear that it was in the realm of materials supply and manufacture that the greatest economies could be achieved, and it seemed that the rational target of the planners in that respect would be the institution of grouped stores and workshops.

Mr. Arthur Dean observed that the Author had presented very clearly, in general terms at all events, the case for the provision of big central yards equipped to receive, handle, sort, stock, and redistribute recovered permanent-way materials. Experience showed that one of the most difficult things to be dealt with was a very natural tendency on the part of widely-dispersed groups of people on the railways to cover themselves by holding sufficient stores locally, to ensure that they would never be caught out. It was not easy to break that tendency down unless it was possible to provide some alternative place from which the materials required urgently could always be made readily available. Precisely how had the gangers' and local stocks on the London and North Eastern Railway been settled in the attempt to restrict to the minimum such dispersed holding of materials?

On the Southern Railway, the problem had not been tackled very extensively during the war. It had been found that dispersed stock

holding enabled many emergencies to be dealt with expeditiously. As soon as the war was over, however, attempt was made to deal with the problem, with the aim of permitting gangers to hold one-eighth, district inspectors one-twelfth, and a central divisional holding of one-twenty-fourth of the annual user of most permanent-way materials; in other words, the total holding would be one-quarter of the annual user dispersed round the whole system. Difficulties had arisen in reaching that objective at once, and some allowance had had to be made, to the extent of about one-sixth being held by gangers and inspectors, and one-sixth held centrally by divisions.

In 1947 it would probably be necessary to cut stringently into those authorized holdings. At some places local people still wished to hold units at junctions in order to cover themselves against something happening, and he had found one case where a piece had been held at a junction against emergency for so long that the junction had been renewed in the meantime, and the piece held would not fit it in any case.



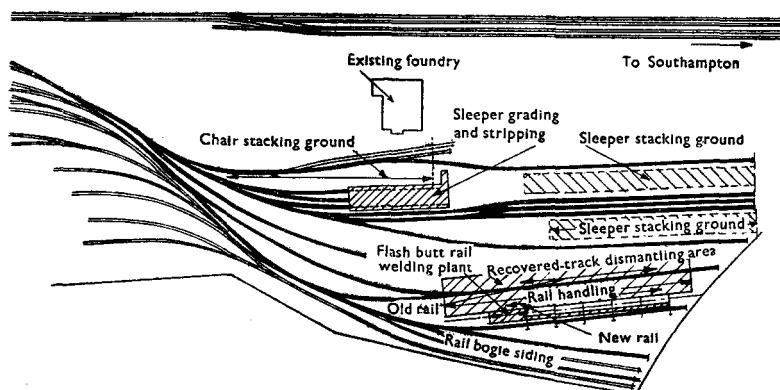
The Southern Railway were in the initial stages of setting up central depots; the principle had been agreed, and *Fig. 10* showed the two places, marked by black dots, where it was at present intended to locate those depots. One had been authorized near Southampton, and would be constructed first. It would be seen that a radius of 60 miles cut right into the London area, but the depot was necessarily much farther away from the straggling portion of the system in Devon and Cornwall. The other proposed site was on the North Kent coast.

In introducing the Paper the Author had indicated that for the present the London and North Eastern Railway intended to carry out pre-assembly at divisional depots. On the Southern Railway a careful examination had been made of the possibility of supplying the whole system with pre-assembled tracks from the two projected depots, but the conclusion was reached that the engine running involved would be uneconomical and that the method lacked the flexibility which was always necessary in any question of supply for relaying. Things never always went exactly according to programme. It had been planned to set up divisional pre-assembly

depots at the places marked with circles in *Fig. 10*, and materials would be supplied in bulk to those depots, thereby creating buffer stocks, which could provide the flexibility required.

The Southern Railway planned to add the central depot at Redbridge to what was already a main supply centre. *Fig. 11* showed diagram-

Fig. 11.



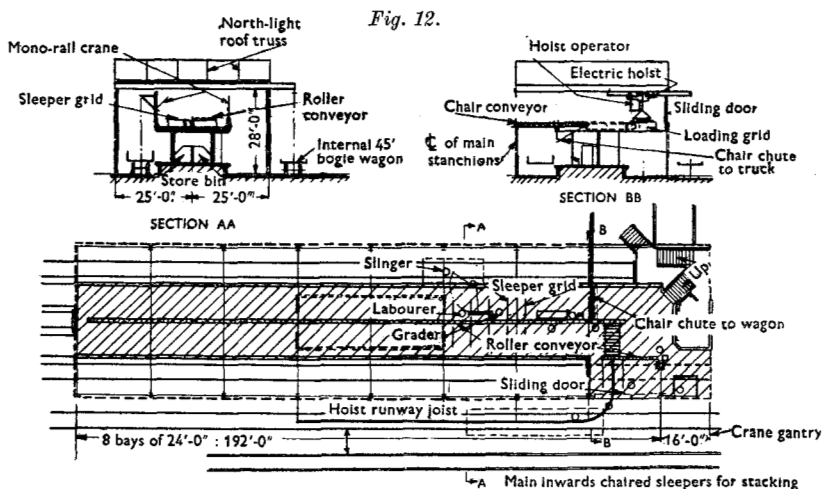
matically the provisional lay-out. It was single-ended, but Mr. Dean agreed that that should be avoided if possible. Fortunately, there was a very good possibility of being able to swing round at the right-hand end of the diagram and connect up with the main line again. There would then be a combined depot where sleepers would be taken in direct from barge, put through the creosoting and charring operations, and distributed. Rail distribution would proceed from the same place. It was the intention to supply maximum-weight trains of sleepers to the divisional depots, or to send them by ordinary goods trains, whilst recovered material would be returned to the central depot for sorting, in what would otherwise be the empty returning sleeper trains. It was not intended to bring back all recovered sleepers. Divisions would hold at their pre-assembly depot those sleepers which they knew they would use the next fortnight or so on siding renewals.

For rail handling the provision of a gantry and crane was proposed, with the rail-welding equipment located alongside.

On the Southern Railway the conclusion had been reached that the real economy from central collection of recovered materials, particularly with regard to small fittings, lay in sorting and distinguishing between material which should be scrapped, and that which could be re-used. It had been possible to do a certain amount of reconditioning during the war by improvised methods, but the cost had differed very little from that of new

material. Account had also to be taken of the fact that the second life of the material might not be anything like as long as the first life. Therefore it had been concluded that the reconditioning of small fittings was not likely to be a paying proposition.

One problem had to be faced on the Southern Railway which would not confront the other systems to the same extent, namely the effect of heavy electric traffic on rail ends. That problem would exist for the next ten to fifteen years, until all the rails in the track subject to heavy electric traffic had been welded. It was planned that recovered rail which had suffered from end hammer and had had to be taken out of the road accordingly, but which was nevertheless of good section, should be taken into the depot and provision was to be made for cropping, re-drilling and, if necessary, welding, and re-issue for use in non-primary lines. It was in that direction that it was considered that the biggest economy in the re-use of material was likely to arise from central depots.



GENERAL PLAN OF RECLAMATION BUILDINGS

Mr. Dean agreed that it was exceptionally difficult to find the right method of handling sleepers. *Fig. 12* showed the Company's first thought on the subject, which was to use a double-floored shop. The first operation after the sleepers had been brought in from the divisional depots would be to hoist them and grade them on the first floor. A conveyor down the middle would take them to a de-chairing machine, where the chairs would be taken off and all fittings sorted; the chairs would then go to chair storage or into the foundry and the small fittings to storage spaces in the lower part of the building. The graded sleepers would then be transferred to stacking sites if no direct re-issue was required. So far he had not found any method of overcoming the need to transfer them on internal

wagons when the stacking of from 80,000 to 250,000 sleepers was involved. Plans were being made for a throughput of up to 800 sleepers per day.

He did not know whether something would be done on those lines ; but the immediate hoisting of sleepers, if it could be effected economically, would provide the material at the right level for very simple gravity feeding either direct into truck or to storage spaces.

He had been concerned to hear the Author's mention of eighty men. If that number were required, the Southern Railway would not find the method to be a paying proposition.

The transfer of recovered permanent-way as assembled direct from renewals either to sidings or to some other line might have been possible on the London and North Eastern Railway before the war, and might even be possible on that system to-day ; but Mr. Dean's experience of inspecting renewals during the past few years had been that on few lengths of track could one readily pick up the whole length and even put it in a siding. The Southern Railway had managed for years on a reduced sleeper supply, and they were now taking out a few lengths of track which could readily be put somewhere else ; some sleepers in every length were fit only for fire-wood, and until the supply of sleepers was much better he could not envisage the possibility of that method of dealing with recovered materials.

Mr. C. E. Dunton observed that the problem of material shortage was made difficult, because there was also a labour shortage, and he was not sure that material conservation was the ultimate end which they should have in view. It was true that at present, owing to restricted world trade, certain articles such as sleepers were not obtainable, and that, temporarily therefore, the main consideration appeared to be to reduce the consumption of such material without regard to labour. But that was a transitory state of affairs, and he considered that, in the interests of the ideal economy of the world, effort should be made to save labour rather than material. Therefore, the quantity of labour involved in reclamation per year of residual life should be balanced against the quantity of labour involved in the manufacture of the new article per year of total life. He believed that if that were done, many tasks of reclamation would be found not to be really profitable.

It should also be remembered that the act of taking sleepers from the track, removing the chairs and components, taking them to pieces, examining them, and replacing them was not always wholly beneficial. Deterioration was involved in the process in addition to the benefit of being able to examine and sort them and perhaps do a little work upon them. He considered that the ideal arrangement was for the material to stay in the track as long as possible. He did not favour any time limit as a basis for renewals, but believed that renewals should be based entirely on the condition and serviceability of the article. Relaying should not be regarded as sacrosanct ; if the rails were better than the sleepers, the latter should be renewed and the rails left alone, and vice versa. That had been

the policy of the London Passenger Transport Board during the war years, when materials had been difficult to obtain, and it would probably be continued.

One type of material had been found profitable to recondition, namely the rails. They suffered from end hammer and also from battering corrugation throughout their length. It was profitable to plane such rails to give them a complete new head. The work was done on a large planing-machine with a 30-foot table, and the reconditioning of a rail, including handling, loading, unloading, interest, and depreciation, could be effected for about £1 1s.

The Board's reclamation was done in their only depot, at Lillie Bridge, where the use of a Goliath crane had been found extraordinarily valuable. It had been considered wiser to have a Goliath rather than a gantry crane, because the gantry was an obstruction and might prove to be a nuisance. The Goliath yard had tracks which crossed the crane rails, and trains could run in and out if the crane was not there at the time.

Some time ago Mr. Dunton had been privileged to see the system of recording the serviceable material at York, and it had brought to his mind a problem which always had to be faced with serviceable material recovered from jobs. The system at York was excellent, but it did not entirely satisfy the requirements which he had in mind. At present the cost of a job was uncertain because the credits for the recovered material came along so much later than the charges for the new material; and they might or might not represent the actual credits for the materials recovered from a particular job, since those materials went into a yard, where they lost their identity.

He suggested that the job should be immediately credited, at the time of issue of the new material, with the same quantity of recovered material at a mixed price intermediate between the scrap and serviceable. Thus the cost of the job would be known. At the same time, by double entry the lineside recovery account would be debited, again at the mixed price. When the material was received in the depot, the lineside recovery account would be credited with the actual amount recovered, still at the mixed price; so that all that would have been done was to check the return in quantity, not in quality. So far, the position would not have been confused by bringing in the quality of the material. Then, after receipt in the depot, the depot account would be debited with that quantity of material at the mixed rate. The depot could dispose of the material in any convenient way, and would be credited with the actual receipts as serviceable or scrap; thus a profit or loss would be made on the year, and in the following year the mixed price would be adjusted so that the two transactions would balance approximately in the future.

He would, however, like to see the total quantity of recovered material reduced rather than increased by leaving it alone as long as possible and not taking it out of the track merely to replace it somewhere else. The

Board, having no secondary lines, had been able to adopt that policy, and tried to obtain as long a life as possible from the material on a site.

Mr. T. H. Seaton agreed that, under present conditions, the greatest scope for economy in connexion with permanent-way materials lay in the use made of serviceable material. In the inspection of permanent-way renewal proposals, in particular, that factor should always be kept in mind ; in fact, in normal times it was often the governing factor in deciding whether or not a length of track should be renewed. An astute District Engineer should always have his answer ready when asked : " What are you going to do with this material when it comes out ? " Mr. Seaton considered that the District Engineer should always show that information on his renewal proposals. He could not agree with Mr. Dean that when a length of track came out some of the sleepers were simply rubbish. Much of the track renewed by crane on the London and North Eastern Railway had gone down again precisely as it came up.

Mr. Seaton agreed with the Author as to the necessity for a properly-equipped central depot, especially for the distribution of new permanent-way materials. In the present difficult times, with fluctuating delivery of materials, such depots were invaluable ; and even in normal times it was impossible to plan permanent-way work without some measure of centralized control, such as could often be exercised only from a central depot.

The Author's suggestion that, with certain exceptions, all material produced should be sent to the central depot was, perhaps, open to some criticism. When Mr. Seaton was a District Engineer the department had no central depot and, although his district depot was well-equipped and highly organized, it had space only for new material and scrap. His method, therefore, had been to grade the material carefully before it was taken up from the track, sending the serviceable material direct to where it was to be used and only the scrap to the depot : and although he was wholly in favour of the principle of central depots, he considered that something more might be done than had been indicated by the Author in the direction of redistribution of serviceable material from job to job, thus saving haulage and double handling. Such a procedure required careful planning, but it could be done in normal times. Some measure of central control over serviceable material was, however, required as the needs of the railway as a whole had to be considered, and not merely individual districts.

Obviously standardization of grading of serviceable material was essential, and in order to achieve that it was probably advisable that the grading should be done by a team of experienced men under central control.

Mr. M. G. R. Smith observed that it was clear, from the observations of the Author and Mr. Seaton, that the London and North Eastern Railway were quite satisfied, as a result of the success of the Darlington scheme, that further reclamation depots were worth installing. In 1943 a Com-

mittee of the Railway Companies Association had reported, on reclamation depots, that :

“ These advantages indicate that the further development of similar depots at suitable centres throughout the country would be of great benefit to the railways generally.

The degree of centralization of reclamation depots economically justifiable depends on the particular circumstances of the railway concerned. The length of haul to depots, the comparative usage of the main lines, and the mileage of sidings and secondary lines compared with primary main line are all factors to be borne in mind. The Southern Railway, being mainly a passenger-carrying company, has not the same scope for utilizing second-hand material for sidings and goods lines. The market value of scrap and other circumstances might make it more economical to sell it on site rather than forward it to a reclamation depot. Generally, therefore, the principle to be followed is one of economics.

Subject to these qualifications the Commission is in agreement with the advantages set out in the previous page and recommends their acceptance.”

That report had referred to economics, which presumably meant the financial side of the matter. In some ways that was a very difficult attitude to introduce. Mr. Smith had had something to do with preparing estimates in connexion with a small existing depot on the Great Western Railway for reclamation work, and it had been necessary to take everything into consideration in preparing those estimates to see whether the proposition was an economic one or not. On some days the estimates proved that it was a great success, and on others that it was an entire failure and ought to be closed at once. Finally, it was decided that, whether it was a success or not, it should go on. It was still working well and was a very useful depot.

At least some of the processes which the Author recommended should be carried out at a central depot depended very largely for success on mass production, and they therefore appeared to be all-line matters rather than area matters. Therefore Mr. Smith suggested that they should be considered on an all-line basis, and situated at the centre of gravity of the railway rather than in a particular area, bearing in mind that a concrete products depot, for example, should be somewhere near the quarry from which the raw materials were obtained. A sleeper creosoting depot should also be located somewhere near the port where the sleepers were imported, or near a canal, so that supplies could be obtained without much haulage.

He failed to see the purpose of the storage of new rails at Darlington. It seemed quite economic and practicable to send new rails direct from the rolling-mill to the site of the relaying. On the Great Western Railway the setting up of a new reclamation depot was under consideration, and the only storage of new rails which was contemplated was a stock to

keep the flash butt-welding depot going, and a small stock for pre-assembly.

With regard to the handling of stripped sleepers, the disadvantage of the gravity method was that once the sleeper had been stripped the rollers carried it only one direction ; but the man stripping the sleepers might be stripping three or four different qualities and would wish to place them in different stacks, which meant travelling sideways as well as by gravity. On the Great Western Railway it was felt that possibly it would be advisable to work with mobile cranes. Plenty of room would be available with a big site, and cranes could deal with the sorting and distribution and also with loading for sale to traders.

Was the stripping of sleepers—the release of the chair screws—on the London and North Eastern Railway effected by pneumatic power or by electricity ?

He concurred in the emphasis laid in the Paper upon protection against bad weather and upon lighting. Much time was lost through bad weather, and if cover was provided so that the men could carry on with their work with ample light the output of the depot was aided tremendously.

Mr. W. H. Best observed that the London Midland and Scottish Railway had accepted the principle of central depots, and had in operation in England and Wales three such depots, two of which had been in operation before the war, whilst the third had been brought in recently. Between them they covered almost all the English and Welsh districts.

He agreed with the Author as to the problematical value of reconditioning small materials, and he doubted whether in normal times it was worth doing. With regard, however, to the re-threading of fishbolts and fitting them with undersize nuts, he gathered that careful records had been kept of the cost of those processes. Could the Author say whether the particular process in question was ever financially justified ?

He wished to join issue with the Author upon the interesting suggestion that the ultimate development of central depots would lead ideally to the construction of one centrally-situated depot such as existed in France, to serve each " area " in respect of all the civil engineering activities which could conveniently or economically be carried on in a depot. Permanent-way materials nowadays consisted very largely of standardized articles, and the manufacture of new components, the fabrication of track units, and the recovery, reconditioning, and re-issue of materials were all closely allied activities and were also mainly repetition processes ; as such they should be dealt with on as large a scale as possible if full economy was to be realized. Therefore, he agreed that centralization was advantageous, if not essential, in so far as permanent-way activities in the strict sense were concerned.

But he was very dubious about the wisdom of bringing into the same depot any or all of the other activities listed in the Paper, which, after all, were not so directly associated with the permanent-way. Taking as an

instance the storage of works materials, the diversity of jobs, the necessity of feeding materials and small fabricated articles to a comparatively scattered staff, and the differing physical characteristics of the different Engineers' Districts, rendered it essential that each District Engineer should have his own workshops, with which, for proper economy, a materials store should always be associated.

He agreed that the storage and maintenance of heavy plant and the manufacture of concrete articles and of standard timber articles should be centralized in a unit covering at least a group of districts, if not on a line basis, but the disadvantages of associating those activities in the same depot and under the same supervision with permanent-way activities proper would, in practice, heavily outweigh any advantages. Theoretical savings were not always realizable when the time came to translate them into practice, and he considered that the Author's hypothetical "well-qualified technical officer" would find himself rather hard pressed to exercise really efficient control and supervision over such a very varied range of activities unless he were very fully supported by specialist technical assistants. Admittedly the size and character of the area to be served by such an all-embracing central depot would be important considerations, but in the case of the London and North Eastern Railway those were virtually pre-determined factors by reason of that company's organization on an area basis.

Mr. Best felt strongly that, whilst centralization could and did effect notable economies when applied to activities of a clearly allied nature, the inclusion in the same scheme of other relatively extraneous activities savoured of centralization for its own sake, and should not be embarked upon without careful consideration and the mostly soundly-based justification.

Mr. Keith Brinsmead observed that he believed the depot at Moulin Neuf to have been the parent reclamation depot, and it had had a considerable influence on the development of the depot at Darlington. The Author was wrong in thinking that the French had constructed such a depot at their own expense; it had been constructed with German reparations money provided to rebuild the *Nord* Railway after the first world war.

In about 1930—only a few years after the amalgamation, when each line had a good deal of its own equipment—the Engineer of the North-Eastern Area of the London and North Eastern Railway had started a purge to bring in scrap and surplus material. In going round he found that on certain sections of primary lines which had been relaid in British standard, every ganger had still a large stock of North Eastern Railway 90-lb. chairs, and so on. Therefore it was decided to collect all the surplus material, and a considerable quantity of serviceable material was realized, with approximately £100,000 worth of scrap.

From that, the idea developed of developing a depot. Strange as it might seem to-day, firewood sleepers could not then be sold, and about

200,000 sleepers that nobody wanted were collected. On the principle that whilst people might not want to buy a side of beef, but would welcome a chop, it was realized that although sleepers were unsaleable because they were difficult to cut up, firewood might be in demand. Therefore a start was made in cutting old sleepers into 6-inch blocks, priced at 1d. apiece ; and that ended up with six circular saws and the need for a sawdust extracting plant !

The Moulin Neuf depot had had a considerable influence on the problem of reclamation. Fifteen years ago there was a considerable quantity of material which was then non-standard ; but the position had since altered considerably. The Darlington depot was based on the ideas of fifteen years ago. It had fallen to Mr. Brinsmead to plan the equipment of the whole of the reconditioning side, and it was interesting, looking back, to decide what would be tackled now and what would not. He would rule out almost all of the reconditioning processes. If a damaged article could be restored, such as straightening a bent chair screw, that was well worth while ; but certainly reforging the various types of old wrought-iron spikes was not satisfactory. He had learnt a bitter lesson over that. He well remembered a visit of the International Railway Congress Association to Darlington. They came round just after he had burnt out the fireclay block and put another in. The party was shepherded round by a man who watched for his signal, and when he held up his hand the furnace was lit. As the last person was leaving the slag began going through the fireclay block. It was not always a paying proposition.

Another aspect of the matter was that nobody liked anything that looked "scruffy", and that was certainly true of all gangers. If something had to be reconditioned it should *look* reconditioned ; merely to straighten it and send it out again, was useless, as it would get left in a corner, covered with dirt, and be thrown into the scrap bin and come round again. The Author had not referred to the reconditioning of signal fittings which was carried out at York. All of those fittings were boiled in a soda-ash solution on arrival, and after reconditioning they were dipped in boiled oil and terebene and marked with a blue band to show that they were reconditioned and not new equipment. They looked beautiful, and they were treasured by the men out on the job. That was a point of psychology which was worth bearing in mind ; otherwise material was liable to be wasted.

Mr. E. L. Triffitt observed that the Author had made out a case for central reclamation depots, but had not emphasized that such a depot could function efficiently only if it were allied with a very careful inspection of materials by the Engineer each year. In Mr. Triffitt's area, the Engineer and his staff inspected every renewal proposed by the District Engineers at the same time a provisional grading was made of the materials, from which a second programme called the "second transfer programme" was prepared, providing for the direct transfer of serviceable material from

job to job. Material coming from the main line might be earmarked for relaying in a secondary line, whilst material from that secondary line might find its way eventually to a siding.

Therefore the track which eventually reached the reclamation depot was not of very high quality, and many of the sleepers were scrap. It was not good policy to push everything back into the depot, as that savoured of failure to carry out proper planning. Obviously also the programme should be balanced very carefully. It was necessary, at the end of the year, to have used up all the serviceable material as far as possible, and to be left only with scrap which could be sold for what it would fetch.

The provisional inspection and grading by the Engineer were of the utmost importance, and it should be borne in mind that that inspection and grading were carried out possibly twelve months before the renewals were carried out and the material recovered.

The direct transfer of materials from renewal to renewal had other advantages. Mr. Seaton had mentioned the great advantage that crane renewals could be carried out. In the North-Eastern area a great deal of match marking of rails was carried out, and it was preferable that in such cases the rails should go direct from one job to another. If the rails went to the central depot and were off-loaded they got out of order and confusion was caused.

The Author had suggested that the central depot should become a very large affair, but Mr. Triffitt agreed with Mr. Best that to concentrate non-permanent-way activities in such a depot would be a retrograde step. Possibly there were sufficient non-permanent-way activities to justify a second depot, which might be called an area workshop. Some activities had not been mentioned, such as a tool refitting plant for the re-pointing of picks and so on. He agreed that the permanent-way depot should contain points and crossings shops, facilities for flash butt-welding of rails into long lengths, and facilities for the creosoting and chairing of sleepers.

He did not consider that the provision of a foundry on an area basis could be justified.

Central depots were excellent things in normal times ; but unfortunately the present times were far from normal, and he wondered what would have been said had a few traffic officers been present at the meeting. He did not doubt that the provision of central depots would produce a very large increase in the engine-miles run. With the present shortage of engine-power and of wagons, and the fully-occupied line-capacity, possibly the advantages of a central depot might be outweighed by traffic considerations.

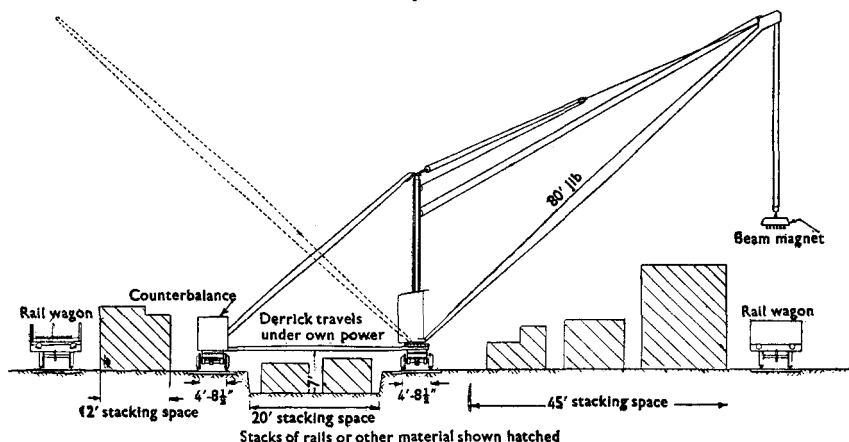
Mr. E. J. Matheson observed that he welcomed the Author's statement that the gantry should be extended to handle point and crossing work as well as rails. If difficulty arose in providing a gantry in the near future a possible alternative might be a travelling Scotch derrick, as shown in *Fig. 13*. With that method almost all the advantages of a gantry were

obtained, and it was quite cheap. If desired, the derrick could be put on a slightly raised track, thus providing a height of 7 feet or 8 feet under the leg of the derrick and giving plenty of room to stack there as well as outside.

Stripping sleepers in a central depot would involve a tremendous increase in the number of wagons required and would necessitate a complete reorganization of engineering department labour out on the line.

It might be a good thing to load the sleepers in the wagons with slings round them. When the wagons came into the depot the crane would hook on to the slings, which would already be in position, and so the sleepers could be unloaded quickly. The slings would then be sent out in bulk to the next relaying job, used on that job, and returned again to the depot, and so on.

Fig. 13.



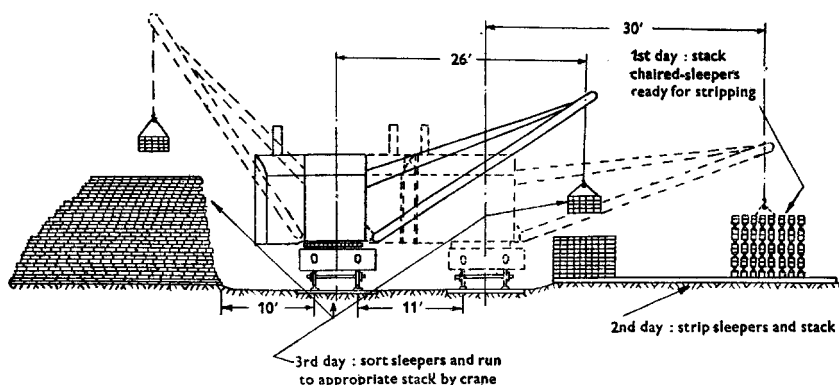
THE USE OF A TRAVELLING DERRICK AS AN ALTERNATIVE TO A GANTRY.

Sleepers could be handled in the depot by a steam crane, as shown in Fig. 14. Mr. Matheson had found steam cranes entirely reliable; they could work for hour after hour and day after day if properly maintained, and he preferred them to petrol cranes. To start with, the sleepers would come into the depot in a wagon. The crane would stand on an adjacent track to hoist the sleepers from the wagon, then swing round, and dump them down in a pile as shown on the right of the Figure. The men could then set to work on stripping them, pulling the sleepers down towards them to do so, and stacking them so that they could be easily slung. On the next day the crane would move to the track to the left, reach right across, lift the sleepers, and stack them in a pile. Such a pile might be 30 feet high and even if the base was only 30 feet almost the same capacity would be obtained as the Author had at Darlington over a length of about 180 feet.

With regard to double-ended sidings, had the Author considered that the possibility of double-ending should be a decisive factor in choosing a site; in other words, if it was not possible on a certain site, should that site be abandoned? Road access was desirable, as it would bring more people to the depot to purchase scrap material.

On the Great Western Railway, the permanent-way inspectors maintained a stock of material. On the London and North Eastern Railway there appeared to be no intermediate depot between the district depot and the ganger; but for emergency work it was far better that the permanent-way inspector should hold something. A typical Great Western inspector would hold about 150 pairs of fishplates, 2,000 keys, a few switch-roads, a few chair-bolts, and other material.

Fig. 14.



SUGGESTED METHOD OF HANDLING SLEEPERS BY STEAM CRANE IN THE DEPOT.

Mr. N. S. Cox observed that all of the previous speakers had appeared to be in favour of central depots—possibly because most of them had been looking at the matter from the head office point of view. As a Divisional Engineer, he was not quite converted to the idea. Some emphasis had been placed on economy, but he could not see where the economy came in when new materials could be delivered direct to the site of the work from rolling-mills or timber-yards. The central depot would have as its principal business, therefore, the sorting and re-grading of recovered materials. Obviously, if material could be graded either before or immediately after it came out of the track and sent at once to the subsidiary line where it was required, that would be much cheaper than sending it to a central depot to be unloaded, graded, reloaded, and sent out again.

He agreed that it was very difficult to get inspectors, or engineers, to agree about the grading of materials, whilst if materials were sent to a central depot it was possible to obtain uniformity of grading. At the same time, he could not see how economy would result. On the Great Western Railway, the material which was coming out was assessed and

allocated to secondary and tertiary lines, or at least proposals were put forward to the Chief Engineer in the hope that he would agree, and any material which was surplus to requirements was made available for use on other divisions. In case of a shortage, the Chief Engineer would naturally allocate material from other divisions.

That was a good system, because if an inspector knew that he was going to have first choice of the material recovered in his district he would take greater care of it and, while it was in the main line, he would keep an eye on it and say to himself: "That will be very useful on such and such a branch line." It might be argued that that was not a good system so far as the railway as a whole was concerned, but the only alternative was to send everything to the central depot, and there the problem of the economic handling of materials arose.

* * Mr. H. E. Robarts observed that the handling of sleepers at a material depot was probably the most uneconomical item dealt with from the point of view of labour required. It would be interesting if the Author could state whether the use of fork lift trucks had been considered for the unloading and stacking of sleepers. It would seem possible to design a suitable fork lift truck which could unload sleepers from drop-sided wagons and convey them to the sorting ground and then stack or reload the sorted sleepers. It would be necessary to provide concrete roads on which the fork lift trucks could run. By the use of such trucks it would be possible to overcome the difficulty of having sleeper loading and unloading sidings at different levels, and would tend to economy in labour and plant. The necessity of having all incoming as well as all outgoing sleepers loaded on drop-sided wagons to enable fork lift trucks to be used would, however, doubtless present difficulty with the present shortage of that type of wagon.

Fork lift trucks could also possibly be used with advantage for loading bags of small fittings such as coach screws and ferrules.

The Author, in reply, observed that the discussion had covered a very wide range. The number of men required to work the central depot at Darlington was about seventy-five. The figure of eighty was a pure estimate, but between seventy and eighty men would probably be required for handling the whole of the materials dealt with. He believed that on the London Midland and Scottish Railway the number was slightly smaller.

With regard to gangers' stocks and general stocks policy, the proposal was that there should be no stock between the District Engineer and the ganger, on the principle that stocks should not be held on the line simply in case something happened, because that would mean that a very large volume of material was in effect being wasted. During the war it was essential that stocks should be widely spread. The present policy was that the District Engineer should hold emergency stocks of new rails and points and crossings, and the ganger what was normally required for day-to-day

* * This communication was submitted in writing.—SEC. I.C.E.

maintenance ; and that, for the rest, reliance should be placed upon quick movement from the District Engineer's depot to any point in the district.

The difference between the practice of the London and North Eastern Railway and the practice of the London Passenger Transport Board was chiefly, as Mr. Dunton had pointed out, that the Board had no secondary lines. All the lines were of first-class importance, so that no track could be taken from one place and put down somewhere else. On the London and North Eastern Railway, on the other hand, there were large variations between the standards required at one point and another, and so transfers were possible.

The question of costs had been examined recently on the London and North Eastern Railway. The accountant wanted greater care to be taken in seeing that the material which went into a depot was actually credited to the job whence it came. Rails and sleepers were valued, and chairs also, whilst "smalls" were given an arbitrary percentage of serviceable and scrap, so that a valuation was credited to the renewal job on their arrival at the depot.

He agreed with Mr. Seaton and other speakers that, as far as possible, track should be re-used in the districts and not sent back to a central depot if use could be found for it where it was, because otherwise extravagant use would be made of traffic facilities. It was important, however, to maintain a uniform standard of material as between districts, and therefore the scheme referred to by Mr. Triffitt, whereby the Engineer, on his renewal inspection, allocated as far as possible the use of the serviceable material from the districts, was something almost approaching perfection, because uniform quality was ensured by the Engineer's inspection, and the actual movement of material was restricted to the minimum.

On the Southern area of the London and North Eastern Railway it was intended to do that as far as possible. The difficulty was that there were eleven districts, as against four districts in the North-Eastern area, and the work of inspection was a much more lengthy process ; but the Author agreed with Mr. Triffitt that a decision during inspection on where to put serviceable material was essential, and he agreed also that nothing should be sent to the central depot which could be used outside without reference to the central depot.

With regard to carrying stocks of new rails at the central depot, the intention was that a very small reserve of new rails should be kept there. In the Southern area rails were sent direct to jobs, but it would be desirable to have a few hundred tons of rails in the depot, so that if a District Engineer ran short it would be possible to rush rails to him. A reservoir or buffer of that kind was an essential feature of any stores set-up. That was all that it was intended to keep in a central depot ; the normal practice would be for new rails to go to jobs direct from the mills.

In reply to Mr. Smith ; in the normal way the gravity dock would drive a sleeper in only one direction, downwards. But at the gravity dock

at Darlington there was considerable lateral movement on Morris roller runways, and one man could move from twelve to fifteen sleepers laterally on the level quite easily with a hatchet which he banged into one of the sleepers, pulling ten or more sleepers along with it, which were then turned round and sent down chutes to their appropriate stacks. At Darlington, therefore, no trouble was found with lateral movement.

The Author agreed with Mr. Best that there was no essential advantage in having non-permanent-way stores and permanent-way stores mixed up in one place, apart from the fact that, if the stores were supplying one area, it was a logical, if somewhat theoretical, conception that one place would be better situated to supply that area than any other place. Conditions varied tremendously. For example, one railway might see fit to manufacture certain articles on a railway basis, whereas there could be no question that permanent-way materials would always be dealt with on a very much smaller basis; therefore he agreed that there was no particular reason for having non-permanent-way stores and permanent-way stores collected together in one depot, except on the ground of economy in supervision. Such economy might not be very large, but there was something very simple from the point of view of administration in the idea of having all the stuff in one place.

The information which Mr. Brinsmead had given about Moulin Neuf was very interesting. It had been bombed rather badly, but the French had repaired it in one year, and it was now almost in full working order again.

Mr. Matheson had suggested the use of slings for handling sleepers. There could be no doubt that if every parcel of sleepers arriving in a wagon had a sling round it, that would be the quickest way of dealing with them, picking them up straightaway by a crane. The difficulty was the number of slings which would be required and the tremendous loss of slings which would be likely to occur. Steam cranes had handled sleepers at Darlington before the installation of the sleeper gravity dock; and, although the Author was unable to give the costs, he knew that the gravity dock had proved economical in labour to some extent, whilst a crane was saved. It would be necessary to go into figures to determine the economy realized.

He did not consider that double-ended sidings were essential, but they did simplify shunting movements, as the material could come in at one end and go out at the other end, thus avoiding a great deal of confused movement.

Mr. Cox's point regarding traffic movement and the unnecessary movement of material was a very debatable question, which had been raised against the central depot idea ever since it was originated. Perhaps the best answer was that it had been accepted by most railways that the central depot was a paying proposition: but the Author agreed that, from the point of view of the District Engineer, it was certainly true that it was undesirable to move material away from a district unnecessarily.