ing the article, that Lindfors suggested the use of a small instrument (Dunouy's) for determining quantitatively the surface tension of any liquid. As the percentage of gum in juices was closely related to the surface tension value, a rapid test by Dunouy's apparatus would give an approximation of the quantity of gums in any juice.

Regarding the Badollet and Paine method of colloid determination this was on the principle of flocculation of colloids by basic dyes in definite ratios. The flocculating point of the colloids in the liquids tested was determined by a rapid optical test.

(Adjourned until 10 a.m. on Wednesday the 9th. March).

Wednesday the 9th March, the Congress continued at 10 a.m.

The first paper taken was that by Mr. J. Pullar on "THE USES OF ELECTRICITY IN THE SUGAR INDUSTRY."

Report of the Uses of Electricity in the Sugar Industry.

By J. PULLAR, *Convenor.*

Since our report of last year, which dealt principally with the advantages of electrified mills, electrical development in the Natal sugar industry has been negligible.

One complete new mill has been designed and ordered, which includes partially electrified auxiliary equipment only. One mill has been completely reconstructed and the electrical plant increased to provide for pumping and other electrically driven auxiliaries. One large mill extension has been ordered, but includes high pressure superheated steam engine for power, instead of the ideal electrical drive, which could have been applied. One mill has ordered power equipment for partially converting auxiliaries to electric drive, and only one concern has extended it's electrical plant for use outside the factory itself.

From this summary it would appear that the industry as a whole has not yet wakened up to the advantages to be obtained from an abundance of electric power, and that the subject matter of our last year's report has not convinced the millers that the advantages in conserving their fuel or at least converting it into useful electric power, are worthwhile.

Nevertheless we feel sure that in due course the advantages will be understood and realised, and we, therefore, proceed with a few notes on the uses of electricity outside the mill itself.

The uses to which electricity can be put in the vicinity of a sugar mill depend to a large extent on the nature of the fields, ownership, available water, and population. They can be classified under principal headings as follows:—

Transportation.
Irrigation.
Cultivation.
Rural and Domestic Uses.

We shall broadly review the possibilities for these uses in the Natal sugar belt.

TRANSPORTATION:

The handling of cane from the field to the factory is being considered by a separate committee, and we do not intend to trespass unduly on the subject matter under this heading, but will rather contribute to the discussion on the subject.

The cane when cut has to be collected and conveyed as a rule to a narrow gauge cane truck or ox-wagon, from which it is drawn by mules, oxen, or locomotive either direct to the mills, or to stations for reloading into S.A.R. Trucks. The expenditure of labour in these operations is very considerable, partly due to the nature of the material handled and partly due to the contour of the country.

It is our considered opinion that electricity can be brought to effective use in this field by the use of electric mules and haulages in the cane fields for collecting and loading the cane, and for marshalling the trucks at the permanent tracks.

The use of trolley, battery, or other equipment for this purpose depends solely upon individual requirements. Conditions differ so much that no general rule can be laid down.

From the marshalling stations at the termini of the portable tracks, the question of steam *versus* electric haulage to the mill again resolves itself into the consideration of individual economic and technical conditions. In some cases trolley electric locomotives can be shown to be a commercial proposition. In some cases battery locomotives have a claim for preference, and sometimes steam must hold its own.

A supply of electricity extended throughout the fields would be of inestimable advantage for some of the purposes described above, and also for mechanical handling of the cane at the various transloading stations.

The advantages offered by the electric locomotive as compared with steam or oil, are the very greatly reduced cost of maintenance, operation and depreciation, and the quick acceleration, ease of handling, reduced wear on track, and absence of the principal cause of cane fires.

It is not our intention to go into the merits of various systems of electric traction, but we expect

Clarification and Filtration Statistic

Nature of Questionnaire.	Mill No. 1	No. 2	No. 4	No. 7	No. 8	No. 9
MACERATION SYSTEM.	Hot 175°F. Returned.	Cold Returned Thin.	Cold No return.	Cold Return of thin Juices	Cold Returned.	Cold No return.
PREVENTATIVE MEASURES AGAINST SOURING OF RAW JUICES.	Flushed with hot water intervals of 4 hours Formalin & Sodium Fluoride.	Yes.	Steam and Lime.	Occasional Clearings.	Once in 24 hours.	Once per 24 hours washed Lime wash and Formalin
STRAINING SYSTEM AND MESH OF STRAINER.	Cush-cush strainer 250 per sq. in. Peck strainer 100 per sq. in.	Cush-cush strainer 250 per sq. inch.	Cush-cush strainer.	Cush-cush strainer 256 per sq. in. Peck strainer 80 per sq. in.	Cush-cush strainer 320 per sq. inch.	Cush-cush strainer 120 holes per sq. in.
HEATING OF RAW JUICE BEFORE TREATMENT BY CHEMICALS.	140°F.	None.	None.	140°F.	None	None.
LIME ADDED BEFORE ACID OR THE REVERSE.	Lime and CO_2 simultaneously	SO_2 first and P_2O_5 lime after.	SO_2 first and P_2O_5 Lime after.	Lime added continuously to pH. 10.0, SO_2 & P_2O_5 after.	SO_2 first and P_2O_5 Lime after.	SO_2 first and Lime after.
DEGREE OF SULPHITATION (Grams SO_2 per Litre.)	— — —	1.5 to 2.0 grams.	2.20 grams.	2.4 grams.	2.5 grams.	1.5 grams.
FINAL REACTION OF TEMPERED JUICE GOING TO HEATERS.	pH 11.0	Slightly Acid to Litmus paper.	1.0 Acidity=to 320 milligrams SO_2 per Litre.	pH. 6.8	pH. 6.8	Neutral to Phenolpthalein.
TEMPERATURE OF JUICE LEAVING HEATERS.	All the Juice filtered 140°F retreated with CO_2 to pH. 8.0 heated to 170°F. Filtered a 2nd. time.	212°F.	200-210°F.	208°F.	190 to 200°F. followed by heating to cracking point in open Defecators.	205°F.
TIME OF SETTLING.	Sulphited to pH. 7.0, brought to boiling & filtered a 3rd time before going to evaporation.	Continuously in Petree giving a cloudy juice reboiled & settled in Hatton Defecators for 45 minutes.	Continuously in Dorr Clarifier.	1¼ hours.	3 hours.	½ to 1 hour.
SETTLING CAPACITY (as gallons per ton cane per hr.)	— — —	1,218 gallons.	— — —	720 gallons.	675 gallons.	585 gallons.
TEMPERATURE OF JUICE ENTERING EVAPORATOR.	— — —	185—190°F.	185°F.	185°F.	195°F.	— — —
PERCENTAGE OF MUDDY JUICE LEFT AFTER FIRST SETTLING.	— — —	20%	— -- —	18%	30%	20 to 30%

TREATMENT OF MUDDY JUICE.	— — —	Diluted to 12 Brix., limed and sulphited heated to 212°F.	— — —	Made neutral to Litmus by Lime, diluted by washings from Subsiders reheated to 212°F and settled.	Limed, Diluted 10 to 15% reheated to 203°F Subsided.	Limed, diluted 25% re heated to 200°F. and subsided.
TIME OF SETTLING.	— — —	Continuously in Dorr.	— — —	1 hour and 20 minutes	1 hour.	½ to 1 hour.
CAPACITY OF JUICE SETTLING TANKS (gallons per ton cane per hour).	— — —	312 gallons. 25% of Primary.	— — —	375 gallons. 50% of Primary.	300 gallons. 44% of Primary.	394 gallons. 66% of Primary.
CLEAR JUICE FROM SETTLING OF MUDDY JUICE.	— — —	Either retreated with raw juice or goes to evaporator.	— — —	Returned to tempered Juice going to heaters.	Goes to Evaporator.	Goes to Evaporator.
MUD FROM 2nd. SUBSIDERS.	— — —	Diluted, Limed and Heated.	— — —	Limed to pH. 8.8.	Limed and reheated.	Agitated with Air Blowe
FILTERING SURFACE OF PRESSES. (sq. ft. per ton cane per hour).	96 sq. ft.	34.4 sq. ft.	No Filter Press used.	118 sq. ft.	87.5 sq. ft.	286 sq. ft.
SIZE OF PRESS.	40 inches.	40" Centre Feed.	— — —	24 inches.	40 inches.	34" x 36"
TYPE OF PUMP AND PRESSURE APPLIED.	Centrifugal Pumps 40lbs. per sq. in.	Reciprocating up to 40lbs.	— — —	Montejus.	Reciprocating 25 to 30 lbs.	Montejus 50lbs. per sq. inch.
CLOTH USED IN FILTER PRESS.	Single, Cotton and Jute Twill.	Single.	— — —	Double jute, with Herring bone flush.	Single.	Single, heavy cotton clot
CAKE STEAMED OR WASHED.	Washed and Steamed.	Steamed.	— — —	No.	No.	Steamed.
TREATMENT OF FILTRATE FROM PRESSES.	Goes to Evaporator.	Sent to Rew Juice.	— — —	Raw Juice.	Goes to Evaporator.	Going to Evaporator.
ISINCRUSTRATION OF THE EVAPORATOR OF FREQUENT OCCURRENCE, AND WHEN DO YOU CLEAN SAME ?	Fair — Weekly Twice per week.	No — weekly.	Normal — weekly.	Normal incrustation — once a week.	Yes — Weekly.	No — weekly.

YOU CLEAN SAME ?						
JUICE HEATER CLEANING.	Twice per week.	Every alternate day.	Every 24 hours.	Every 48 hours.	Every 24 hours.	Every 24 hours.
JUICE HEATER SURFACE (sq. ft. per ton of cane per hour).	38 Raw & CO_2 Juice. 25 Clarified Juice.	64 sq. ft.	94.2 sq. ft.	46 sq. ft.	65 sq. ft.	53 sq. ft.
SYRUP.	Filtered.	8 to 10 hours.	Settled 1 hour.	No Settling.	Settled 6 hours.	Settled 24 to 36 hours.
CAPACITY SYRUP SUBSIDERS (gallons per ton cane per hour).	400 gallons.	415 gallons.	470 gallons.	334 gallons.	300 gallons.	1,094 gallons.
REACTION OF SYRUP GOING TO PAN.	Sometimes Sulphited or phosphated pH 64 to 6.6	— — —	— — —	pH. 6.6	pH. 6.4.	Sulphited at 1.5-2.0 grms. per Litre.
SYRUP BOTTOMS.	— — —	Sent to Scum Tanks.	Returned to Mixed Juice and Retreated.	Sent back to tempered Juice going to heaters.	Returned to Raw Juice.	Returned to Raw Juice.
TYPE OF SULPHUR PLANT.	Quarez	Cooler, no scrubber, Tower 22 ft.	Cooler, no scrubber, 25ft. tower.	Tower.	Cooler only no scrubber.	Flat type furnace, cooler no scrubber, tower 16ft.
SULPHUR BURNT PER TON CANE IN LBS.	— — —	2.6	4.62	2.68	1.87	1. 85
LIME USED PER TON CANE IN LBS.	— — —	6.8	9.8	8.54	5.26	7.0
P_2O_5 USED PER TON CANE IN LBS.	— — —	0.6	0.34	1.83	0.25	0.20 in low grade.
SOURCE OF LIME USED.	Taungs.	Taungs.	Taungs.	Taungs & Umzimkulu.	Taungs.	Taungs.

s from South African Sugar Mills.

No. 10	No. 11	No. 12	No. 13	No. 16	No. 17	No. 18	No. 19
Hot water 130°F. Juices returned.	Cold Juices. No return.	Cold Returned	Cold water, return of thin Juices.	Cold Returned	Cold water. No return.	Cold water No return.	Cold Returned
Wash down.	Cleaned once per week. Lime wash.	Wash every 8 hours	Cleaned once per week Lime Wash.	Gutters kept clean but no chemical used.	Continues flow of Formalin in mill bed.	— — —	Weekly liming.
Cush-cush strainer 250 Holes per sq. in.	Cush-cush strainer.	Cush-cush strained 250 Holes per sq. inch.	Ordinary scraper, cush-cush strainer 80 holes per sq. in., Peck strainer 100 holes per sq. inch.	Brass Cush-cush strainer.	Ordinary cush-cush strainer 220 holes per sq. in.	Cush-cush strainer 256 Holes per sq. in.	Cush-cush strainer 250 holes to sq. in.
212°F.	None.	150°F.	140°F.	150 to 160°F.	None	None	122 - 131°F
Lime and P_2O_5 used simultaneously, no sulphur.	SO_2 first and P_2O_5 lime after.	Lime first to pH 8.1 P_2O_5 after and no Sulphur.	Lime first to pH 88-9.0 SO_2 and P_2O_5 after.	12 galls. lime at 12° Be. per 1,000 galls, juice. Lime first. and SO_2 & P_2O_5 after.	SO_2 first and P_2O_5 Lime after.	SO_2 first and P_2O_5 Lime after.	Lime first 9 gallons 15°Be. per 1,000 gallons juice Sulphite after.
Nil.	2.0 grams.	Nil.	1.2 grams	— — —	— — —	— — —	2.52 grams
pH. 7.4	Slightly Acid to Litmus paper.	pH 7.0	6.9 pH	Slightly Acid.	Slightly acid.	— — —	pH. 6.8 to 7.2
212°F	200°F. and followed by heating to cracking point in open Defecator.	190°F.	212°F.	— — —	200°F.	— — —	170°-175°F in heater followed by heating in open clarifier
Continuously in Dorr Clarifier.	2 hours.	1½ hour.	1½ to 2 hours.	½ hour to ¾ hour.	7 to 8 hours.	1 hour	¾ to 1½ hours
900 Gallons.	700 gallons.	720 gallons	500 gallons	558 gallons.	1,000 gallons	466 gallons.	990 gallons.
195°F.	160°F.	180°F.	185°F.	185-198°F.	150°F	— — —	170°-185°F.
15%	15%	15%	12.5%	10-15%	30%	10%	— — —

Limed diluted 20% no heating subsided.	Limed, diluted 10% re-heated to cracking point and Subsided.	Limed to pH 8.2 diluted 20% and reheated to 190° F. and filtered without settling.	Neutralised by Milk of Lime, reheated to 210°F. and Subsided.	Limed, reheated to boiling and filtered. without settling.	Limed reheated to 200°F. and subsided.	Limed and Blown up.	Lime, slightly diluted, heated and filtered without settling.
3 hours.	3 hours.	Nil	3 to 4 hours.	Nil	10 hours	— — —	Nil.
143 gallons. 16% of Primary.	300 gallons. 43% of Primary.	— — —	193 gallons. 33% of Primary.	— — —	333 gallons 33% of Primary.	— — —	— — —
Returned to Raw Juice.	Goes to Evaporator.	— — —	Returned to hot tempered Juice.	Returned to Raw Juice.	Returned to Raw Juice	— — —	— — —
Limed.	Lime added.	— — —	Lime to pH 8.8 Kieselguhr used experimentally.	Limed and boiled.	Kieselguhr added.	— — —	— — —
30.3 sq. ft.	110 sq. ft.	75.4 sq. ft.	57.5 sq. ft.	112 sq. ft.	58.0 sq. ft.	— — —	118.5 sq. ft.
22 inches.	— — —	Side feed 34" x 24"	24 inches.	— — —	26 inches.	27 inches.	31½ x 31½ ins.
Montejus 40lbs. per sq. inch.	Reciprocating Pump 20-40lbs.	Reciprocating safety valve 45 lbs.	Montejus 35 lbs. per sq. in.	Reciprocating 40 to 50lbs.	Reciprocating	Montejus 80lbs. per sq. inch.	Reciprocating 40-100 lbs.
Double Cloth and Calico.	Double, close woven cloth.	Single, White Drill.	Double Cloth Hessian Herring Bone.	Single	Single, Flax.	Single, Cotton Twill.	Double.
No	No.	No	No	— — —	Steamed and Washed.	No	Steamed.
Returned to Raw Juice.	Neutralised by P_2O_5 and settled before running to Evaporator.	Returned to Raw Juice	Returned to Raw Juice	Sulphited	Returned to Raw Juice.	Returned to Raw Juice.	Sent to Raw Juice.
No — Weekly.	Of constant occurence — weekly.	No — Weekly	Yes, since the use of P_2O_5 in conjunction with SO_2 & CaO Weekly cleaning.	No — weekly.	No — Week-ends.	Yes — Bi-Weekly.	Yes twice weekly.

Once per week.	Every 24 hours.	Once per. week.	Primary weekly. Secondary every 12 hours.	Weekly.	Alternate Days.	— — —	Weekly.
43.6 sq. ft.	60 sq. ft.	52.8 sq. ft.	Primary 34.4. Secondary 25.	16 sq. ft.	33 sq. ft.	— — —	31 sq. ft. and defecators.
Settled 3 hours.	12 to 18 hours.	No Settling	Settled 2 hours	Subsided about 8 hours.	No settling.	Subsided 4 hours.	Treated by P_2O_5 Settled 6 to 9 hours.
256 gallons.	944 gallons.	106 gallons.	192 gallons	449 gallons.	666 gallons.	466 gallons.	470 gallons.
pH. 7.	— — —	pH 6.8	— — —	— — —	— — —	— — —	pH. 6.4 to 6.6 by P_2O_5
Returned to Raw Juice	Treated in Blow ups and resettled.	Washed to evaporator supply tank.	Mixed with hot tempered Juice.	Returned to raw juice.	No Bottom.	Returned to Liming	Mud sent to 2nd. massecuite
— — —	Cooler, No scrubber, 25 ft. tower.	— — —	Prentice burner, water cooled gas pipe, no scrubber, towel 18 ft.	No cooler Tower, no scrubber, 30 ft. tower.	Cooler, no scrubber, Steam Injector.	Cooler, no scrubber, 35ft. tower.	Cooler, no scrubber Tower 23 ft.
— — —	2.5	— — —	1.10	2.5	1.0	1.25	3.76
4.2	6.2	4.16	4.91	6 to 7	3.5	3.5	9.47
1.5	0.37	1.07	0.96	0.25	1.0	0.25	0.28
Taungs.	Taungs.	Taungs & Umzimkulu.	Taungs unslaked	Taungs.	Taungs.	Taungs	Taungs.

expression of views on the subject, which warrants discussion.

There must be five hundred miles, at least, of narrow gauge permanent track on the cane lands, and the traffic expressed in ton miles must be a very large figure indeed.

As a rough estimate, assuming that cane is always hauled to the nearest mill, the average distance it has to travel will be about five miles, and as not less than 2-1/2 million tons of cane is crushed per season, this will amount to approximately 12,500,000 ton miles in cane traffic.

It is obvious that any saving that can be effected in this direction, even if only a small percentage, must be a very considerable gain to the industry.

It is quite reasonable to predict that most of the large mills could to advantage electrify the cane lines within say an area of eight miles from the mill, providing that the same distribution mains could be made available to supply power for other purposes such as pumping, ploughing, and domestic uses.

In some cases without these additional uses electric transportation will still show material savings over steam.

In the mill yard also electricity would be invaluable for off-loading appliances and truck haulage. Electric capstans are already in use, but there is no instance where an electric shunting locomotive is used. It would save much time and would cost very little to operate and maintain.

To enter into details of this application of power would necessitate a lengthy paper and would crowd out other equally important applications.

IRRIGATION:

The area of land under cane, which it would be possible to irrigate by pumping, is a larger proportion of the total than we think is realised. There is a very great similarity throughout the cane belt in the contour of the land and disposition of minor water supplies.

From data in connection with areas which have been carefully investigated from the point of view of irrigation, we should consider the proportion would work out at about 20% of the total cane land.

The majority of irrigation plants which would be scattered about the cane lands, would consist of small high lift pumping units averaging from 75 to 150 horse power.

There might be a few such large units serving bigger areas and lower lifts, but based on the investigated area mentioned above, the total demand for irrigation purposes would be in the neighbourhood of 30,000 h.p.

One or two typical irrigation plants have been installed by the Natal Estates, Ltd., which serve to show the simplicity and orderliness of electrical equipment for this purpose, which has been fully appreciated by this enterprising firm.

It is not within the province of this paper to enter into details of irrigation, but we cannot omit to give the proved gain to be obtained from these small high lift plants, as they are showing a return of at least 25% on the investment, which excludes the unevaluated assets such as improved cane, reduced cost of handling from growing cane to mill, or the insurance against loss of crop due to drought.

Electricity is the ideal power for irrigation of this nature on account of the low cost, simple plant, possibility of using direct coupled high lift pumps, which are practically automatic in operation, requiring only a minimum of even the roughest labour.

No doubt this subject will be one of interest to the planters, and we shall expect a full discussion.

CULTIVATION:

This use is so far non-existent in Natal. In Europe and America it is rapidly gaining ground, although there does not seem to be the progress that could be expected.

It is accepted that farming is the greatest industry in every country, and the ultimate wealth of every nation must depend principally on the development of agriculture.

In spite of relatively cheap labour being available for farm work, the actual cost of labour in farming is high.

To reach an efficient economic position on the land, work must be done on it. The more work done the better the results, but there must be a definite ratio of work done and expected results, and there must be a point on the curve when the amount of work done reaches its maximum economic limit.

We can find no figures published by the agriculturists to guide us in this matter, but we do know that every acre of cane land must be ploughed completely at least once every 7 or 8 years, necessitating four operations, and every other year should be cultivated by ploughing or harrowing.

The expenditure of energy in this cultivation will vary somewhat according to the nature of the soil, the contour of the country, and the depth of the furrow. Some data furnished by Mr. Matthews in a paper "Electric Farming Economics" read at the World's First Power Conference in England, gives 12 to 14 in. furrows one to one and a quarter acres ploughed per hour at a cost of 33 units per acre. This was for average land in good heart. For 10 ins. furrows plus 6 in. sub-soiling there would be a performance of one and a quarter to one and three-eighths acres per hour, with a consumption of 36 to 40 units.

We can assume that our conditions are much more strenuous and furrows deeper, so that we can take a consumption 50% in excess, say 60 units per acre. The cost of a units will vary between 0.5 of a penny and one penny, and even if only one acre is ploughed in an hour employing one skilled man and two natives, costing say 4/-, the total cost per acre would be from 6/6d. to 9/-.

We expect to learn something from the planters during the discussion on this subject, and also from people using tractors or steam ploughs for this purpose.

Many types of electric ploughs and tractors have been developed, but in our opinion the design of the equipment should be conceived here, as it is im-

possible for manufacturers situated so far from the point of use to develop a design entirely suitable for our conditions, and even here it will be necessary to work along several lines to suit our varying lands and soils.

We cannot leave this subject without remarking on the enormous field there is for development in electric ploughing. With about 280,000 acres under cane and an estimated consumption of sixty units per acre three times a year, the total power bill using electricity throughout would be a figure between £150,000 and £200,000.

RURAL AND DOMESTIC:

The population surrounding sugar mills consists chiefly of employees of the industry, farmers or planters, storekeepers, railway men, and the usual dependent industries.

There is no reason why the employees in the country districts should not receive the full benefits of the service electricity can and does give. Plenty of light, electric cooking, fans in summer, refrigeration, and hot water, to say nothing of the multitudinous variety of other labour saving devices.

Power to the farmer or planter and dependent industrialists would help him over many troubles, which are really not troubles at all, but necessary incidentals to their callings. In England it has been proved that to the farmer, electric power is a boon, even at the price of ten pence per unit, and the following is a published comparative table of costs, in which repairs and maintenance are taken into account:—

Form of Power.	*Equivalent price per unit.*	*Ratio.*
Hand Labour	14/-	17
Horse Power	3/4	4
Oil Tractor Power	1/11	2.3
Electric Power	-/10d.	1

Farmers are using electricity with success for the following purposes:—

Dehydrators.
Chicken Breeders.
Butter Churning.
Milking Machines.
Centrifugal Driving.
Hay Hoists.
Boilers.
Grindstones.
Incubators.
Refrigerators.
Mangles.
Wood Splitters.
Saws, Chaff Cutters.
Threshing Machines.
Pumping.
Cooking.

and many other purposes.

There is no reason why the farmer should not take advantage of the service electricity can give in labour saving and cheap production of power for almost any purpose, just as the town industrialist does almost without exception.

We have nearby the example of the Natal Estates, Ltd., a self-contained industrial concern engaged in both planting and milling. This concern has installed for use outside the factory motors aggregating 800 h.p. supplied from 22 transformers and fed by 25 miles of power line.

Here is the proof of our contention that given facilities for supply of power to the planters and other inhabitants of cane districts, there would be built up a huge demand with its resulting benefits to the supplier, user, and the country as a whole.

CONCLUSION:

If our contentions are correct regarding utility and benefits of electric power in the cane lands, then the position must be considered from the other side, from the point of view of the supplier of power.

We can conceive a continuous network along the cane belt being supplied by sundry mills, and perhaps in addition a central power supply organisation. This is too much to expect at present or until the S.A.R. enters into an electric traction scheme for the coast lines, which to the best of our knowledge has not yet been under consideration.

This will come one day, but in the meantime we can see no reason why the large mills should not throw out distribution mains into the countryside within economic distance, and equip their factories to supply power as a by-product industry.

The electrical plant installed in the factory with its boiler plant, is at present shut down for half the year. Why should this investment not be made remunerative for the full twelve months? It could be made so for the matter of a moderate additional expenditure in equipment, and without increasing the permanent staff.

The question of rural electrical supply is one of maximum interest, and not one affecting the sugar industry only. It presents certain difficulties which are quite surmountable but require very careful investigation.

Sweden is the pioneer and leader in this development. Nearly 50% of the total arable land is served by electric power, and the cost of rural power is in the region of 4d. per unit. Denmark is also rapidly taking advantage of rural electric power.

In the U.S.A. it is estimated that only 5% of the power used in agriculture is electric, but this 5% includes over 600,000 h.p. in one State alone, so that even the 5% must in total be a very considerable figure indeed.

In each of the above countries special technical development has taken place, and the leading manufacturers market special plant designed for farmers and for rural supply schemes. Especially is this the case in Sweden.

The cane belt offers more advantages for a rural supply of power than most other agricultural districts in Natal, but it is dependent upon the adoption of electric transportation and or the use of all available water for irrigation.

It has been our endeavour to create an interest in this subject, hoping that by means of a free dis-

cussion both sides of the industry will see the very large benefits to be derived from the more general availability of electricity throughout the cane belt.

We are satisfied that the claims of such service are possible, and that from the suppliers point of view it would be practicable and profitable.

Mr. Watson (Amatikulu) asked Mr. Pullar what he thought of the danger to the overhead system where all the cane was burnt—that was to say, the overhead equipment for haulage transport of any kind.

Mr. Pullar replied that he did not think the dangers were insurmountable. It would probably necessitate special construction in some cases, but he did not know that the distributing arrangements would of necessity be overhead equipment. Did the questioner mean for auxiliary haulages or for main transportation ?

Mr. Watson said he referred to main transportation—overhead wire and trolley wire.

Mr. Pullar remarked that he did not think it was a very serious difficulty. Certainly it was a point which would have to be considered. Anyhow, he thought it could be overcome.

Mr. Watson said he just mentioned it because up where he was, they had a lot of telephone lines all over the farms and very often when a farmer put his lands under fire they found the telephone wires were out of use for a long time.

The Chairman considered it would be a great improvement if electricity was employed in connection with ploughing. There was one thing he would like to ask Mr. Pullar—that was, would it be practicable and economical; he did not say all the sugar fields should have wires scattered all over the place, but would it be practicable to erect wires wherever required, just as at the present time they put down portable tracks for a small tramway. He supposed it would be possible to do it, but he wanted to know whether it would be economical.

Mr. Pullar replied that the system depended entirely on the nature and size of the equipment; that the thing was tied up with the general availability of power about the farms. He had tried to make a point that with the use of irrigation and transportation they would naturally have power well distributed over the farms and the branch circuits required for leads such as for ploughing and cultivating he thought could be made of some portable nature just as a coalcutter down the mines had to get its supply from the nearest main by means of flexible apparatus. It presented certain difficulties. It was entirely new to this country, so it was difficult to lay down any definite scheme. It was the principle one had to decide upon, and then one could work out the economic conditions.

Mr. W. Simmonds (Esperanza) said he would like to ask Mr. Pullar if he could tell them, taking the South Coast, where they were going to get a water supply, as they had not enough water to supply the mills, let alone irrigation.

Mr. Pullar replied that it all depended on what the questioner called the South Coast. What was the matter with the Illovo River ? That was only one, was it not ? There were a lot more rivers.

He had mentioned in his paper the question of certain areas which had been carefully investigated. It was very obvious of course, where those were, and he was still of the opinion that that particular area was one not too well served with water; it was very badly served, and he thought Mr. Simmonds would consider it far worse than the South Coast; yet 20% of the land was irrigable, and, as a matter of fact, very nearly 20% of it was under irrigation. So he thought if they looked round for water and saw what a small stream would give when it was properly used, they would see that throughout the territory more than 20% of the land could be irrigated. He was not talking about big irrigation schemes impounding water, and so on, but small pumping schemes. He had spent a pleasant day, as Mr. Simpson knew, quite recently searching for water at Mount Edgecombe, and they saw small streams which one could walk over, but which in the aggregate amounted to a very considerable factor and one of very great value. That had been proved of course by actual results.