THE SUPPLY OF ELECTRICITY FOR X-RAY WORK IN THE FIELD.

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If electricity could be obtained in the same manner as medicines and surgical materials a far-reaching problem would be solved. Up to the present the consummation of such a desirable means of meeting the important needs of the X-ray worker during active operations in the field has not been attained. It therefore becomes a very serious question how far the difficulties common to a supply of electricity can be best overcome. Unfortunately, during a campaign these difficulties become intensified through local considerations and the exigencies of war. Where accumulators are used means are not always available for keeping in touch with an electrical generating station to keep them charged. Such a station may be within easy distance, perhaps a long way off, and it may happen—for instance, in an uncivilised country—that no means whatever are available for charging the cells. These latter exigencies are the most serious of all, and unless provided against by the provision of a portable charging plant as part of the X-ray apparatus the surgeon is totally deprived of a valuable aid when making his diagnosis.

Regarding the various methods for obtaining the necessary supply of electrical energy it has, I think, been clearly demonstrated in practice that primary batteries, thermopiles and static machines are unsuitable. Although many attempts have been made to render static machines portable, and no doubt some success has been attained, yet from their construction they are very delicate and cumbersome and very sensitive to climatic conditions. For photographic work they are not equal to the induction coil. The use of accumulator cells is limited to situations where they can be kept charged, and it is mainly the object of this paper to suggest means by which charging can be effected under most conditions. In a paper of mine read before the Röntgen Society, and reproduced in this Journal, I maintained that for field use no X-ray apparatus can be considered complete which does not possess its own means for generating electricity, and my opinion is now shared by
other experts. I have endeavoured by actual experiments to devise a generating apparatus suitable to the needs of an X-ray installation. In this the first consideration is a motor, of which three kinds are well known, namely, oil, petrol or steam engines. Unfortunately, oil engines of a small size are not very efficient. They require a certain amount of skill in manipulation, and are very heavy and bulky for the power they give out. In a petrol-driven engine we have a motor as near perfection as it is possible to get, having weight, power and general efficiency in view, provided a supply of petrol is available. This matter of a petrol supply will prove a stumbling block to its adaption for use under every condition of service. In a steam engine we have a machine which under recent improvements can be worked anywhere. These improvements have been brought about in the race for supremacy in actuating the machinery of the motor car, and consist of a new system in valve construction, increased power for size, and the introduction of a steam generator having none of the disadvantages of an ordinary boiler. The engine in itself is most compact and easily managed, and being of high speed can be adapted to drive the armature shaft direct without the need of using belts and pulleys. The steam generator, which is commonly styled a flash boiler, is simply a helical of steel tubing suitably heated when the engine is running. Only sufficient water is injected into the coils to produce steam for each stroke of the piston, the water on entrance being immediately vaporised. Hence there is no boiler to burst through mismanagement, water or steam gauges to be attended to, only the heating of the coils to be seen to. The fuel may be either coal, wood or paraffin, the latter requiring a special burner. An engine of this description, with steam generator and dynamo, could, so I am informed by a reliable firm, be obtained, packed ready for shipment, weighing approximately 3 cwt. The dynamo need not be large, several patterns now in the market being very compact and efficient. One giving 300 watts would not only be suitable for charging batteries, driving coil direct, but in addition, if necessary, lighting up an operation room. The detail of the plant would consist of: Engine, three-quarter horse power. Steam generator provided with pump, and means for using either coal, wood or paraffin. Switch-board having voltmeter, ammeter, fuses and
switches. Dynamo, Manchester type, compound wound. Supply of wires, sixteen candle-power lamps with holders. With this plant the induction coil could be driven direct from the dynamo.

Such a contrivance would, in suitable hands, prove a great boon to the X-ray specialist, not to mention the surgeon who ultimately benefits by the results obtained.

There is another method of providing electrical current, which, provided a dynamo is available, could be obtained by annexing it with the shafting in a mill. But how often are mills to be found working during a campaign? Certainly in Ladysmith this was instanced, yet we dare not depend on always finding such a convenient means of driving our dynamo. It was quite an accident that a dynamo there was available for use, as it forms no part of an X-ray apparatus. When an X-ray installation is complete in itself, with means for charging batteries, then and only then will its utmost efficiency under any circumstances be available for the needs of the surgeon who has every right in warfare to command its assistance.