15. The .5-inch gun appeared, at first sight, to be the natural successor to the .303 inch, but experiments showed that the type available to us in the Autumn of 1940 was practically defeated by the 8-mm. armour carried in the M.E. 109. It was true that the bullet would pierce 20-mm. or more of armour in the open, but it was found that the minute deceleration and deflection of the axis of the bullet, caused by its passage through the structure of the fuselage, exercised a very important diminution on its subsequent penetrative powers.

16. Experiments carried out with .5-inch guns of higher velocity in America have given encouraging results, and it is not at present possible to dogmatise on the subject. It would, however, be foolish to adopt a gun which could be defeated by a slight thickening of the armour carried by the Bomber and the aim should be to defeat the thickest armour which it is practically possible for the enemy to carry.

17. We have at present no gun of a calibre between .5-inch and 20-mm. (.8 inch). The latter was originally adopted by the French because it was of about the right size to fire an explosive shell through an airscrew of a Hispano Suiza engine, and was adopted by us from them. If, therefore, it proves to be of the best weight and calibre for an armour piercing, that is due to accident rather than design.

18. A study of available data might lead one to suppose that a calibre of about 15-mm. would be the ideal, and I understand that this size has recently been adopted by the Germans; but we cannot now start designing a new gun for this war, and we must choose between the .5-inch and the 20-mm. We shall soon get reliable data from American Fighter types in action. They have faith in the .5-inch gun.

19. The Armament of the Royal Air Force is not its strongest point, and in my opinion we should do our own Design and Experimental work, and satisfy our requirements without being dependent on Woolwich and Shoeburyness.

20.—(C) Incendiary ammunition may be fired from guns of any calibre and Bomber tanks have been set on fire by .303 inch ammunition. The bigger the bullet, however, the bigger the hole, and a small bullet stands a good chance of being quenched before it can take effect. In any case, the fuel tanks of a Bomber constitute so small a proportion of the whole target that they cannot be made the sole objective of attack; and it seems that the adoption of a large-calibre gun and the use of a proportion of incendiary ammunition therein will afford a satisfactory compromise.

21.—(D) It was assumed by the French that the 20-mm. shell would be effective against the structure of modern aircraft. I do not know what trials they carried out, but the tests done by us at Shoeburyness and Orfordness indicate that the effect of a 20-mm. shell exploding instantaneously on the surface of an aircraft is almost negligible, except in a small percentage of lucky strikes. The normal effect is that a hole of about 6-inch diameter is blown in the surface, and that the effect at any distance is nil, since the shell is blown almost into dust. Occasionally the fuze penetrates and does some damage, but this is slight in comparison with the total weight of the shell. Even the big 37-mm. shell, though it may be spectacular damage, will not often bring a Bomber down with a single hit. Greater damage is done if the fuze is given a slight delay action, so that it bursts inside the covering of the aircraft, but small delay action fuzes are unreliable in operation and difficult to manufacture, and, on the whole, it seems doubtful if explosive shells are as efficient as armour-piercing and incendiary projectiles, especially as they will not penetrate armour. Another point must be remembered, viz., that a drum of explosive shells is a very dangerous item of cargo: if one is struck and detonated by a bullet it is not unlikely that they will all go off and blow the aeroplane to pieces.

22.—(E) The use of large shells (comparable to Anti-Aircraft types) from Fighter aircraft is practically prohibited by considerations of weight if a gun is used. The gun itself must be heavy and the structure must be strengthened to withstand the shock of recoil. The walls and base of the shell also have to be made uneconomically heavy to withstand the discharge. All these difficulties, however, can be overcome if the Rocket principle is used. It is true that a Rocket can be discharged only in the direct line of flight, but that is no particular handicap to a Fighter. It can have a light firing tube, there is no recoil, and the shell can be designed for optimum fragmentation effect. (I have been told that a 3-inch Rocket shell develops the same explosive and fragmentation effect as a 4.5-inch Anti-Aircraft gun shell). It also starts with an advantage over the terrestrial rocket in that it has an initial velocity of about 300 m.p.h. through the air, which gives it enhanced accuracy. For this weapon a " Proximity Fuze " would be ideal, but, pending the development of this, there is no reason why the Rocket should not be used with a Time and Percussion Fuze used in conjunction with a range-finder in the Aircraft.

23. This item was put on the programme about 7 years ago, and I think it a great pity that it was allowed to drop. True, unexpected difficulties may be encountered, and nothing may come of the project, but it is an important experiment, and our knowledge of what is and is not possible will not be complete until it has been tried.

24. I think that our decision to adopt the 20-mm. gun is probably the wisest which we could have taken, but to carry increased load efficiently something bigger than the Hurricane or Spitfire is needed. The Typhoon with 2,000 h.p. should be ideal when it has been given an adequate ceiling.

25. In the meantime the Hurricane must be somewhat overloaded with 4 Cannons, and mixed armament (2 Cannons and 4 Brownings) in the Spitfire is merely a compromise necessitated by loading conditions. Might not the high-velocity American .5-inch gun prove a suitable armament for the small fighter?

26. As regards ammunition for the 20-mm. gun, the so-called " solid " bullet was merely a cheap steel bullet produced by the French for practice purposes. Its mass and velocity have enabled it hitherto to smash through armour to which it has been opposed, but an improved design will probably be needed before long; doubtless the matter is receiving attention. I understand that the incendiary bullet—the equivalent of the de Wilde .303-inch—has been giving good results.